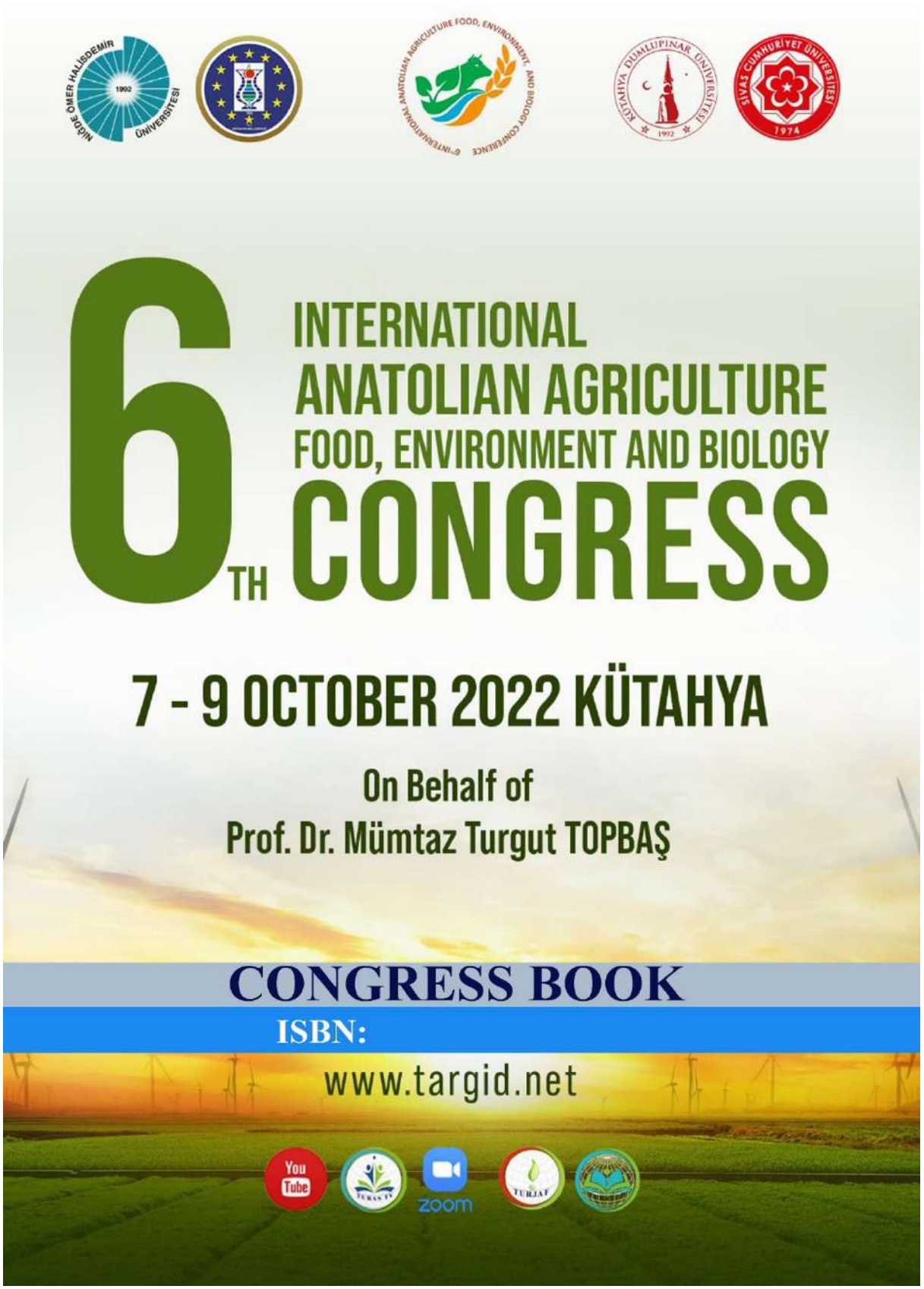
6TH INTERNATIONAL ANATOLIAN AGRICULTURE FOOD, ENVIRONMENT AND BIOLOGY CONGRESS
7 - 9 OCTOBER 2022 KÜTAHYA
On Behalf of
Prof. Dr. Mümtaz Turgut TOPBAŞ
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6th International Anatolian Agriculture, Food, Environment and Biology Congress

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The responsibility of all the papers contained in this book belongs to the authors. The book can be utilized provided that reference is made.

October 2022

FOREWORD

6th International Anatolian Agriculture, Food, Environment and Biology Congress
(Targid 2022)

The 6th International Anatolian Agriculture, Food, Environment and Biology Congress has been organized in Kütahya on 7-9 October 2022 to bring the developments in agriculture, food, environment and biology to the agenda and to enable new collaborations. It hosted by Kütahya Municipality under the leadership of Niğde Ömer Halisdemir University, Sivas Cumhuriyet University, Kütahya Dumlupınar University and The Turkish Journal of Agriculture - Food Science and Technology (TURJAF), organized by Turkish Science and Technology Publishing (TURSTEP). Presentations will be hybrid (face-to-face and online) at our congress.

In the congress, the participant scientists working in agriculture and related disciplines shared scientific developments, offered scientific solutions to international problems, increased their cooperation, and created scientific outcomes that will benefit humanity. Online oral and poster presentations in our congress were simultaneously broadcasted live on the TURJAF TV channel on YouTube and these videos will be available in the future in our channel. In this way, researchers who are interested in the subject can watch these presentations again on YouTube and TARGID's (www.targid.org) website later.

359 papers from 24 countries were presented to our congress. 147 of these papers came from foreign countries and 212 came from Türkiye. The countries of the participants who sent papers to the congress and the number of incoming articles are as follows; Algeria (7), Australia (1), Azerbaijan (18), Bangladesh (5), Ethiopia (6), Germany (1), Ghana (3), India (1), Iran (4), Iraq (3), Italy (1), Lebanon (1), Malaysia (2), Nepal (1), Nigeria (30), Pakistan (42), Poland (2), Rawalpindi (1), Romania (2), Rwanda (10), Spain (1), Sri Lanka (3), USA (2), and Türkiye (212).

As the host of the congress, the Mayor of Kütahya Prof. Dr. Alim Işık, and the chairmen of the Congress Prof. Dr. Hasan Eleroğlu, Prof. Dr. Muhammet Dönmez, Porf. Dr. Sedat Karaman, Prof. Dr. Zeliha Selamoğlu, TURJAF editors Prof. Dr. Hasan Eleroğlu and Prof. Dr. Ahmet Şekeroğlu have undertaken important duties in the organization and successful progression of the congress. Additionally, Asst. Profs. Mustafa Duman, Burak Şen and Emre Aksoy have taken responsibilities as the secretary of the congress. Finally, Res. Asst. Mustafa Güzel, Yunus Emre Şentürk, Brian Tainika and Mustafa Özcan from the "CNS Congress Organizations" company helped with the congress organization. We would like to thank the Mayor of Kütahya Prof. Dr. Alim Işık, and all our stakeholders and all scientists who participated and supported the congress.

Sincerely yours,

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Turkish Science and Publishing (TURSTEP)

CONGRESS PROGRAMME

Kütahya Belediyesi Konferas Salonu /Kütahya Municipality Conference Hall

	7 Ekim 2022 Cuma/ 7 October 2022 Friday *Time by Türkiye*	
Saat/Hour	AÇILIŞ PROGRAMI /OPPENİNG PROGRAMME **Açılış Konuşmaları/ Opening Ceremony** Prof.Dr. Ahmet ŞEKEROĞLU, Kongre Koordinatörü Prof.Dr. Hasan ELEROĞLU, Kongre Başkanı Prof.Dr. Musa SARICA, TURJAF Editörü Prof.Dr. Kazım UYSAL, Kütahya Dumlupınar Üniveritesi Rektörü Prof.Dr.Alim IŞIK, Kütahya Belediye Başkanı, Kongre Ev Sahibi Ali ÇELİK, Kütahya Valisi İbrahim YUMAKLI, Tarim Ve Orman Bakanliği Bakan Yardimcisi	
15.00-15.30		
	Açılış Oturumu, Çağrılı Bildiriler / OPENING SESSION, Invited Papers Başkan/ Moderator**:** Prof.Dr. Alim IŞIK	
15.30-16.00	Prof.Dr. Yusuf DEMİR, *Ondokuz Mayıs Üniversitesi*	İklim Değişikliğinin Tarım Ve Su Kaynaklarına Etkisi/The Impact Of Global Climate Change On Agriculture And Water Resources
16.00-16.30	Prof.Dr. Musa SARICA, *Ondokuz Mayıs Üniversitesi*	Etlik Pilic Islah Calısmalarında Gelinen Asama: Basarmak Zorundavız / Stage Reached in Broiler Breeding Studies in Türkiye: We Have to Success
16.30-17.00	Prof.Dr. Mustafa AVCI *Niğde Ömer Halisdemir Üniversitesi*	Yem Bitkileri Yetiştiriciliğinde Karşılaşılan Sorunlar Ve Çözüm Önerileri/ Problems encountered in forage crop cultivation and solutions

8 Ekim 2022 Cumaertesi, 08 October 2022 Saturday, Time by Türkiye

PROF.DR. YAŞAR HIŞIL SALONU/ PROF.DR. YAŞAR HHIŞIL HALL

1. Oturum/ 1st session

Oral Presentation FACE-to-FACE

(Kütahya Belediyesi Konferas Salonu /Kütahya Municipality Conference Hall)

Başkan/ Moderator: Prof.Dr. Mustafa Avcı

Saat/Hour	Yazar/Autor/s	Ülke/ Country	**Başlık/Title**
09.00-9.15	Barka Mohammed Salih, Cherif-Anntar Asma	Algeria	Genetic Characterization Of Escherichia Coli O157: H7 Isolated From Meat In Tlemcen "Algeria"
9.15-9.30	Muhammad Abbas, Laaraib Nawaz , Haseeb Anwar	Pakistan	Expression Level Of Mydgf (Myeloid-Derived Growth Factor) In Liver Fibrosis
9.30-9.45	Jadesola Sanusi, Chidinma Kujore, Oluwaseun Oyelami , Christianah Adebayo – Tayo, Rachael Fashogbon	Nigeria	Characterization And Antimicrobial Potential Of Silver Nanoparticle Using Carica Papaya Leaf Extracts
9.45-10.00	Muhammad Salim, Muhammad Yasin	Pakistan	Demographic Study Of Drosicha Species Fed On Different Hosts Under Laboratory Conditions In Skardu, Gilgit Baltistan
10.00-10.15	Ara		Break

8 Ekim 2022 Cumartesi, 08 October 2022 Saturday, Time by Türkiye

PROF.DR. YAŞAR HIŞIL SALONU/ PROF.DR. YAŞAR HHIŞIL HALL

2. OTURUM/ 2st session

Oral Presentation FACE-to-FACE

(Kütahya Belediyesi Konferas Salonu /Kütahya Municipality Conference Hall)

Başkan/ Moderator: Ahmad Ur Rahman Saljoqi

Saat/Hour	Yazar/Autor/s	Ülke/ Country	**Başlık/Title**
10.15-10.30	Ahmad Ur Rahman Saljoqi, Muhammad Saleem	Pakistan	Toxicity Of Various Insecticides Against Trichogramma Chilonis (Ishii) (Hymenoptera: Trichogrammatidae) Under Controlled Laboratory Conditions
10.30-10.45	Ghulam Hussain, Haseeb Anwar, Rabia Akram, Shamaila Zafar, Faiqa Sajid, Tehreem Iman, Suman Saeed, Zakia Saeed	Pakistan	Comparison Of The Effects Of Cannabis Sativa L. (Leaves) Extracts In Ethyl Acetate And N-Hexane On The Restoration Of Muscle Function Following A Peripheral Nerve Damage
10.45-11.00	Ali Hasnain, Muhammad Umar Farooq Awan, Harma, Ayesha Iqbal, Khadija Bari, Muhammad Usama Aziz, Arooba John, Binyameen, Maryam Iqbal, Muhammad Naveed Anjum, Rida Hayat, Zahid Mehmood, Mubashara Inam, Maham Batool, Warda Fatima	Pakistan	Molecular Assessment Of Air Pollution Impact On Genomorphic Characteristics Of Mimusops Elengi L. Planted Along The Road Side Of Lahore City, Pakistan
11.00-11.15	Harma, Muhammad Umer Farooq Awan, Ali Hasnain, Maryam Iqbal, Binyameen, Rida Hayat, Muhammad Naveed Anjum, Mubashara Inam, Maham Batool, Warda Fatima	Pakistan	Genotoxic And Physio-Chemical Deterioration Of Eichhornia Crassipes (Mart.) Solm Growing In Paper Mill Effluents
11.15-11.30	Ara		Break

8 Ekim 2022 Cumartesi, 08 October 2022 Saturday, Time by Türkiye

PROF.DR. YAŞAR HIŞIL SALONU/ PROF.DR. YAŞAR HHIŞIL HALL

3. OTURUM/ 3st session

Oral Presentation FACE-to-FACE

(Kütahya Belediyesi Konferas Salonu /*Kütahya Municipality Conference Hall)*
Başkan/ Moderator: Prof.Dr. Musa Sarıca

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
11.30-11.45	Muhammad Khalid Bashir, Muhammad Ashfaq, Arifa Zaib	Pakistan	Can Calorie Intake Ensure Food And Nutritional Security? The Case Of Peri-Urban Residents Of North Punjab, Pakistan
11.45-12.00	Kadir Erensoy, Musa Sarıca	Türkiye	Performance Of Anadolu-T Broiler Parent Stock And Their Hybrids
12.00-12.15	Ahmet Demirbas, Hasan Durukan, Mustafa Ozturk, Handan Sarac, Tolga Karakoy	Türkiye	Determination Of The Yield And Yield Parameters Of Demre Sivrisi, Dogal Sarı Sivri And Dogal Carliston (Capsicum Annuumm L.) Pepper Varieties Growed By Fertigation Method In Greenhouse Conditions
12.15-12.30	Hasan Durukan, Zekeriya Duran, Handan Sarac, Ahmet Demirbas	Türkiye	Farklı Organik ve İnorganik Gübre Uygulamalarının Mısır Bitkisinin Verimine ve Gelişimine Etkileri
12.30-13.30	Ara		Break

8 Ekim 2022 Cumartesi, 08 October 2022 Saturday, Time by Türkiye
PROF.DR. YAŞAR HIŞIL SALONU/ PROF.DR. YAŞAR HHIŞIL HALL
4. OTURUM/ 4st session
Oral Presentation FACE-to-FACE
(Kütahya Belediyesi Konferas Salonu /Kütahya Municipality Conference Hall)
Başkan/ Moderator: Prof.Dr.Kadir Saltalı

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
13.30-13.45	Zeynep Danışman, Emre Yörük, Murat Pekmez	Türkiye	Potential Antifungal Effects Of Cumin Seed Oil On Fusarium Graminearum
13.45-14.00	Merve Sahan, Nuriye Meraklı, Liaquat Ali Bhutto, and Abdulrezzak Memon	Pakistan Türkiye	Expression Of Some Metal Transporter Atpases In Brassıca Rapa Grown Under Cadmium Stress
14.00-14.15	Abdulrezzak Memon	Türkiye	Endomembrane Trafficking Pathways For The Development Of Symbiotic Membrane Compartments During Rhizobium-Legume Symbiosis
14.15-14.30	Adil Koray Yildiz, Hasan Ulutaş, Cemil Altin	Türkiye	Development of Electronic Data Collection Hive System for Use in Precision Beekeeping
14.30-14.45	Ara		Break

8 Ekim 2022 Cumartesi, 08 October 2022 Saturday, Time by Türkiye
PROF.DR. YAŞAR HIŞIL SALONU/ PROF.DR. YAŞAR HIŞIL HALL
5. OTURUM/ 5st session
Oral Presentation FACE-to-FACE
(Kütahya Belediyesi Konferas Salonu /Kütahya Municipality Conference Hall)
Başkan/ Moderator: Doç.Dr.Mehmet Akif Boz

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
14.45-15.00	Ahmet Uçar, Mehmet Akif Boz, Kadir Erensoy, Musa Sarıca	Türkiye	The Effect Of Egg Weight And Hatching System On Hatch Time, Hatchability And Gosling Quality Traits In Turkish Geese
15.00-15.15	Serpil Yilmaz, Esra Erikçi Bilgin	Türkiye	Connection Of Fisheries Management And Ballast Water Management Contract (Bwm Convention, 2004)
15.15-15.30	Canan Köse Zafer, İbrahim Yılmaz	Türkiye	Evaluation Of Chemical Use In Beekeeping Activities In The Şile Region Of Istanbul Province
15.30-15.45	Orcan Demircan, Abdulrezzak Memon	Türkiye	Using Of Landoltia Punctata To Remove Chromium From Leather Wastewater
15.45-16.00	Ara		Break

8 Ekim 2022 Cumartesi, 08 October 2022 Saturday, Time by Türkiye
PROF.DR. YAŞAR HIŞIL SALONU/ PROF.DR. YAŞAR HIŞIL HALL
6. OTURUM/ 6st session
Oral Presentation FACE-to-FACE
(Kütahya Belediyesi Konferas Salonu /Kütahya Municipality Conference Hall)
Başkan/ Moderator: Prof.Dr.Leyla İdikut

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
16.00-16.15	Derya Saygili, Nural Karagözlü, Cem Karagözlü	Türkiye	Traditional Fermented Camel Milk Products
16.15-16.30	Tuğrul Yakupoğlu, Nutullah Özdemir	Türkiye	Changes In Erosion Susceptibility Of A Chromic Haplustert Pasture Soil By Some Polymers Under Simulated Rainfall
16.30-16.45	Burak Şen, Berna Gümüş, M. Cüneyt Bağdatli, Ali Kaan Yetik	Türkiye	Investigation Of The Effect Of Different Irrigation Levels To Be Applied To Strawberry Varieties On Fruit And Plant Development Parameters In Nigde Climate Conditions
16.45-17.00	Muhammed Alhashemi, Kadir Saltali	Türkiye	Determination Of Zinc (Zn) Sorption Properties Of Gyttja, Leonardite And Compost
17.00-17.15	Burcu Dillioğlu, Nuriye Meraklı, Abdulrezzak Memon, Liaquat Ali Bhutto	Türkiye Pakistan	Effect Of Cr-Stress On The Glutathione Reductase (GR) Gene Expression In B. Juncea L. Var. S-9
17.15-18.00	Ara		Break

8 Ekim 2022 Cumartesi, 08 October 2022 Saturday Time by Türkiye
PROF.DR. YAŞAR HIŞIL SALONU/ PROF.DR. YAŞAR HIŞIL HALL
7. Oturum/ 7st session

Oral Presentation FACE-to-FACE
(*Kütahya Belediyesi Konferas Salonu /Kütahya Municipality Conference Hall)*
Başkan/ Moderator:Prof.Dr. Cem Tokatlı

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
18.00-18.15	Burcu Aksüt, Hakan Polatci, Adil Koray Yildiz	Türkiye	The Effect of Different Drying Techniques and Conditions on Drying Parameters and Thermo-physical Properties of Peach
18.15-18.30	Abdülrezzak Memon Ve Nuriye Meraklı	Türkiye	Comparative structural analysis of heavy metal ATPases in Arabidopsis thaliana, Arabidopsis halleri, Brassica rapa, and Brassica juncea
18.30-18.45	Alper Uğurluoğlu, Cem Tokatlı, Ekrem Mutlu	Türkiye	Assessment Of The Water Quality By River Pollution Index...
18.45-19.00	Cem Tokatlı, Şirin Güner Onur, Mediha Büyükgöze Dindar, Md. Saiful Islam	Türkiye	
19.00-19.15	Adnan Ayan, Özge Oktay Ayan	Türkiye	Kütahya Bölgesindeki Sokak Kedilerinde Bulunan Giardia duodenalis'in Mikroskobik ve Moleküler Yöntemlerle Saptanması
19.15-19.30	Seyfettin Demirci, Asaf Özalp, İbrahim Yılmaz	Türkiye	Investigation of the Expectations and Satisfaction of the Partners from Agricultural Credit Cooperatives in Trabzon
	Ara	Break	

8 Ekim 2022 Cumartesi, 08 October 2022 Saturday, Time by Türkiye
PROF.DR. OSMAN TEKİNEL SALONU/ PROF.DR. OSMAN TEKİNEL HALL
OTURUM/ 1st session
Oral Presentation Online
Başkan/ Moderator: Prof.Dr. Hanife Mut/ Dr. Burak Şen

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
9.00-9.15	H.M.B.M.M.D. Herath, D.M.S. Duminda, And P. N. Yapa	Sri Lanka	The Impact of the Surrounding Land Uses on Water Quality of Some Selected Cascade and Perennial Tanks in Anuradhapura District, Sri Lanka
9.15-9.30	Hatice Yildirim, Latif Gürkan Kaya, Hüseyin Samet Aşikkutlu	Türkiye	The Relationship Between Creative Cities and Expo Cities
9.30-9.45	Erdem Gülümser, Hanife Mut, Uğur Başaran, Medine Çopur Doğrusöz	Türkiye	İskenderiye Üçgülü (Trifolium Alexandrinum L.) Tek Yillik Çim (Lolium Multiflorum L.) Karişimlarinin Ot Verimi Ve Kalitesi
9.45-10.00	Mustafa Ozturk, Umut Yılmaz, Burak Özgün, Ebru Karaçaltı, Melis Aksoy	Türkiye	Investigation of Vegetable Milk (Extract) Production from Pumpkin Seeds
10.00-10.15	Ara		Break

8 Ekim 2022 Cumartesi, 08 October 2022 Saturday
PROF.DR. OSMAN TEKİNEL SALONU/ PROF.DR. OSMAN TEKİNEL HALL
2. OTURUM/ 2st session
Oral Presentation Online
Başkan/ Moderator: Prof.Dr. Nuray Şahinler /Dr. Burak Şen

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
10.15-10.30	Nuray Şahinler, Nesibe Özge Toy	Türkiye	Bees In Polination And The Effect Of Global Warming On Bees
10.30-10.45	Nesibe Özge Toy, Nuray Şahinler	Türiye	Quality Parameters Of Honey An Important Bee Product
10.45-11.00	Arda Sözcü, Merve Gündüz	Türkiye	Comparison Of Egg Production And Stress Level Of White And Brown Layer Hens Kept In Different Production Systems
11.00-11.15	Yadigar Leyla Doğan, Rabia Küçük	Türkiye	Smart Agriculture Stages In The World
11.15-11.30	Ara		Break

8 Ekim 2022 Cumartesi, 08 October 2022 Saturday, Time by Türkiye
PROF.DR. OSMAN TEKİNEL SALONU/ PROF.DR. OSMAN TEKİNEL HALL
3. OTURUM/ 3st session
Oral Presentation Online
Başkan/ Moderator:Prof.Dr.Kenan Yıldız /Dr. Burak Şen

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
11.30-11.45	Rifat Olgun	Türkiye	Evaluation of the Visual Landscape Quality of Parks: The Case of Serik/Antalya
11.45-12.00	Ibraheem ALHASSAN and Abdullahi Bala SHUKURANA	Nigeria	Infiltration Characteristics of Soils of Some Selected Sites in Federal University, Gashua, Yobe State, Nigeria
12.00-12.15	Muhammet Rahmetullah Çiğdem, Alperen Donat, Emircan Dinçer, Kenan Yildiz, Osman Nuri Öcalan	Türkiye	Do IBA and Paclobutrazol Applications Increase Rooting Performance of Blackberry Cuttings?
12.15-12.30	Ali Baran Yilmaz, Hanife Mut	Türkiye	Determination of Hay Yield and Quality of Different Alfalfa (Medicago sativa L.) Varieties in Bilecik Ecological Conditions
12.30-13.30	Ara		Break

8 Ekim 2022 Cumartesi, 08 Oct ober 2022 Saturday, Time by Türkiye
PROF.DR. OSMAN TEKİNEL SALONU/ PROF.DR. OSMAN TEKİNEL HALL
4. OTURUM/ 4st session

Oral Presentation Online

Başkan/ Moderator: Dr. Orhan Soydan/Dr. Burak Şen

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
13.30-13.45	Orhun Soydan	Türkiye	Analysis of Accessibility of Primary Schools in Niğde Using GIS
13.45-14.00	Orhun Soydan	Türkiye	Detection of Burned Areas by Remote Sensing Techniques: Antalya Manavgat Forest fire case study
14.00-14.15	Erdem Gülümser, Hanife Mut, Uğur Başaran	Türkiye	Global Warming and Forage Crops
14.15-14.30	Yaşar Serhat Saygili, Bülent Çakmak	Türkiye	Investigation of Agricultural Mechanization Situation in İzmir Province and Districts
14.30-14.45	Ara		Break

8 Ekim 2022 Cumartesi, 08 October 2022 Saturday, Time by Türkiye

PROF.DR. OSMAN TEKİNEL SALONU/ PROF.DR. OSMAN TEKİNEL HALL

5. OTURUM/ 5st session

Oral Presentation Online

Başkan/ Moderator: Prof.Dr. Sedat Karaman /Dr. Burak Şen

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
14.45-15.00	Onur Sefa Alkaç, Sabriye Belgüzar, Esat Tuncel, Sümeyye Aldirmaz	Türkiye	The Effect of Plant Growth Promoting Rhizobacteria and Mycorrhiza Applications on The Plant Growth of Zinnia elegans L. ve Dahlia variabilis L.
15.00-15.15	Onur Sefa Alkaç, Esra Öndeş, Esat Tunce, Rümeysa Temir	Türkiye	Effects of Different Organic Source Materials on Growth, Flowering, and Yield in Zinnia Plant
15.15-15.30	İsmail Yüksel Genç	Türkiye	Artificial Neural Network Applications in Seafood
15.30-15.45	Kübra Eroğlu, Sabriye Belgüzar	Türkiye	Antibacterial Effect of Salvia bracteata ve Tagetes erecta Plant Extracts Against Some Plant Pathogen Bacteria
15.45-16.00	Ara		Break

8 Ekim 2022 Cumartesi, 08 October 2022 Saturday Time by Türkiye

PROF.DR. OSMAN TEKİNEL SALONU/ PROF.DR. OSMAN TEKİNEL HALL

6. OTURUM/ 6st session

Oral Presentation Online

Başkan/ Moderator: Doç. Dr. Sevinç Yeşilyurt/Dr. Burak Şen

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
16.00-16.15	Muazzez Gürgan Eser, Sevinç Yeşilyurt	Türkiye	The Relationship Of Antibacterial Activity Of Origanum Majorana L. With Its Plant Nutrient Elements
16.15-16.30	Onur Sefa Alkaç, Esat Tuncel, Emircan Dinçer, Alperen Donat	Türkiye	The Effect Of Compost, Bacteria, And Mycorrhiza Applications On The Phytochemical Contents Of Edible Tulip Petals
16.30-16.45	Duygu Sevinç, Muazzez Gürgan Esen, Çetin Yağcılar	Türkiye	Can Spirulina Cure Diabetes Patients?
16.45-17.00	Nuray Şahinler, Nesibe Özge Toy	Türkiye	Importance For Queen Bee And Colony
17.00-17.15	Ara		Break

8 Ekim 2022 Cumartesi, 08 October 2022 Saturday Time by Türkiye

PROF.DR. OSMAN TEKİNEL SALONU/ PROF.DR. OSMAN TEKİNEL HALL

7 OTURUM/ 7st session

Oral Presentation Online

Başkan/ Moderator: Dr. Suzan Biran Ay /Dr. Burak Şen

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
17.15-17.30	Hacer Gülocak, Sultan Kıymaz	Türkiye	Determination Of Usability Of Wastewater For Irrigation Purposes In Agriculture In Kırklareli Region
17.30-17.45	Merve Kesim, Suzan Biran Ay	Türkiye	Development Of Prebiotic Edible Films For Food Applications
17.45-18.00	Merve Karakoyun, Sinem Öztürk Erdem	Türkiye	Selenium And Its Effects In Horticulture
18.00-18.15	Yasin Aşik, Hüseyin Samet Aşikkutlu, Latif Gürkan Kaya	Türkiye	Effects Of Construction On The Visual Quality Of Campus Landscapes: The Case Of Burdur Mehmet Akif Ersoy University, Türkiye
18.15-18.30	Hüseyin Samet Aşikkutlu, Latif Gürkan Kaya, Yasin Aşik	Türkiye	Effect Of Environmental Pollution On Landscape Ecology
18.30-18.45	Ara		Break

8 Ekim 2022 Cumartesi, 08 October 2022 Saturday Time by Türkiye

PROF.DR. OSMAN TEKİNEL SALONU/ PROF.DR. OSMAN TEKİNEL HALL

8. OTURUM/ 8st session

Oral Presentation Online

Başkan/ Moderator: Dr. Serkan YEŞİL /Dr. Burak Şen			
Saat/Hour	Yazar/Autor/s	Ülke/ Country	**Başlık/Title**
18.45-19.00	Sibel Alapala Demirhan, Nuray Şahinler	Türkiye	Global Epidemic and Its Effects on Livestock
19.00-19.15	Nuray Şahinler, Sibel Alapala Demirhan	Türkiye	The Importance of Animal Products for Nutrition and Health
19.15-19.30	Serkan Yeşil	Türkiye	Serological Detection of Three Common Tomato Viruses in Tomato Cultivation Areas of Ereğli District, Konya
19.30-19.45	Sekan Yeşil	Türkiye	Determination of Some Virus Diseases Infecting Dahlia Species Grown for Landscape Purposes in Konya Province Parks and Home Gardens by Serological Methods

8 Ekim 2022 Cumartesi, 08 October 2022 Saturday Time by Türkiye

PROF.DR. ERDOĞAN PEKEL SALONU/ PROF.DR. ERDOĞAN PEKEL HALL

1. OTURUM/ 1st session

Oral Presentation Online

Başkan/ Moderator: SHAFA'ATU GIWA IBRAHIM /Dr. Mustafa Duman

Saat/Hour	Yazar/Autor/s	Ülke/ Country	**Başlık/Title**
09.00-9.15	Shafa'atu Giwa Ibrahim, Catherine A. Otitolaiye	Nijerya	Comparative Analysis Of Organoleptic And Nutritive Properties Of Fresh And Powdered Milk Yoghurt
9.15-9.30	Shafa'atu Giwa Ibrahim, Amina Rabe Musa	Nijerya	Production And Bacteriological Quality Of Soy Yoghurt
9.30-9.45	Aijaz Ali Panhwar	Pakistan	Global Water Resources Managent, Quality And Challenges For Sustainable Development Goals
9.45-10.00	Eric DUSHIMIRIMANA	Rwanda	Response Of NPK Split Application For Irish Potatoes Derived From The Nutrients' Uptake Pattern
10.00-10.15	Job Nyagashi, Noëlla Josiane Umuhoza Karemera, Sylvestre Habimana, Philippe Sibomana.	Rwanda	Impact Of Combined Inorganic Fertilizers With Vermicompost On Growth, Yield And Quality Of Bio-Fortified Beans (Phaseolus Vulgaris)
10.15-10.30	Ara		Break

8 Ekim 2022 Cumartesi, 08 October 2022 Saturday, Time by Türkiye

PROF.DR. ERDOĞAN PEKEL SALONU/ PROF.DR. ERDOĞAN PEKEL HALL

2. OTURUM/ 2st session

Oral Presentation Online

Başkan/ Moderator: Dr. Allah Bakhsh/Dr. MustafaDuman

Saat/Hour	Yazar/Autor/s	Ülke/ Country	**Başlık/Title**
10.30-10.45	Mahmood-ur-Rahman	Pakistan	Risks, Regulations And Genetic Engineering: A Way Forward For Commercialization Of Gm Crops In Pakistan
10.45-11.00	Erastus Dushimeyesu, Sylvestre Habimana, Fabrice Musana Rwalinda	Rwanda	Evaluation Of Yield Decrease In Common Beans Due To Anthracnose (Colletotrichum Lindemuthianum) Below Sub-Temperate Environment Of Northwestern Of Rwanda.
11.00-11.15	Aneela Yasmeen, Allah Bakhsh, Abdul Qayyum Rao	Pakistan	Reduction In Cold Induced Sweetening Of Potato Through Knock Out Of Vacuolar Invertase Gene
11.15-11.30	Waseem Akram, Asif Sajjad, Ammad Ahmad, Muhammad Sajjad, Muhammad Nawab	Pakistan	Pollination Of Brassica Campestris (Cruciferae) By Male Vs. Female Andrena Savignyi (Andrenidae: Hymenoptera)
11.30-11.45	Maria Fayyaz	Pakistan	A Review On Economics Importance Of Ginger Production In Pakistan
11.45-12.00	Philippe Sibomana, Josiane Noella Karemera Umuhoza, Sylvestre Habimana and Job Nyagashi	Rwanda	Physiological Variations Of Tomato Varieties (Solanum Lycopersicum L) Grown In The Environmental Conditions Of Busogo, Musanze District, Rwanda
12.00-12.10	Ara		Break

8 Ekim 2022Cumartesi, 08 October 2022 Saturday, Time by Türkiye

PROF.DR. ERDOĞAN PEKEL SALONU/ PROF.DR. ERDOĞAN PEKEL HALL

3. OTURUM/ 3st session

Poster Presentation Online

Başkan/ Moderator: Dr. Muazzez Gürgan Eser/Dr. Mustafa Duman

Saat/Hour	Yazar/Autor/s	Ülke/ Country	**Başlık/Title**
12.10-12.15	Mediha Nur Evren, Muazzez Gürgan Eser, İbrahim İsmet Öztürk	Türkiye	Investigation Of Some Antibacterial Effects Of Some Plant Extracts
12.15-12.20	Huseynli Atlas	Azerbaijan	Express Determination Of Ecotoxicantic Volume Substances In Waste Water Formed In The Process Of Hydrogen Purification Of Petroleum Oils
12.20-12.25	Emre Yörük, Safa Oufensou, Özlem Sefer, Quirico Migheli, Virgilio Balmas	Türkiye Italy	Genetic Characterisation Of Fusarium Culmorum Isolates From Çanakkale
12.25-12.30	Khadidja Hammou And Noureddine Djebli	Algeria	The Hepato-Therapeutique Effect Of Honey-Sidr From The Algerian Sahara On The Pathology Of Alzheimer Disease Study In Mice
12.30-13.30	Ara		Break

8 Ekim 2022 Cumartesi, *08 October 2022 Saturday Time by Türkiye*

PROF.DR. ERDOĞAN PEKEL SALONU/ PROF.DR. ERDOĞAN PEKEL HALL

4. OTURUM/ 4st session

Oral Presentation Online

Başkan / Moderator: Dr. Dr. Mustafa Duman

Saat/Hour	Yazar/Autor/s	Ülke/ Country	**Başlık/Title**

13.30	Erastus Dushimeyesu, Sylvestre Habimana, Fabrice Musana Rwalinda	Rwanda	Evaluation Of The Effects Of Drying Methods Post Aflatoxin Infection In Maize
13.45	Aijaz Ali Panhwar	Pakistan	Sustainable Development Goals Of, Environmental Challenges & Global Water Resources Crisis
14.00	Prodipto Bishnu Angon, Md. Shafiul Islam	Bangladeş	Comparative Analysis Between Food Affordability And Healthy Life Among The Rural And Cities People Of Bangladesh
14.15	Muhammad Kashan Ali, Hafiz Zakaullah	Pakistan	Vermicompost And Its Biological Application In Plants
14.30-14.45	Ara		Break

8 Ekim 2022Cumartesi, 08 October 2022 Saturday, Time by Türkiye

PROF.DR. ERDOĞAN PEKEL SALONU/ PROF.DR. ERDOĞAN PEKEL HALL

5. OTURUM/ 5st session

Oral Presentation Online

Başkan/ Moderator: Dr. Ahmet Uçar/Dr. Mustafa Duman

Saat/Hour	Yazar/Autor/s	Ülke/ Country	**Başlık/Title**
14.45	Koray Korkmaz	Türkiye	Comparison Of Israeli Carp Meat, Scales, Visceral Organs And Bone Structures In Terms Of Nutritional Content
15.00	Yılmaz Uçar, Mustafa Durmuş, Ali Rıza Köşker, Koray Korkmaz, Hatice Yazgan	Türkiye	The Influence Of Sweet Potato Peel Extract On Biogenic Amine Accumulation In Amino Acid Decarboxylase Broth By Food-Borne Pathogens
15.15	Muhammad Abbas Khan, Muhammad Yasir Naeem	Rawalpindi Türkiye	Medicinal Potential, Health Benefits And Bioactivity Of Mentha Piperita L. (Peppermint)
15.30	Ahmed Abdirahman Ahmed, Gökçen Yıldız	Türkiye	The Role Of Lactic Acid Bacteria In Food Preservation
15.45-16.00	Ara		Break

8 Ekim 2022Cumartesi, 08 October 2022 Saturday, Time by Türkiye

PROF.DR. ERDOĞAN PEKEL SALONU/ PROF.DR. ERDOĞAN PEKEL HALL

6 OTURUM/ 6st session

Oral Presentation Online

Başkan/ Moderator: Prof.Dr. Cem Tokatli/Dr.Mustafa Duman

Saat/Hour	Yazar/Autor/s	Ülke/ Country	**Başlık/Title**
16.00-16.15	Gülşen Uzun Gören, Şennan Yücel	Türkiye	Biological and Ecological Characteristics of Freshwater Lobster (Astacus leptodactylus Eschscholtz, 1823)
16.15-16.30	Gülşen Uzun Gören, Şennan Yücel	Türkiye	The Importance of Nutrition, Stock Density and Shelter Use in Juvenile Period in Freshwater Lobster Astacus leptodactylus (Eschscholtz, 1823) Breeding
16.30-16.45	Cem Tokatli	Türkiye	An Impact Assessment of Covid-19 Lockdown Period on the Sediment Quality of Meriç - Ergene River Basin in Türkiye
16.45-17.00	Cem Tokatli	Türkiye	Which Organism is More Suitable as a Toxic Metal Accumulation Bioindicator – Fishes or Diatoms: A Case Study of an A Class Wetland in Türkiye?
17.00-17.15	Ara		Break

8 Ekim 2022Cumartesi, 08 October 2022 Saturday Time by Türkiye

PROF.DR. ERDOĞAN PEKEL SALONU/ PROF.DR. ERDOĞAN PEKEL HALL

7OTURUM/ 7st session

Oral Presentation Online

Başkan/ Moderator: Dr. Erdinç Altınçekiç /Dr. Mustafa Duman

Saat/Hour	Yazar/Autor/s	Ülke/ Country	**Başlık/Title**
17.15-17.30	Erdinç Altınçekiç, Şeniz Öziş Altınçekiç	Türkiye	Importance of Feed Quality in the Production of Foods Obtained from Ruminants and Human Welfare
17.30-17.45	Erdinç Altınçekiç	Türkiye	Understanding Aerobic Deterioration and Ensuring Stability in Silo Feeds
17.45-18.00	Oluwadurotimi Olutosin Akintade, Gbemisola Elizabeth Ogunleye, Abiodun Busuyi Ogbesejana	Nigeria.	Analysis Of Organic Compounds In Industrial Effluents And Surface Water
18.00-18.15	Hasan Hüseyin İpçak, Muzaffer Denli	Türkiye	Perinatal Nutrition of Broiler Chicks
18.15-18.30	Erdem Artuvan, Salih Aksay	Türkiye	Optimization of Nucleic Acid Isolation in High-Fat Dairy Products
18.30-18.45	Ara		Break

8 Ekim 2022Cumartesi, 08 October 2022 Saturday Time by Türkiye

PROF.DR. ERDOĞAN PEKEL SALONU/ PROF.DR. ERDOĞAN PEKEL HALL

8 OTURUM/ 8st session

Oral Presentation Online

Başkan/ Moderator: Prof.Dr. Songül Çakmakçı /Dr. Mustafa Duman

Saat/Hour	Yazar/Autor/s	Ülke/ Country	**Başlık/Title**

18.45-19.00	Mehmet Ali Salik, Songül Çakmakçi	Türkiye	Geographical Indication Ayran and Yogurts of Türkiye
19.00-19.15	Abdullah Özbilgin, Recep Gümüş, Kübra Çınar Topçu	Türkiye	The Effect of Hesperidin Added to Japanese Quail Rations on Some Nutrient Contents of Egg
19.15-19.30	Hakan Polatci, Mehmetcan Olgaç, Hüsne Gök	Türkiye	*Eggplant (Solanum melongena L.) Drying Kinetics and Color Change*
19.30-19.45	Recep Gümüş, Abdullah Özbilgin	Türkiye	The Effects of Some Herbal Extracts Supplementation in Ration on Calcium, Phosphorus, and Magnesium Levels in Serum of Broiler Breeding in Stocking Density

8 Ekim 2022 Cumartesi, 8 October 2022 Saturday, Time by Türkiye

PROF.DR. NURETTİN KAŞKA SALONU/ PROF.DR. NURETTİN KAŞKA HALL

1. OTURUM/ 1st session

Oral Presentation Online

Başkan/ Moderator: Dr. Asif Ahmad/Yunus Emre Şentürk

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
09.00-9.15	Dereje Haile	Etiyopya	Phosphate Solubilizing Bacteria (PSB) Isolation From Tomato Rhizospheres At Koka District, Ethiopia
9.15-9.30	Teka Bekuma Abdisa, Girma Mamo Diga, Alemayehu Regassa Tolessa	Etiyopya	Trend And Temporal Variation Of Droughts In East Wollega Zone, Western Ethiopia
9.30-9.45	Asif Ahmad, Hassan Aziz, Muhammad Zohaib Zia, Rai Muhammad Amir, Muhammad Adeel Javed, Muhammad Tauseef Azam	Pakistan	*Meat Quality Packaging By Application Of Novel Edible Film And Coatings: A Review*
9.45-10.00	Asif Ahmad, Hassan Aziz, Muhammad Zohaib Zia, Rai Muhammad Amir, Muhammad Adeel Javed, Muhammad Tauseef Azam	Pakistan	Food Security In Pakistan
10.15-10.30	Hamza Badamasi, Umar Faruk Hassan, Harami Malgwi Adamu, Nasirudeen Mohammed Baba, Dahiru Ajiya Adamu	Nigeria	Heavy Metals Contamination Levels In Vegetables Grown Around Riruwai Mining Area, Kano State, Nigeria
10.30-10.45	Ara		*Break*

8 Ekim 2022 Cumartesi, 8 October 2022 Saturday, Time by Türkiye

PROF.DR. NURETTİN KAŞKA SALONU/ PROF.DR. NURETTİN KAŞKA HALL

2. OTURUM/ 2st session

Oral Presentation Online

Başkan/ Moderator: Dr. Kamala Kamal Badalova /Yunus Emre Şentürk

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
10.45-11.00	Guduro Beriso Ware	Etiyopya	Women Empowerment In Agricultural Activities And Its Impact On Farming Household Food Security: The Case Of Anna Sorra District, Guji Zone, Oromia Regional State, Ethiopia.
11.00-11.15	Niyazi Sh. Rasulzade, Namiq Sh. Rasulov, Kamala K.Badalova	Azerbaycan	Study Of Antibacterial Properties Of Salicylic Acid Derivatives
11.15-11.30	Abraham Dirbaba Guyysasa	Etiyopya	Modeling Surface Water Resources For Effective Water Allocation Using Water Evaluation And Planning (WEAP) Model, The Case Of Dabana Watershed, Dhidesa Sub Basin Of Ethiopia
11.30-11.45	Faiz Ahmad Joyia, Nazar Hussain, Ghulam Mustafa, Aqsa Parvaiz, Muhammad Sarwar Khan	Pakistan	Establishment Of An Efficient In Vitro Regeneration System For Spinach (Spinacia Oleracea L.)
11.45-12.00	Muhammad Qasim, Bilal Ahmad	Pakistan	Upregulatd Gene Expression Profiles Of BAK1 And BAK1/BCL2 Cause Age Related Hearing Impairment (ARHI) By Triggering Apoptosis
12.00-13.00	Ara		Break

8 Ekim 2022 Cumartesi, 8 October 2022 Saturday Time by Türkiye

PROF.DR. NURETTİN KAŞKA SALONU/ PROF.DR. NURETTİN KAŞKA HALL

3. OTURUM/ 3st session

Oral Presentation Online

Başkan/ Moderator: Dr. Dilvin İpek/Yunus Emre Şentürk

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
13.00	Dilvin İpek	Türkiye	*Antiviral Effects of a Natural Disinfectant Formulation on Enteric FCV, MNV Viruses*
13.15	Dilvin İpek, Irene Falcó, Gloria Sánchez, Necati Barış Tuncel, Seda Özdikmenli Tepeli	Türkiye Spain	Antiviral and Antibacterial Effects of Anatolian Folk Medicinal Plants Sideritis Trojana Ehrend and Hypericum perforatum Extracts via Ethanolic and Ultrasound
13.30	Osman FETOSHI And Ayten ÖZTÜRK	Türkiye	Removal of Methyl Red Dye From Aqueous Solution by Bacterial Consortium
13.45	Kanij Fatema Tuz Zohora, Bir Jahangir Shirazy, Md. Asaduzzaman, Nadia Akter, Saikat Hossain Bhuiyan, A. K. M. Ariful Hoque, A. A. M. Mohammad Mustakim, Maniruzzaman, A. B. M. Zahidul Hoque, Abul Kalam Azad	Bangladesh	Rural Development And Food Security Through Homestead Vegetable Production: A Case Study
13.45-14.00	Ara		Break

8 Ekim 2022 Cumartesi, 8 October 2022 Saturday Time by Türkiye

PROF.DR. NURETTİN KAŞKA SALONU/ PROF.DR. NURETTİN KAŞKA HALL

4. OTURUM/ 4st session

Oral Presentation Online

Başkan/ Moderator: Dr. Aijaz Hussain Soomro/Yunus Emre Şentürk

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title

14.00	Aijaz Hussain Soomro, Aimal Khan, Tahseen Fatima Miano, Asadullah Marri, Shahzor Gul Khaskheli	Pakistan	*Effect Of Carrot And Cowpea Powder Incorporation On The Nutritional Quality Of Biscuits*
14.15	Abhisek shrestha, Bharti Thapa	Nepal	*Evaluation Of Elite Sugarcane Genotypes In Nepal*
14.30	Alabi K.O; Afe A.I; and J.A. Isaac	Nijerya	Soil Suitability Assessment For Sustainable Production Of Cucumber (Cucumis Sativus L.) In The Southern Guinea Savanna Zone Of Nigeria
14.45	Eniola Ajibola Olowu, Ian Timothy Riley	Nijerya Avustralya	Farmer Perception Of Trees In A Semiarid Agroecological Zone
14.45-15.00	Abdul Munim Farooq Komal Shabir, Saman Riaz, Allah Bakhsh, Abdul Qayyum Rao	Pakistan	Transformation and Expression Analysis of CEMB VIP3A Gene in Local Maize Inbred Lines
15.00	Ara		Break

8 Ekim 2022 Cumartesi, 8 October 2022 Saturday, Time by Türkiye

PROF.DR. NURETTİN KAŞKA SALONU/ PROF.DR. NURETTİN KAŞKA HALL

5. OTURUM/ 5st session

Oral Presentation Online

Başkan/ Moderator: Doç.Dr. Pınar Oğuzhan Yıldız/Yunus Emre Şentürk

Saat/Hour	Yazar/Autor/s	Ülke/ Country	**Başlık/Title**
15.15	Pınar Oğuzhan Yıldız	Türkiye	Caviar Technology
15.30	Rahimeh Jaberi, Pınar Oğuzhan Yıldız	Türkiye	YıldızUse of Dietary Fibers in Fish and Fish Products
15.45	Gökhan Arslan, Pınar Oğuzhan Yıldız	Türkiye	Carbon Footprint
15.45-16.00	Kadir Erten, Aylin Ağma Okur, H. Ersin Şamlı	Türkiye	Impacts of Using Insects As Feedstuff on The Animal Immune System
16.00-16.15	Sabri Demir, H. Vasfi Gençer, Yasin Kahya	Türkiye	The Effect of Using Drawn Combs on Colony Weight Gain and Honey Yield
16.15-16.30	Ara		Break

8 Ekim 2022 Cumartesi, 8 October 2022 Saturday, Time by Türkiye

PROF.DR. NURETTİN KAŞKA SALONU/ PROF.DR. NURETTİN KAŞKA HALL

6. OTURUM/ 6st session

Oral Presentation Online

Başkan/ Moderator: Doç.Dr. Sertaç Güngör/Yunus Emre Şentürk

Saat/Hour	Yazar/Autor/s	Ülke/ Country	**Başlık/Title**
16.30-16.45	Sertaç Güngör, Sabriye Melis Çinçinoğle	Türkiye	Economic, Cultural And Environmental Impacts Of EXPO`21 HATAY In The Scope Of Sustainability
16.45-17.00	Sertaç Güngör, Elif Nur Doğan	Türkiye	Determination And Evaluation Of Field Adequacy By Ankara Göksu Park Users
17.00-17.15	Nil Irmak Kugu, Kübra Yılmaz, Derya Deniz Şirinyıldız, Aslı Yorulmaz	Türkiye	RASFF (Rapid Alert System For Food And Feed) Notifications For Food And Food Contact Materials In 2021
17.00-17.15	Özlem Esmer, Erinç Koçak, Alp Efe Cevrem, Orhan Kicikoğlu	Türkiye	Alkali Extraction Of Phenolic Compounds From Tomato Peel: Optimization Of Extraction Conditions And Investigation Of Phenolic Profile By Lc/Msms
17.15-17.30	Ara		Break

8 Ekim 2022 Cumartesi, 8 October 2022 Saturday, Time by Türkiye

PROF.DR. NURETTİN KAŞKA SALONU/ PROF.DR. NURETTİN KAŞKA HALL

7. OTURUM/ 7st session

Oral Presentation Online

Başkan/ Moderator: Doç.Dr. Rifat Olgun /Yunus Emre Şentürk

Saat/Hour	Yazar/Autor/s	Ülke/ Country	**Başlık/Title**
17.30-17.45	Pınar Küçük, Nazlı Savlak	Türkiye	Cauliflower Powder as an Alternative Source for Gluten-Free Products
17.45-18.00	Rifat Olgun	Türkiye	Evaluation of Noise in Children's Playgrounds: The Case of Dokuma Park
18.00-18.15	Ayca Aydogdu Emir, Elif Isik	Türkiye	Guar Gum and Sumac Based Active Food Packaging: Effect of Sumac Form and Solvent Type
18.15-18.30	Nesrin Dursun	Türkiye	Physical and Chemical Pretreatments Applied to Lignocellulosic Biomass
18.30-18.45	Seda Işık, Özlem Akpınar	Türkiye	Ultrasound Assisted Extraction And Optimization Of Pectin From Pumpkin Peels
18.45-19.00	Jannatul Ferdous , Jannatun Nayeema , Tithi Sarker	Bangladesh	Sunflower Growth, Yield And Nutrient Uptake As Influenced By Different Nitrogen Levels

8 Ekim 2022 Cumartesi, 08 October 2022 Saturday, Time by Türkiye

PROF.DR. ERCAN TEZER SALONU/ PROF.DR. ERCAN TEZER HALL

1. OTURUM / 1st session

Oral Presentation Online

Başkan/ Moderator: Dr. Adewale Isaac Olutumise/Ahmet Akyol

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
09.00-9.15	Sordji Larweh, Ammal Abukari	Ghana	*Small-Scale Farmers' Perception Of The Adoption Of Agroforestry Practices In Tolon District, Ghana*
9.15-9.30	Adewale Isaac Olutumise, Babatunde Peter Ekundayo, Olanrewaju Olaniyi Omosehin	Nijerya	Opportunity Cost And Hindrances To Climate Adaptation Among Cassava Farmers In Southwest, Nigeria: A Panacea For Food Security
9.30-9.45	Harshit P Bhavsar	Hindistan	Vertical Axis Maglev Wind Turbine Having Various Designs
9.45-10.00	Hamza Badamasi, Umar Faruk Hassan, Harami Malgwi Adamu, Nasirudeen Mohammed Baba, Dahiru Ajiya Adamu	Nijerya	*Heavy Metals Contamination Levels In Vegetables Grown Around Riruwai Mining Area, Kano State, Nigeria*
10.00-10.15	Fathima Fasha and P. Neelamanie Yapa	Sri Lanka	Development Of An Antimicrobial Topical Skin Cream With Using Wood Apple (Limonia Acidissima L.) Pulp Against Staphylococcus Aureus, Pseudomonas Aeruginosa And Candida Albicans

*8 Ekim 2022 Cumartesi, **08 October 2022 Saturday, Time by Türkiye***

PROF.DR. ERCAN TEZER SALONU/ PROF.DR. ERCAN TEZER HALL

2. OTURUM / 2st session

Oral Presentation Online

Başkan/ Moderator: Dr. Asif Ahmad/Ahmet Akyol

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
10.30-10.45	Ridwan Mukaila, Abraham Falola, Sheu-Usman Oladipo Akanbi	Nigeria	Revisiting The Food Security And Nutrition Status Of Farming Households After Covid-19 Lockdown In Nigeria
10.45-11.00	Asif Ahmad, Hassan Aziz, Anwaar Ahmadi Attiq ur Rehman, Muhammad Adeel Javed, Muhammad Tauseef Azam	Pakistan	A Review: Assessment Of Moringa Oleifera Seed Purification Role In Drinking Water
11.00-11.15			
11.15-11.30	Hafidha Mehallah and Noureddine Djebli	Algeria	Morinda Longissima Effect On Inflammation In Carrageenan- Induced Paw Edema In Mice - Histological Study
11.30-11.45	Ara		Break

8 Ekim 2022 Cumartesi, 08 October 2022 Saturday, Time by Türkiye

PROF.DR. ERCAN TEZER SALONU/ PROF.DR. ERCAN TEZER HALL

3.OTURUM / 3st session

Oral Presentation Online

Başkan/ Moderator: Dr.Bekir AYYILDIZ/Ahmet Akyol

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
11.45	Ünal Şirin, Sedat Karaman	Türkiye	A Research on Agricultural Products Storage Warehouses in Van Province
12.00	Bekir Ayyildiz, Onur Saraçoğlu, Hakan Karadağ, Hakan Polatci	Türkiye	
12.15	Gülşah Bektaş, Güler Yenice	Türkiye	The Effects of Betulinic Acid Administration on Protein and Lipid Profile in Liver Damaged Rats
12.30	Kutbettin Arslan, Gulten Okmen, Başak Gormen	Türkiye	The Determination of Antibacterial Activities of Peels of Fruits Punica granatum L.Against the Crop Spoiling Pathogens
12.30-13.30	Ara		Break

8 Ekim 2022 Cumartesi, 08 October 2022 Saturday, Time by Türkiye

PROF.DR. ERCAN TEZER SALONU/ PROF.DR. ERCAN TEZER HALL

4. OTURUM / 4st session

Oral Presentation Online

Başkan/ Moderator: Prof.Dr. Suat Dikel/Ahmet Akyol

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
13.30-13.45	Suat Dikel, İbrahim Demirkale, Ece Evliyaoğlu	Türkiye	Digitalisation In Aquaculture Management
13.45-14.00	Suat Dikel, Ece Evliyaoğlu, İbrahim Demirkale	Türkiye	Application Of Blockchain Technology In Fisheries And Aquaculture Production Sector
14.00-14.15	Aysel Kekillioğlu, Ümmügülsüm Yakupoğlu	Türkiye	Research On The Bio-Ecology And Biological Control Process Of Eurytoma Amygdali, Enderlein (Hymenoptera: Eurytomidae)
14.15-14.30	Aysel Kekillioğlu, Ali Aslan Erdoğan	Türkiye	Research On The Bio-Ecology, Morphology And Seasonal Variation Of Dendrobaena Veneta (Rosa, 1886)
14.30-14.45	Ara		Break

8 Ekim 2022 Cumartesi, 08 October 2022 Saturday, Time by Türkiye

PROF.DR. ERCAN TEZER SALONU/ PROF.DR. ERCAN TEZER HALL

5.OTURUM / 5st session

Oral Presentation Online

Başkan/ Moderator: Dr. Asuman Büyükkılıç Yanardağ /Ahmet Akyol

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
14.45-15.00	Dilvin İpek, Nukhet N. Demirel Zorba	Türkiye	Sanitizing Stainless Steel Process Surfaces By New Natural Disinfectant Formula
15.00-15.15	Asuman Büyükkılıç Yanardağ, İbrahim Halil Yanardağ	Türkiye	A Review: Covid-19 Impacts On Soil
15.15-15.30	Mustafa Ulas , Nilufer Gulnar Celik	Türkiye	Valproic Acid Prevents Oxidative Spleen Damage Due To Spinal Cord Injury By Regulating Antioxidant Enzymes In Rats
15.30-15.45	Ali Rıza Köşker, Yılmaz Uçar, Mustafa Durmuş, Koray Korkmaz, Hatice Asuman Yılmaz	Türkiye	Metal levels of commercially important Saurida lessepsianus from North-Eastern Mediterranean: Health risk estimation
15.45-16.00	Ara		Break

8 Ekim 2022 Cumartesi, 08 October 2022 Saturday, Time by Türkiye

PROF.DR. ERCAN TEZER SALONU/ PROF.DR. ERCAN TEZER HALL

6.Oturum / 6st Session

Oral Presentation Online

Başkan/ Moderator: Dr. Fatma Ergün /Ahmet Akyol

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
16.00-16.15	Aysel Kekillioğlu, Kutbettin Arslan, Fatma Soysaldı, Gülten Ökmen	Türkiye	Determination of Antibacterial and Antioxidant Activities of Eisenia fetida (Savigny, 1826) Against Mastitis Pathogens
16.15-16.30	Aysel Kekillioglu, Manal Mutahar Ali Al-Hajj	Türkiye	Challenges Of Scientific Research in Molecular Biotechnology in Yemen
16.30-16.45	Gülşah Keklik	Türkiye	Data Mining Methods Used In Livestock And An Application
16.45-17.00	Fatma Ergün	Türkiye	Determination Of Phytochemicals And Antioxidant Capacities Of Fresh Scots Pine (Pinus Sylvestris L.) Sprouts Consumed As Herbal Tea
17.00-17.15	Ara		Break

8 Ekim 2022 Cumartesi, 08 October 2022 Saturday, Time by Türkiye

PROF.DR. ERCAN TEZER SALONU/ PROF.DR. ERCAN TEZER HALL

7.OTURUM / 7st session

Oral Presentation Online

Başkan/ Moderator: Doç.Dr. Cem Baltacıoglu/Ahmet Akyol

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
17.15-17.30	Mehmet Yetisen, Cem Baltacıoglu, Hasan Uslu	Türkiye	Reactive Extration Of Lactic Acid Using Trioctylamine With Environmentally Friendly Solvents
17.30-17.45	Asiye Özcan Tarım, Cem Baltacıoglu	Türkiye	New Trends In Functional Beverages Nowadays
17.45-18.00	Orkun Emiralioğlu, Mehmet Zahit Yeken, Ali Çelik, Vahdettin Çiftçi	Türkiye	The Monitoring Of The Resistance Genes Associated With BCMV And BCMNV In Promising Common Bean Lines
18.00-18.15	Burcu Aksüt, Hakan Polatci, Muhammed Taşova	Türkiye	The Effect Of Drying Methods On Drying And Thermo-Physical Properties Of Apricot Kernels
18.15-18.30	Hatice Yildirim, Latif Gürkan Kaya, Hüseyin Samet Aşikkutlu	Türkiye	Is The World Ready for A New Pandemic After The Covid-19 Pandemic?
18.30-18.45	Ara		Break

8 Ekim 2022 Cumartesi, 08 October 2022 Saturday Time by Türkiye

PROF.DR. ERCAN TEZER SALONU/ PROF.DR. ERCAN TEZER HALL

8.OTURUM / 8st session

Oral Presentation Online

Başkan/ Moderator: Dr.Saba Zafar /Ahmet Akyol

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
18.45-19.00	Amar Rouabhi, Abdelali Djelloul, Abdelhamid Mekhlouf	Algeria	Assessment of Durum wheat behavior according to phenology and climatic patterns in the semi-arid region of Setif-Algeria
19.00-19.15	Wajid khan, Nisar Ali, Muhammad Nazir Uddin, Dawood Ghafoor, Muhammad Ishaq, Haji khan, Muhammad Rizwan, Shahab Ahmad khan	Pakistan	Differential antimicrobial potential of Ajuga bracteosa Wall ex. Benth based on extraction solvents
19.15-19.30	Saba Zafar, Haris Khurram, Muhammad Kamran, Madeeha Fatima, Aqsa Parvaiz, Rehan Sadiq Shaikh	Pakistan	Association Study for GJA8 Variants with Age-Related Cataract in Population of Pakistan
19.30-19.45	Md. Shafiul Islam, Shitosri Mondal, Prodipto Bishnu Angon, Md. Abdul Jalil	Bangladesh	A Critical Review on The Accumulation of Microplastics In Agroecosystem and Its Effects on Terrestrial Plants

8 Ekim 2022 Cumartesi, 08 October 2022 Saturday, Time by Türkiye

PROF.DR. AHMET CAN ÜLGER SALONU/ PROF.DR. AHMET CAN ÜLGER HALL

1. OTURUM / 1st session

Oral Presentation Online

Başkan/ Moderator: Dr. Ebrahim Alinia-Ahandani /Dr. Emre Aksoy

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
09.00-9.15	Alieva Tarana, Hajiyeva Hadiyya,Samedova Ayten, Malikova Afag	Azerbaijan	Soil Contamination With Protein And Vitamin Preservatives
9.15-9.30	Adigozalov Parviz	Azerbaijan	Evaluation Of Environmentally Harmful Mineral Fertilizer Standards In Irrigated Gray Brown Soils In Samukh District
9.30-9.45	Muhammad Umair Asghar, Mariusz Korczyński, Sibel Canoğulları Doğan, Sema Yaman	Poland Türkiye	Alternatives To Antibiotics In The Poultry Diet Regarding One Health Concept
9.45-10.00	Ebrahim Alinia-Ahandani, Zahra Alizadeh-Terepoei, Zeliha Selamoglu	İran Türkiye	Overview On Raspberry Leaves And Blue Cohosh (Caulophyllum Thalictroides) As Partus Preparatory
10.00-10.15	Tahira Jabeen Ursani, Fahmida Channa	Pakistan	Prevalence And Frequency Of Diabetic Autonomic Neuropathy (DAN) And Their Related Risk Factors In Type 1 Diabetic Patients Of Hyderabad And Jamshoro
10.15-10.30	Ara		Break

8 Ekim 2022 Cumartesi, 8October 2022 Sunday Time by Türkiye

PROF.DR. AHMET CAN ÜLGER SALONU/ PROF.DR. AHMET CAN ÜLGER HALL

2.OTURUM / 2st session

Oral Presentation Online

Başkan/ Moderator: Prof.Dr. Tahira Jabeen Ursani/Dr. Emre Aksoy

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
10.30-10.45	Muhammad Umair Asghar, Mariusz Korczyński, Martyna Wilk, Barbara Król, Maja Słupczyńska, Sibel Canoğulları Doğan, Sema Yaman	Poland Türkiye	Nutritional Strategies Particularly Lactic Acid Bacteria To Reduce Methane Production In Ruminants
10.45-11.00	Muhammad Junaid Khilji, Tahira Jabeen Ursani and Jawaid Ahmed Khokhar	Pakistan	The Testosterone Role In Adolescent Males From Hospital Of Hyderabad And Jamshoro
11.00-11.15	Aijazan Parveen Lakhiar, Tahira Jabeen Ursani and Jawaid Ahmed Khokhar	Pakistan	Evaluation Of Diabetic Foot Complications In Outdoor Patients At Different Hospitals From District Naushahro Feroze Sindh
11.15-11.30	Usman M. Khan, Mesut Selamoglu	Pakistan Türkiye	The Role Of E-Commerce In The Daily Food Sector
11.30-11.45	Aliyeva Tarana, Abdullayev Rizvan, Melikova Afak	Azerbaijan	Interrelation Of Humic Substances With Chemical Substances And Pollutants
12.00-13.30	Ara		Break

8 Ekim 2022 Cumartesi, 8 October 2022 Sunday Time by Türkiye

PROF.DR. AHMET CAN ÜLGER SALONU/ PROF.DR. AHMET CAN ÜLGER HALL

3. OTURUM / 3st session

Oral Presentation Online

Başkan/ Moderator: Dr. Oyeyemi Sunday Dele /Dr. Emre Aksoy

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
13.30-13.45	Oyeyemi Sunday Dele, Oyedele Alfred Adedayo and Ismaila Grace Kehinde	Nigeria	Studies on Nutritional Profile and Mineral Bioavailability of Some Solanum species Consumed as Fruits in Ekiti State, Nigeria
13.45-14.00	Jerry Ampofo-Asiama, Nazir Kizzie-Hayford, Salifu Seidu-Larry	Ghana	Effect Of Sweetening Type On The Quality And Acceptability Of Roselle Tea.
14.00-14.15	Sadia Zafar and Asghari Bano	Pakistan	Comparative Effect Of Wild Type Of Pseudomonas Moraviensis And Its Mutants On Chickpea Under Salinity
14.15-14.30	Obembe Olusola Michael	Nigeria	Insecticidal Activity Of The Seed Powders Of Bush Banana, Uvaria Afzelli Scott Elliot Against Maize Weevil, Sitophilus Zeamais Motschulsky (Coleoptera: Curculionidae).
14.30-14.45	Ara		Break

8 Ekim 2022 Cumartesi, 8 October 2022 Sunday Time by Türkiye

PROF.DR. AHMET CAN ÜLGER SALONU/ PROF.DR. AHMET CAN ÜLGER HALL

4. OTURUM / 4st session

Oral Presentation Online

Başkan/ Moderator: /Dr.Emre Aksoy

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
14.45-15.00	Arif Şanli, Fatma Zehra Ok	Türkiye	Effects Of Foliar Plant Growth Regulator Applications On Fruit And Essential Oil Yield Of Fennel (Foeniculum Vulgare Mill)
15.00-15.15	Burhan Özsoy, Özge Doğanay Erbaş Köse	Türkiye	Overall Assessment Of The Efficiency Of Nitrification And Urease Inhibitors
15.15-15.30	Metin Caglar, Rzgar Farooq Rashid, Zeliha Selamoglu	Irak Türkiye	Atatürk Dam Lake's (Adıyaman, Türkiye) Planktonic Diatoms
15.30-15.45	Sahebeh Hajipour , Ebrahim Alinia-Ahandani , Zeliha Selamoglu	İran Türkiye	A Fundamental Approach To The Medicinal Effects Of Walnut Green Husk (Juglans Regia L)
15.45-16.00	Ara		Break

8 Ekim 2022 Cumartesi, 8 October 2022 Sunday Time by Türkiye

PROF.DR. AHMET CAN ÜLGER SALONU/ PROF.DR. AHMET CAN ÜLGER HALL

5.OTURUM / 5st session

Oral Presentation Online

Başkan/ Moderator: Dr. Carmen –Olguța Brezuleanu /Dr. Emre Aksoy

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
16.00-16.15	Ebrahim Alinia-Ahandani	İran	A Glimpse Of The Amazing Effects Of Some Effective Medicinal Plants On The Skin
16.15-16.30	Carmen –Olguța Brezuleanu , Diana Elena Creangă, Mădălina-Maria Brezuleanu , Alexandru Sorin Tudoran	Romania	Aspects Related To The Implementation Of European Instruments, Programs And Policies For The Protection Of The Environment In The Romanian Space
16.30-16.45	Usman M. Khan, Mesut Selamoglu, Ali Murad Khan	USA Türkiye Pakistan	The Globalization Of The Food Sector And The Importance Of The Logistic
16.45-17.00	Usman M. Khan, Mesut Selamoglu, Ali Murad Khan	USA Türkiye Pakistan	The Role Of E-Commerce In The Daily Food Sector
17.00-17.15	Vahid Saatchian, Seyed karim Saadat Mirghadim, Zeliha Selamoglu, Ebrahim Alinia-Ahandani	İran Türkiye	Identifying And Modeling Factors Affecting The Special Value Of The Green Brand In Women's Recreational-Sports Activities
	Ara		Break

8 Ekim 2022 Cumartesi, 8 October 2022 Sunday Time by Türkiye

PROF.DR. AHMET CAN ÜLGER SALONU/ PROF.DR. AHMET CAN ÜLGER HALL

6. OTURUM / 6st session

Oral Presentation Online

Başkan/ Moderator: /Dr. Emre Aksoy

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
17.15-17.30	Niyonsenga Evergiste, Musana Rwalinda Fabrice, Saidi Rumanzi Mbaraka, Ismael Niyokwizigirwa, Erastus Dushimyesu, Theophile Kanyarwanda, Egide Niyibizi, Eric Muhayimana, Emmanuel Niyigaba	Rwanda	Effects Of Inorganic And Organic Fertilizers On Irish Potato (Solanum Tuberosum L.): Growth, Yield And Pocessing Quality In Volcanic Soil-Musanze District
17.30-17.45	Laiba Arshad, Ibrahim Jantan, Syed Nasir Abbas Bukhari	Pakistan Malaysia Saudi Arabia	Enhanced Immunosuppressive Effects Of 3,5-Bis[4 (Diethoxymethyl) Benzylidene]-1-Methyl-Piperidin- 4-One, An A, B-Unsaturated Carbonyl-Based Compound As Plga-B-Peg Nanoparticles
17.45-18.00	Theophile Kanyarwanda, Habimana Sylvestre, Umuhoza Karemera Noella Josiane, Musana Rwalinda Fabrice, Uwisize Grace, Niyokwizigirwa Ismael, Dushimeyesu Erastus, Niyonsenga Evergiste, Niyomugabo Jean De Dieu, Tuyishime Emmanuel	Rwanda Burundi	Effect of organic and industrial fertilizers on reducing sugar, specific gravity, dry matter and starch composition of fresh harvested irish potato varieties in Musanze District Rwanda
18.00-18.15	Sambo S. Mailumo, Godfrey C. Onuwa	Nigeria	Adoption Index of Recommended Onion Production Practices and Correlation of Multivariate Factors among Smallholder Farmers
18.15-18.30	Hadjer Chenini-Bendiab and Noureddine Djebli	Algeria	Nephroprotective effect of Algerian date seed extract (Phoenix dactylifera L.) against mercuric chloride-Induced alterations of kidney tissue
18.30-18.45	Erastus Dushimeyesu, Sylvestre Habimana, Fabrice Musana Rwalinda, James Mushayija	Rwanda Japan	Evaluation Of The Effect Of Fertilization And Drying Methods On Pre And Post Aflatoxin Infection In Maize Under Busogo Climatic Conditions
	Ara		Break

8 Ekim 2022 Cumartesi, 8 October 2022 Sunday Time by Türkiye

PROF.DR. AHMET CAN ÜLGER SALONU/ PROF.DR. AHMET CAN ÜLGER HALL

7.OTURUM / 7st session

Oral Presentation Online

Başkan/ Moderator:Prof.Dr. Hasan Eleroğlu /Dr. Emre Aksoy

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
18.45-19.00	Mehmet Zahit Demir, Hasan Eleroğlu	Türkiye	Effects of Addition of Phytase Enzyme, Red Pepper, Dried Caper Powder, Propolis Extract and Alfalfa Juice to Free-Raised Egg Chicken Feeds on Egg Quality Parameters
19.00-19.15	Derya Güloğlu		
19.15-19.30	Arif Şanli, Hülya Özgönen Özkaya	Türkiye	Antifungal Activities Of Sulphur Applications Against Rhizoctonia Solani And Fusarium Solani On Potato
19.30-19.45	Büşra Sena Savaş, Şebnem Şimşek	Türkiye	Some Bioactive Properties of Tea Waste
	Ara		Break

9 Ekim 2022 Pazar, 9 October 2022 Sunday, Time by Türkiye

PROF.DR. OSMAN TEKİNEL SALONU/ PROF.DR. OSMAN TEKİNEL HALL

1. OTURUM / 1st session

Oral Presentation Online

Başkan/ Moderator: Dr. Muhammad Shahid/Dr.Burak Şen

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
09.00-9.30	Dr. Muhammad Shahid	Pakistan	Seed Priming: A Shortgun Approach For Crop Improvement With Special Reference To Maize Under Salt Stress
9.30-9.45	Sordji Larweh, Ammal Abukari	Ghana	Small-Scale Farmers' Perception Of The Adoption Of Agroforestry Practices In Tolon District, Ghana
9.45-10.00	Festus Maniriho, and Mehmet. A. Aşkin	Rwanda Northern Cyprus	Occurrence Of Parthenocarpic Embryos Development During Fruit Formation Among Olive (Olea Europea) Cultivars
10.00-10.15	Oluwadurotimi O. Akintade, Gbemisola E. Ogunleye, Abiodun Ogbesajana	Nigeria.	Analysis of organic compounds in industrial effluents and surface water.
10.15-10.30	Ara		Break

9 Ekim 2022 Pazar, 9 October 2022 Sunday Time by Türkiye

PROF.DR. OSMAN TEKİNEL SALONU/ PROF.DR. OSMAN TEKİNEL HALL

2.OTURUM / 2st session

Oral Presentation Online

Başkan/ Moderator: Doç.Dr. Halil Toktay/Dr. Burak Şen

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
10.30-10.45	Aqsa Parvaiz, Ghulam Mustafa, Faiz Ahmad Joyia	Pakistan	Red Rot Resistant Transgenic Sugarcane Developed By Over-Expression Of SUGARWIN Gene(S)
10.45-11.00	Muhammad Amjad Ali, Usman Arshad, Halil Toktay	Pakistan Türkiye	Combination Of Biochar With Antagonistic Microbes To Control Plant Parasitic Nematodes In Different Crops: A Way Forward To Green Plant Protection Strategies
11.00-11.15	Begna Tesema Bekana, Tolera Megersa, Fedhasa Benti	Ethiopia	Effects Of Land, Use Land Cover And Slope Gradients On Soil Fertility At Kori Sub-Watershed, East Wollega, Ethiopia
11.15-11.30	Andrew Bamidele Falowo	Nigeria	Evaluation Of Nutritional And Antioxidant Properties Of Chenopodium Ambrosioides L. And Crassocephalum Crepidioides Leaf Meal As Potential Feed Additives
11.30-11.45	A.P.L.N.S. Jayakody, K.W.A. Madhushan, A.T. Pelawatta and P. N. Yapa	Sri Lanka	Effect Of Biofertilizers And Organic Amendments On Germination And Seedling Growth Of Common Dry Zone Forest Species In Sri Lanka: Sustainable Reforestation Practices In Sri Lanka
12.00-13.30	Ara		Break

9 Ekim 2022 Pazar, 9 October 2022 Sunday Time by Türkiye

PROF.DR. OSMAN TEKİNEL SALONU/ PROF.DR. OSMAN TEKİNEL HALL

3. OTURUM / 3st session

Oral Presentation Online

Başkan/ Moderator: Doç. Dr. Hakan Polatcı/Dr.Burak Şen

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
13.30-13.45	Ali Cingöz	Türkiye	The Effects Of Using Safflower Seed Flour On Quality Characteristics Of Cupcakes
13.45-14.00	Hakan Polatci, Hüsne Gök, Mehmetcan Olgaç	Türkiye	Determination Of Optimal Drying Characteristics For Color Quality Parameters Of Carrot (Daucus Carota L.) At Different Drying Temperatures
14.00-14.15	Mustafa Güneşdoğdu, Ahmet Şekeroğlu	Türkiye	The Efficiency Of Different Methods In Acceptance Queen Bees To Colonies
14.15-14.30	Gülşah Keklik	Türkiye	Evaluation Of Studies On The Use Of Biotechnological Developments In Agricultural And Animal Production
14.30-14.45	Ara		Break

9 Ekim 2022 Pazar, 9 October 2022 Sunday Time by Türkiye

PROF.DR. OSMAN TEKİNEL SALONU/ PROF.DR. OSMAN TEKİNEL HALL

4.OTURUM / 4st session

Oral Presentation Online

Başkan/ Moderator: Prof.Dr. İbrahim Ak/Dr. Burak Şen

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
14.45-15.00	Taşkın Değirmencioğlu	Türkiye	Protein Requirements Of Buffalo
15.00-15.15	Sümer Haşimoğlu, İbrahim Ak, Metin Güldaş, Nizamettin Şenköylü	Germany Türkiye	Ukraine – Russian Conflict Creates A Series Food (Grain) Security Threat For Turkish Agriculture/Economy And Vulnerability Evaluations On Innovated Per Adult Human Unit Method (PAHUM) Vs. Per Capita
15.15-15.30	Çay Ve Polifenoller Serim Tuna Koç	Türkiye	Tea And Polifenols
15.30-15.45	Fekal Mikrobiyota Transplasyonu Serim Tuna Koç	Türkiye	Fecal Microbiota Transplation
15.45-16.00	Ara		Break

9 Ekim 2022 Pazar, 9 October 2022 Sunday Time by Türkiye

PROF.DR. OSMAN TEKİNEL SALONU/ PROF.DR. OSMAN TEKİNEL HALL

5.OTURUM / 5st session

Oral Presentation Online

Başkan/ Moderator:Prof.Dr. Sedat Karaman/Dr. Burak Şen

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
16.00-16.15	Hatice Çınar, Kerim Çınar	Türkiye	Investigation Of Spatial Analysis Of Small Houses Built In Konya
16.15-16.30	Hatice Çınar, Mine Sungur	Türkiye	Metaphorical Approach in Interior Architecture Education
16.30-16.45	Fatma Ergün	Türkiye	Determination Of Phytochemicals And Antioxidant Capacity Of Satureja Hortensis L.
16.45-17.00	Gülşah Keklik	Türkiye	A Study On Applications Of Deep Learning Network Architectures In Animal Husbandry
17.00-17.15	Ünal Şirin, Sedat Karaman, Fatih Şevki Erkuş, Şefik Tüfenkçi	Türkiye	Determination Of Biogas Energy Potential To Be Obtained From Animal Manures In Van Province
17.15-17.30	Ara		Break

9 Ekim 2022 Pazar, 9 October 2022 Sunday Time by Türkiye

PROF.DR. OSMAN TEKİNEL SALONU/ PROF.DR. OSMAN TEKİNEL HALL

6.OTURUM / 6st session

Oral Presentation Online

Başkan/ Moderator: Dr. Hakan Karadağ/Dr.Burak Şen

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
17.30-17.45	Pınar Küçük	Türkiye	Alternative Raw Material Source For Gluten-Free Products: Cauliflower Powder
17.45-18.00	Hakan Karadağ, Fatma Dumlu , Mehmet Murat Cömert	Türkiye	Aeroponic Cultivation In Türkiye And The World
18.00-18.15	Osman Nuri Öcalan, Fatmanur Çezik, Ala Asi Mohammed Al-Salihi , Muhammet Rahmetullah Çiğdem , Kenan Yildiz	Türkiye	The Effect Of Post-Harvest Calcium Chloride Applications On The Shelf Life Of Strawberry
18.15-18.30	Emircan Dinçer, Onur Saraçoğlu, Osman Nuri Öcalan	Türkiye	Rooting Performances Of Promising Black Mulberry (Morus Nigra L.) Genotypes Determined In Tokat Province Under Same Environmental Conditions
18.30-18.45	Sevilcan Korkut, Zeynep Simsek, Muhammet Donmez	Türkiye	Sensory Quality Properties of Fermented Foods
18.45-19.00	Büşra Altay, Zekeriya Can Erbil	Türkiye	Solid Waste Landfill Site Selection; Konya City Sample
19.15	Zekeriya Can Erbil, Büşra Altay	Türkiye	The Relationship between Shadow Analysis and Sustainability in University Campuses: The Example of Selcuk University Alaeddin Keykubat Campus
	Ara		Break

9 Ekim 2022 Pazar, 9 October 2022 Sunday,Time by Türkiye

PROF.DR. ERDOĞAN PEKEL SALONU/ PROF.DR. ERDOĞAN PEKEL HALL

1.OTURUM / 1st session

Oral Presentation Online

Başkan/ Moderator: Prof.Dr. Zeliha Selamoglu/Dr. Mustafa Duman

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
09.00-9.30	Prof.Dr. Noureddine Djeblii	Algeria	Neuroprotection Of Algerian Dates Against Alzheimer's Disease In Vivo Studies
9.30-9.45	Betul Ozdemir, Zeliha Selamoglu	Türkiye	The Use Of Natural Products In Preventive Medicine And Healthy Life
9.45-10.00	Bayramov Qiyas	Azerbaijan	Synthesis Of N1,N3-Di(N1',N1'-Didesoxymethylazon-N'-Monodesoxymethylazone)Diphenylquanidine And Research As A Corrosion Inhibitor
10.00-10.15	Bayramov Qiyas	Azerbaijan	Synthesis Of N4, N5-Di(N1',N1'-Didesoxymethylazon-N'-Monodesoxymethylazone)Diphenylcarbazone Compound And Research As A Corrosion Inhibitor
10.15-10.30	Begna Tesema Bekana, Tolera Megersa, Fedhasa Benti	Ethiopia	Effects Of Land, Use Land Cover And Slope Gradients On Soil Fertility At Kori Sub-Watershed, East Wollega, Ethiopia
10.30-10.45	Ara	Break	

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PROF.DR. ERDOĞAN PEKEL SALONU/ PROF.DR. ERDOĞAN PEKEL HALL

2.OTURUM / 2st session

Oral Presentation Online

Başkan/ Moderator: Dr. Ade Isaac Afe/Dr.Mustafa Duman

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
10.45-11.00	Tarana Aliyeva	Azerbaijan	Study Of Ecological And Chemical Indicators Of The Girmizi Lake
11.00-11.15	Tarana Aliyeva	Azerbaijan	Eco-Chemical Study Of Water And Bottom Sediments Taken From Lake Zabrat
11.15-11.30	Afe, A.I., Alabi, K.O., Wahab, A.A., and Oladipo, S.F	Nigeria	Growth And Yield Responses Of Sesame And Sorghum In Sesame/Sorghum Intercropping
11.30-11.45	Babatunde Oluwasegun Alao , Andrew Bamidele Falowo	Nigeria	Nutritional Composition, Sensory Quality And Consumer Acceptability Of Beef Sausage Fortified With Edible Meat Waste
	Ara	Break	

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PROF.DR. ERDOĞAN PEKEL SALONU/ PROF.DR. ERDOĞAN PEKEL HALL

3. Oturum / 3st session

Oral Presentation Online

Başkan/ Moderator: /Dr. Mustafa Duman

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
11.45-12.00	Aliyeva Tarana, Samedova Ayten, Hajiyeva Hadiyya, Melikova Afak	Azerbaijan	Cadmium And Zinc In The Environment
12.00-12.15	Alieva Tarana, Hajiyeva Hadiyya, Samedova Ayten, Malikova Afag	Azerbaijan	Soil Contamination With Protein And Vitamin Preservatives
12.15-12.30	Adigozalov Parviz	Azerbaijan	Evaluation Of Environmentally Harmful Mineral Fertilizer Standards In Irrigated Gray Brown Soils In Samukh District
12.30-12.45	Sanaa Khaled, Hiba Al Wardany, Ward Al Bast	Lebanon	Lebanese Consumer Perception towards Moringa Oleifera : Sensory Evaluation of Moringa Oleifera Fortified Labneh
12.45-13.30	Ara	Break	

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PROF.DR. ERDOĞAN PEKEL SALONU/ PROF.DR. ERDOĞAN PEKEL HALL

4.OTURUM / 4st session

Oral Presentation Online

Başkan/ Moderator: Prof.Dr. Derviş Özdemir/Dr. Mustafa Duman

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
13.30-13.45	Dervis Ozdemir	Türkiye	Macro-Anatomical Comparison Of Celiac Artery In Hasak And Hasmer Sheep
13.45-14.00	Dervis Ozdemir	Türkiye	Macro-Anatomical Studies On The Pancreas Of Mammals
14.00-14.15	Semra Küçük	Türkiye	The Carotenoids In The Aquatic Animals
14.15-14.30	Mehmet Cem Beyhan, İbrahim Gönen	Türkiye	Research On Measuring The Healthy Nutrition Knowledge Levels Of Gastronomy Students
14.30-14.45	Ara	Break	

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PROF.DR. ERDOĞAN PEKEL SALONU/ PROF.DR. ERDOĞAN PEKEL HALL

5.OTURUM / 5st session

Oral Presentation Online

Başkan/ Moderator: /Dr. Mustafa Duman

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
14.45-15.00	Melike Tuncer, Müzeyyen Kalfazade, Hasan Basri Öksüz, Dilara Gönüllü, Sevil Çıkrıkcı Erünsal	Türkiye	Investigation Of The Single-Walled Carbon Nanotube Addition To SLA Resin: Printability And Electrical Properties
15.00-15.15	Neslihan Öner, Yağmur Yaşar Fırat	Türkiye	Environmental Effects Of Food Production Systems And Dietary Models
15.15-15.30	Yüksel Aksoy, Ahmet Şekeroğlu, Mustafa Duman	Türkiye	A Study On Determination Of Survival Rate, Some Reproductive And Growth Traits Of Akkaraman Sheep Reared Rural Farm Conditions In Niğde Province
15.30-15.45	Tarık Balkan	Türkiye	Abamectin, hexythiazox and spiromesifen resistance in populations of Tetranychus urticae Koch (Acari:Tetranychidae) collected from cucumber greenhouses in central district of Tokat province
15.45-16.00	Ara	Break	

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PROF.DR. ERDOĞAN PEKEL SALONU/ PROF.DR. ERDOĞAN PEKEL HALL

6.OTURUM / 6st session

Oral Presentation Online

Başkan/ Moderator: Prof.Dr. Kenan Yildiz /Dr. Mustafa Duman

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
16.00-16.15	Fatmanur Çezik, Çetin Çekiç, Kenan Yildiz, Hakan Karadağ, Osman Nuri Öcalan	Türkiye	Effects Of Light And Dark Conditions On Root Development Of Black Mulberry (Morus Nigra L.) Hardwood Cuttings
16.15-16.30	Ala Asi Mohammed Al-Salihi, Mehmetcan Olgaç, Emircan Dinçer, Hakan Polatçi, Onur Saraçoğlu	Irak Türkiye	Comparison Of Some Quality Parameters In Fresh And Dry Samples Of Morus Rubra Fruits
16.30-16.45	Mehmet Emin İşbilir, Onur Saraçoğlu, Emircan Dinçer, Alperen Donat, Ala Asi Mohammed Al-Salihi	Türkiye Irak	Effects Of Paclobutrazol Applications On Rooting Performance Of Black Mulberry (Morus Nigra L.) Hardwood Cuttings
16.45-17.00	Sevinç Yeşilyurt, Muazzez Gürgan	Türkiye	Bioremediaiton In Forest Ecosystem
17.00-17.15	Ara	Break	

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PROF.DR. ERDOĞAN PEKEL SALONU/ PROF.DR. ERDOĞAN PEKEL HALL

7.OTURUM / 7st session

Oral Presentation Online

Başkan/ Moderator: Dr. Tarık Balkan /Dr. Mustafa Duman

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
17.15-17.30	Tarık Balkan, Sabriye Belgüzar, Mehmet Kızılarslan, Özlem Yılmaz	Türkiye	Biodegradation of Some Pesticides by Enterobacter cloacae; in vitro
17.30-17.45	Esra Ünbaş, Coşkun Konyalı, Türker Savaş	Türkiye	Effects of Cold Stress During Incubation on Hatchability and Sex Ratio in Layers
17.45-18.00	Turgut Atay, Mustafa Alkan, Betül Tarhanacı	Türkiye	Contact effects of Mentha piperita L. (Lamiaceae) essential oil on two important stored product pests [Tribolium castaneum (Herbst, 1797) (Coleoptera: Tenebrionidae) and Sitophilus granarius (Linnaeus, 1758) (Coleoptera: Dryophthoridae)]
18.00-18.15	Özlem Derebaşı, Ahmet Şükrü Demirci, Göksel Tırpancı Sivri	Türkiye	Utilization of Postbiotics in Foods
18.15-18.30	Ara	Break	

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PROF.DR. ERDOĞAN PEKEL SALONU/ PROF.DR. ERDOĞAN PEKEL HALL

8.OTURUM / 8st session

Oral Presentation Online

Başkan/ Moderator: Doç.Dr. Deniz Dinçel /Dr. Mustafa Duman

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
18.30-18.45	Mustafa Varo, Sibel Alapala Demirhan, Ali Gündüz	Türkiye	Investigation of Some Morphological Traits of Hair Goats in Under Breeder Conditions in Isparta Province
18.45-19	Zeynep Eroglu, Mutlu Cevik	Türkiye	Investigation Of The Changes In Rheological Properties Of Purpel Basil Sherbet Samples Concentrated By Ohmic Heating At Different Voltage Gradient
19.00-19.15	Deniz Dinçel	Türkiye	Determination of the frequency of g.1267 G >A polymorphism in the MC4R gene in Berrichon du Cher Sheep

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PROF.DR. NURETTİN KAŞKA SALONU/ *PROF.DR. NURETTİN KAŞKA HALL*

1.OTURUM / 1st session

Oral Presentation Online

Başkan/ Moderator: Dr. Emre Aksoy/Yunus Emre Şentürk

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
09.00-9.15	Aliu Olamide Oyedun and Lukman Omoniyi Lawal	Nigeria	Microplastics As A Threat To Meat Consumption, Review
9.15-9.30	Jannatun Nayeema, Jannatul Ferdous	Bangladesh	Transplanted Aman Growth, Yield And Nutrient Uptake As Affected By Phosphorous
9.30-9.45	Ridwan Mukaila	Nigeria	*Investigating Rural Households' Willingness To Pay For Improved Solid Waste Management And Its Driving Factors. Evidence From Nigeria*
9.45-10.00	Anees Ur Rehman, Muhammad Mudassir Iqbal, Attif Ramzan	Pakistan	A Review On Soil Water Conservation By Mulching Practices
10.15-10.30	Ara		*Break*

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PROF.DR. NURETTİN KAŞKA SALONU/ PROF.DR. NURETTİN KAŞKA HALL

2.OTURUM / 2st session

Oral Presentation Online

Başkan/ Moderator: Ashiq Hussain/Yunus Emre Şentürk

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
10.30-10.45	Nadjet Mostefa and Noureddine Djebli	Algeria	Evaluation Of The Neuroprotective Activity Of Passiflora Edulis Seeds On Alzheimer's Disease "In Vivo Study"
10.45-11.00	Ashiq Hussain	Pakistan	Evaluation Of Total Antioxidant And Oxidant Status, Oxidative Stress Index And DPPH Free Radical Scavenging Activities Of Pumpkin (Cucurbita Maxima) Seeds Ethanolic Extracts
11.00-11.15	Sanubar Aslanova	Azerbaijan	Productivity, Forage Quality And Capacity Of Thymuseta-Vicaetum-Festucosum Formation In The Mountain Part Of Talısh
11.15-11.30	Muhammad Mudassir Iqbal, Attif Ramzan, Anees Ur Rehman	Pakistan	Sterilization Effect Of 0.1 Hgcl2 On The Invitro Germination Of Papaya (Carica Papaya Linn) Seeds To Produce Disease-Free Plants
11.30-11.45	Ara		Break

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PROF.DR. NURETTİN KAŞKA SALONU/ PROF.DR. NURETTİN KAŞKA HALL

3.OTURUM / 3st session

Poster Presentation Online

Başkan/ Moderator: Dr. Olugbenga David Oloruntola/Yunus Emre Şentürk

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
11.45-11.50	Norazura Aila Mohd Hassim and Sivaruby Kanagaratnam	Malaysia	Wide Temperature Range Palm-Based Chocolate Spread
11.50-11.55	Clement Olufemi Osowe, Olugbenga David Oloruntola, Olufemi Adesanya Adu, Simeon Olugbenga Ayodele and Samuel Adebowale Adeyeye	Nigeria	Under Tropical Conditions, Dietary Supplementation With Vitamin C And Ficus Exasperata Leaf Powder Enhanced Broiler Chicken Growth And Meat Quality
11.55-12.00	Akpeji Stephanie, Odunayo Olawuyi and Bukola Adebayo-Tayo	Nigeria	Application Of Rhizobium And Its Exopolysaccharides In Drought And Disease Control
12.00-12.05	Alao Omoniyi Solomon, Jadesola Fawzhia Sanusi, Gbemisola Elizabeth Akinola and Bukola Christianah Adebayo-Tayo	Nigeria	Nutritional Composition And Shelf-Life Extension Of Formulated Nano-Food Blends Fortified With Selenium Enriched Lactobacillus Pentosus (LP-Senps) Nanoparticles
12.05-12.10	Huseynli Atlas	Azerbaijan	Determination Of Ecotoxicantic Substances In Solid Waste Caused By Hydrogen Purification Process Ofpetroleum Oils
12.10-12.15	Sevinj Hajiyeva, Shamilov Nazim, Tarana Aliyeva, Madina Nabiyeva	Azerbaijan	Ecological Assessment Of Transboundary Rivers Of Azerbaijan
12.15-12.20	Sevinj Hajiyeva, Nazim Shamilov, Tarana Aliyeva, Madina Nabiyeva	Azerbaijan	Modern Ecological Situation And Pollution Of The Araz River
12.20-12.25	Oyinlola, K. A., Ogunleye, E. O., Adeyemo, M. O., Adebayo-Tayo, B.C. and Garuba E. O.	Nigeria	Bioactive Compound Profiling And In-Vitro Antimicrobial Study Of Ginger (Zingiber Officinale) Against Pneumococcal Bacteria
12.25-12.30	Gbemisola Elizabeth Ogunleye, Bukola Christianah Adebayo-Tayo, Kubrat Abiola Oyinlola, Oluwadurotimi Akintade, Racheal Oluwayemisi Fashogbon, Temiloluwa Adesina	Nigeria	Green Synthesis, Characterization And Antimicrobial Potential Of Selenium Nanoparticles From Ocimum Gratissimum
12.30-12.35	Olumuyiwa Joseph Olarotimi	Nigeria	Dietary Influence Of Monosodium Glutamate On Serum Electrolytes And Antioxidant Status Of Laying Hens
12.35-12.40	Olugbenga David Oloruntola, Andrew Bamidele Falowo, Simeon Olugbenga Ayodele, Samuel Adebowale Adeyeye, Clement Olufemi Osowe, and Deborah Adebukola Oloruntola	Nigeria	Justicia Carnea Leaf Meal Has The Potential To Improve The Performance And Immunoglobulins Of Broiler Chickens Fed Aflatoxin-Contaminated Diets
12.40-12.45	Norazura Aila Mohd Hassim and Sivaruby Kanagaratnam	Malaysia	Wide Temperature Range Palm-Based Chocolate Spread
12.45-13.30	Ara		Break

9 Ekim 2022 Pazar, October 2022 Sunday, Time by Türkiye

PROF.DR. NURETTİN KAŞKA SALONU/ PROF.DR. NURETTİN KAŞKA HALL

4.OTURUM / 4st session

Oral Presentation Online

Başkan/ Moderator: *Dr.* İlkay Kutlar /Yunus Emre Şentürk

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
13.30-13.45	Oktay Yazıcı, İlkay Kutlar	Türkiye	
13.45-14.00	Cansel Özge, İlkay Kutlar	Türkiye	
14.00-14.15	Dervis Ozdemir	Türkiye	Macro-anatomical Studies on the Skeletal System of Mammals. II. Ossa Membri Pelvini
14.15-14.30	Aykut Şener, Sedat Kıçır, Muharrem Kaya	Türkiye	*A Study on The Response of Triticale to Different Doses of Foliar Epibrassinolide Application*
14.30 -14.45	Ara		*Break*

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PROF.DR. NURETTİN KAŞKA SALONU/ PROF.DR. NURETTİN KAŞKA HALL

5.OTURUM / 5st session

Oral Presentation Online

Başkan/ Moderator: Dr. Şerife Topkaya/Yunus Emre Şentürk

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
14.45-15.00	Yunus Emre Şentürk, Ahmet Akyol, Ahmet Şekeroğlu, Brian Tainika, Mustafa Duman	Türkiye	The Effect of Different Breeding Systems on Egg Quality
15.00-15.15	Muhammed Rafıq Hafiz, Şerife Topkaya	Türkiye	Molecular analysis of the presence of Potato leafroll virus and Potato virus X
15.15-15.30	Özlem Altuntaş, Leyla Doğan	Türkiye	The Effect Of The Covid-19 Process On Vegetable Agriculture In Türkiye
15.30-15.45	Özlem Altuntaş İbrahim Kutalmış Kutsal	Türkiye	Then Effects Of Some Rhizobacteria Species On Plant Development And Fruit Quality In Melons Grown Under Irrigated And Non-Irrigated Conditions
15.45-16.00	Adnan Ayan, Burçak Aslan Çelik, Özlem Orunç Kilinç, Özgür Yaşar Çelik, Özge Oktay Ayan	Türkiye	
	Ara		Break

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PROF.DR. NURETTİN KAŞKA SALONU/ PROF.DR. NURETTİN KAŞKA HALL

6. OTURUM / 6st session

Oral Presentation Online

Başkan/ Moderator: Yunus Emre Şentürk

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
16.00-16.15	Zeynep Kilci, Ramazan Ulku Cetin	Türkiye	Determination Of Chemical And Microbiological Quality In Commercial Tahini Samples
16.15--16.30	Zeynep Kilci, Ramazan Ulku Cetin	Türkiye	Determination Of Chemical And Microbiological Quality In Commercial Tahini Halva Samples
16.45-17.00	Ara		

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PROF.DR. NURETTİN KAŞKA SALONU/ PROF.DR. NURETTİN KAŞKA HALL

7.OTURUM / 7st session

Oral Presentation Online

Başkan/ Moderator: Prof.Dr. Yusuf Ziya OĞRAK / Yunus Emre Şentürk

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
17.00-17.15	Duygu Sevinç, Muazzez Gürgan Eser	Türkiye	Investigation of Antibacterial Activity of Aromatized Kombucha
17.15-17.30	Yusuf Ziya Oğrak, Şahin Alici	Türkiye	Investigation of Stray Dogs Problem in Sivas Province Animal Shelter Example
17.30-17.45	Yusuf Ziya Oğrak, Sevgi Durna Daştan, Taner Daştan	Türkiye	Investigation of Mitochondrial COI gene polymorphisms of dogs in Sivas Municipality Dog shelter
17.45-18.00	Hasan Asil	Türkiye	Agriculture 4.0 and Its Applications in Türkiye
18.00-18.15	Ara		

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PROF.DR. NURETTİN KAŞKA SALONU/ PROF.DR. NURETTİN KAŞKA HALL

8.OTURUM / 8st session

Oral Presentation Online

Başkan/ Moderator: Dr. Suzan Biran Ay / Yunus Emre Şentürk

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
18.15-18.30	Merve Kalaycı, Suzan Biran Ay	Türkiye	Production And Characterization of Carboxymethyl Cellulose (CMC)/ Gelatine (GLT)/ Tara Gum (TG) Biomedical Films Enriched with Smoke Tree Leaf Extract
18.30-18.45	Elif Duyuşen Güven, Serpil Özmıhçı, Görkem Akıncı, Berkay Tümer, Melda Uyar	Türkiye	Investıgatıon of the development of purslane plant (Portulaca Oleracea L.) under soil stress conditions
18.45-19.00	Elif Duyuşen Güven, Görkem Akinci, Ayşenur Özuysal	Türkiye	Evaluation Of Energy Potential In Dumping Sites: A Case Study For Akhisar- Manisa
19.00-1915	İlker Atik, Ayşe Janseli Denizkara, Gökhan Akarca, Azize Atik	Türkiye	Biological Activities Of Extracts Of Red And Yellow Hawthorn Fruits In Different Solvents

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PROF.DR. ERCAN TEZER SALONU / PROF: DR: ERCAN TEZEL HALL

1.OTURUM / 1st session

Oral Presentation Online

Başkan/ Moderator: Dr. Bukola C Adebayo-Tayo/Ahmet Akyol

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
09.00-9.15	Muhammad Muddassir Ali	Pakistan	*Cytotoxic and Genotoxic effects of Bisphenol S on different Model Organisms*
9.15-9.30	Bukola C Adebayo-Tayo, Solomon Omoniyi Alao, Jadesola Fawzhia Sanusi	Nijerya	Phytofabrication and biological evaluation of silver nanoparticles of Bridelia ferruginea extracts
9.30-9.45	Hira Ishaq, Wajahat Mehmood	Pakistan	Impact of Cumin on physiological function of Body,Review
9.45-10.00	Oyetoro John Oyewole And Adewole Williams A.	Nijerya	Effect Of Amrec Technologies Of Federal University Of Agriculture Abeokuta On Income Level Of Cassava And Soya-Bean Farmers In Ogun-State, Nigeria
10.00-10.15	Gabriela Savastre, Alin Ciobica, Gabriel-Ionut Plavan	Romania	A Modern Perspective On The Influence Of Pesticides In Some Neuropsychiatric Manifestations
10.15-10.30	Ara		Break

9 October 2022 Sunday Time by Türkiye

PROF.DR. ERCAN TEZER SALONU / PROF: DR: ERCAN TEZEL HALL

2.OTURUM / 2st session

Oral Presentation Online

Başkan/ Moderator: Fatma Coşkun Topuz /Ahmet Akyol

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
10.30-10.45	Onur Sefa Alkaç, Muhammed Esat Tunce, Esra Öndeş, Rümeysa Temir, Mehmet Güneş	Türkiye	Effects of Different Levels of Compost and Fertilization Applications on the Growing Media on Gerbera (Gerbera jamesonii sp.) Plant Growth and Flowering
10.45-11.00	Onur Sefa Alkaç, Fulya Okatar	Türkiye	The Effects of Different Rhizobacteria and Mycorrhiza Applications on Root Growth of Rose Cuttings
11.00-11.15	Fatma Coşkun Topuz	Türkiye	Mathematical Modeling of Fresh Green Pepper (Capsicum L.) Dried at Different Powers in Microwave Oven
11.15-11.30	Cem Okan Özer, Ganime Beyzanurvar, Ezgi Demir Özer	Türkiye	The Effect Of Pomegranate (Punica Granatum L.) Flower Extracts On The Physicochemical Properties Of Heat-Treated Chicken Sausages
11.30-11.45	Ahmet Tamkoc, Ozkan Taspınar, Ahmet Konuk, Tuba Uzun, Saliha Mutlu, Bilal Mohammed Abbas Al-Rubaye, İlker Topal	Türkiye	Selection Of Winter-Resistant Genotypes And Determination Of Some Agricultural Characteristics In Hybrid Feed Pea Lines (F2)
11.45-11.50	Ara		Break

9 October 2022 Sunday Time by Türkiye

PROF.DR. ERCAN TEZER SALONU / PROF: DR: ERCAN TEZEL HALL

3.OTURUM / 3st session

Poster Presentation Online

Başkan/ Moderator: Prof.Dr. Kutbettin Arslan /Ahmet Akyol

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
11.50-11.55	Gülten Ökmen, Kutbettin Arslan, Başak Görmen, Zeynep Biter	Türkiye	Determination of antibacterial activity of Helichrysum arenarium L. extracts against crop spoiling pathogens
11.55-12.00	Emre Aydemir, İnci Bilge	Türkiye	Artificial Intelligence Applications In Livestock
12.00-12.05	Emre Aydemir, İnci Bilge	Türkiye	Disease Diagnosis In Animals With Artificial Intelligence Based Odor Detection Sensors
12.05-12.10	Emre Aydemir	Türkiye	Some Digestive Respiratory And Nervous Diseases Observed In Poultry
12.10-12.15	Semra Küçük	Türkiye	The Ferritins in the Aquatic Products
12.15-12.20	Sergen Ünal, Esma Özsoy, Özlem Sefer, Ayşe Feyza Tufan Dülger, Neslihan Zahide Öztürk Gökçe, Emre Yörük	Türkiye	Determination Of Resistance Levels Of Hordeum Vulgare L. Lines Grown In Türkiye Against F. Culmorum
12.30-13.30	Ara		Break

9 October 2022 Sunday Time by Türkiye

PROF.DR. ERCAN TEZER SALONU / PROF: DR: ERCAN TEZEL HALL

4.OTURUM / 4st session

Oral Presentation Online

Başkan/ Moderator: Prof.Dr. Kutbettin ARSLAN/Amet Akyol

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
13.30-13.45	Muhammad Tjammal Rehman, Iqra Saleem1, Arslan Rasool, Muhammad Shahid	Pakistan	Structural Characterization Antioxidant, Hemolytic And Antimicrobial Activities Of Gymnema Sylvestre
13.45-14.00	Arslan Rasool, Hamna Mazhar, Muhammad Tjammal Rehman, Muhammad Shahid	Pakistan	Characterization And Evaluation Of Pharmacological Potential Of Crocus Sativus Stigma Extract
14.00-14.15	Aliyeva Tarana, Abdullayev Rizvan, Melikova Afak	Azerbaijan	Interrelation Of Humic Substances With Chemical Substances And Pollutants
14.15-14.30	Aliyeva Tarana, Samedova Ayten, Hajiyeva Hadiyya1, Melikova Afak	Azerbaijan	Cadmium And Zinc In The Environment
14.30-14.45	Ara		Break

9 October 2022 Sunday Time by Türkiye

PROF.DR. ERCAN TEZER SALONU / PROF: DR: ERCAN TEZEL HALL

5.OTURUM / 5st session

Oral Presentation Online

Başkan/ Moderator: Dr. Vildan Akdeniz/Ahmet Akyol

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
14.45-15.00	Vildan Akdeniz	Türkiye	Effects of Ultrasonication on Probiotics and Prebiotics in Dairy Technology
15.00-15.15	Ayse Nur Tarhan, Muhammet Donmez, Zeynep Simsek	Türkiye	Properties of Buffalo Milk Raised in Kutahya Region
15.15-15.30	Elif Yaganoglu, Caner Yerli, Nergiz Dila Senol	Türkiye	Effect of hazelnut husk compost on physiological properties of pepper under drought stress
15.30-15.45	Onur Sefa Alkaç, Esra Öndeş, Rümeysa Temir, Esat Tuncel, Mehmet Emin İşbilir	Türkiye	Acceleration the Growth of Dahlia (Dahlia sp.) Plants Grown with a Growth Retardant with Gibberellic Acid
15.45-16.00	Ara		Break

9 October 2022 Sunday Time by Türkiye

PROF.DR. ERCAN TEZER SALONU / PROF: DR: ERCAN TEZEL HALL

6.OTURUM / 6st session

Oral Presentation Online

Başkan/ Moderator: Prof.Dr. Cengiz Yücedağ /Ahmet Akyol

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
16.00-16.15	Leyla İdikut, Duygu Uskutoğlu	Türkiye	Investigation of the Effect of Fertilizer Doses on Bean Pod Properties
16.15-16.30	Leyla İdikut, Duygu Uskutoğlu, Kazım Emre Göktaş, Samet Karadeniz	Türkiye	Investigation of Winter Cultivation of Different Chickpea Varieties
16.30-16.45	Sevgi Belikırık, Cengiz Yücedağ	Türkiye	Determination of the Recreational Status of the Marmaris National Park
16.45-17.00	Ali Üney, Cengiz Yücedağ	Türkiye	A Study on Morphological Characteristics of Some Angiosperm Ornamental Plant Seedlings
17.00-17.15	Canberk Akkoç, Cengiz Yücedağ	Türkiye	The Effects of Demographic Characteristics on Plant Preference of People Living in Detached Houses: The Case of Fethiye, Türkiye
	Ara		Break

9 October 2022 Sunday Time by Türkiye

PROF.DR. ERCAN TEZER SALONU / PROF: DR: ERCAN TEZEL HALL

7.OTURUM / 7st session

Oral Presentation Online

Başkan/ Moderator: Doç.Dr. Serdar DURU /Ahmet Akyol

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
17.15-17.30	Serdar Duru, Süleyman Can Baycan	Türkiye	Comparison of Performance of Holstein Cattle Raised in Two Farms with Similar Environmental Conditions in Bursa and Aydın
17.30-17.45	Burak Uzun, F. İlknur Unuvar , İlkay Dellal	Türkiye	Türkiye's Foreign Trade Competitiveness in Quince
17.45-18.00	Ece Gökçe Çakır – Dindar	Türkiye	A Study on the Taxonomy of Gentiana lutea (Gentianaceae)
18.00-18.15	Semra Küçük	Türkiye	The Using of Probiotics for Aquatic Organisms
18.15-18.30	Semra Küçük	Türkiye	The Coenzyme Q10 (CoQ10) in Fish

9 Ekim 2022 Pazar, 9 October 2022 Sunday, Time by Türkiye

PROF.DR. AHMET CAN ÜLGER SALONU/ PROF.DR. AHMET CAN ÜLGER HALL

1. OTURUM / 1st session

Oral Presentation Online

Başkan/ Moderator: Dr.Hülya Sayğı /Dr. Emre Aksoy

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
09.00-9.15	Ismael Niyokwizigirwa	Rwanda	Testing the Biological Control Potentials of Fungi Associated Within Potato Crop in Higher Lands of Rwanda
9.15-9.30	Songül Çakmakçi, Mehmet Ali Salik	Türkiye	Lipophilic Antioxidants Of Milk And Their Benefits To Human Health
9.30-9.45	Aykut Şener	Türiye	Determination of Quality Characteristics of Local Bean Lines Selected by Selection Breeding Method
9.45-10.00	Hülya Sayğı	Türkiye	Applications of Organomineral and Chemical Fertilizers in Strawberry Production Effects on Plant Growth
10.00-10.15	Hayriye Göknur Ağca Küçükaydin, Göksel Tirpanci Sivri, Ömer Öksüz	Türkiye	Production of Vitamin B12 by Propionic Acid Bacteria
10.15-10.30	Ara		Break

9 Ekim 2022 Pazar, 9 October 2022 Sunday Time by Türkiye

PROF.DR. AHMET CAN ÜLGER SALONU/ PROF.DR. AHMET CAN ÜLGER HALL

2.OTURUM / 2st session

Oral Presentation Online

Başkan/ Moderator: Dr. Hande Baltacıoğlu/Dr. Emre Aksoy

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title
10.30-10.45	İkbal Abdullah Şahin, Hande Baltacioğlu	Türkiye	Non-Thermal Technologies In Fruit Juice Processing
10.45-11.00	Elif Ildiz, Şükrü Canpolat, Cemil İşlek, Elif Yürümez Canpolat, Yasemin İşlek, Ilgaz Akata	Türkiye	Bjerkandera adusta collected from Niğde: Analysis of Total Phenolic Compound, Antioxidant, and Antimicrobial Properties
11.00-11.15			
11.15-11.30	İsmail İbrahim İsmail Al-Barwari, Murat Turan, Ferda Karakuş	Irak Türkiye	Determination of Factors Affecting Red Meat Consumption Habits in Duhok Province (Northern Iraq)
11.30-11.45	Gizem AKSU	Türkiye	The Effect of Indole Acetic Acid on Forage Soybean under Drought Stress
12.00-13.30	Ara		

9 Ekim 2022 Pazar, 9 October 2022 Sunday Time by Türkiye

PROF.DR. AHMET CAN ÜLGER SALONU/ PROF.DR. AHMET CAN ÜLGER HALL

3. OTURUM / 3st session

Oral Presentation Online

Başkan/ Moderator: Dr.Olgaç Güven /Dr. Emre Aksoy

Saat/Hour	Yazar/Autor/s	Ülke/ Country	Başlık/Title

13.30-13.45	Orhun Soydan, Ahmet Benliay	Türkiye	Redesigning Landscape Equipment's With Parametric Design: The Case Of Konyaaltı Expo 2016 Park
13.45-14.00	Yaşar Serhat Saygili, Bülent Çakmak	Türkiye	Investigation Of Agricultural Machinery Usage And Agricultural Production In İzmir
14.00-14.15	Olgaç Güven, Mehmet Özbaş	Türkiye	Reproductive Characteristics Of The Common Cuttlefish (Sepia Officinalis, Linnaeus, 1758) Population Distributed In The Antalya Bay
14.15-14.30	Olgaç Güven, İdris Koraltan	Türkiye	Impact Of Microplastic Pollution On Biota In The Coastline Of Türkiye
14.30-14.45	Ara		Break

9 Ekim 2022 Pazar, 9 October 2022 Sunday Time by Türkiye

PROF.DR. AHMET CAN ÜLGER SALONU/ PROF.DR. AHMET CAN ÜLGER HALL

4. OTURUM / 4st session

Oral Presentation Online

Başkan/ Moderator: Dr.Emre Aksoy

Saat/Hour	Yazar/Autor/s	Ülke/ Country	**Başlık/Title**
14.45-15.00	Hasan Asil	Türkiye	Altınözü Ethnobotany
15.00-15.15	Hasan Asil	Türkiye	Determination of the ratio of essential oils and components of Lavandula stoechas spp. (Karabaş) at different harvest times
15.15-15.30	Hasan Asil	Türkiye	Essential Oil Components of Çalba Plant in Altınözü
15.30-15.45	Lubna Ansari	Pakistan	Identification of Traded Medicinal Plants and their Socioeconomic Impact on Local Community of Astore District

9 Ekim 2022 Pazar, 9 October 2022 Sunday, Time by Türkiye

PROF.DR. AHMET CAN ÜLGER SALONU/ PROF.DR. AHMET CAN ÜLGER HALL

5. OTURUM / 4st session

Oral Presentation Online

Başkan/ Moderator: Dr.Emre Aksoy

Saat/Hour	Yazar/Autor/s	Ülke/ Country	**Başlık/Title**
15.45-16.00	Alaje Veronica Ifeoma, Amadi Joyce Okama, Alaje Musibau Adewale, Geply Olufunke Ajoke and Appah Ogechukwu Rose	Nigeria	Seed Handling And Extraction In Dacryodes Edulis And Its Implications On Seed Germination: Prospect For Food Security
16.00-16.15	Sude Günel, Yağmur Parlatan, Yağmur Esentur, Bengü Ertürk, Ciğdem Akın Pekşen	Türkiye	Effects of Tetracycline Exposure on Neocaridina Davidi Behavior, Reproduction, and Morphology
16.15-16.30	Ali Kaan Yetik, Halis Seçme, Burak Nazmi Candoğan Ece Gökçe Çakır Dindar	Türkiye Türkiye	Trend Analysis of Reference Crop Evapotranspiration in Niğde Province
16.30-16.45	Emre Aksoy	Türkiye	Phytosiderophore Analog Efficiently Alleviates Iron Deficiency Symptoms in Soybean
	Ara		Break

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Abstract
It was determined that adding Phytase enzyme with 16 hours of illumination daily increased egg yield, feed consumption and egg weight significantly (P<0.01). Egg weight, egg white and yolk weights, egg shell weight and breaking resistance increased. and its effect on egg quality criteria was positive. Addition of 0.75% red pepper to the ration showed higher redness values of egg yolks (P<0.001). The difference was found to be statistically significant. In this study, it was revealed that the addition of red pepper had a positive effect on the yolk color of free-raised laying hens. An in vivo experiment was conducted to determine the effect of adding Dried Capers (Capparis spinosa) leaf to the diet. Powder (DCL) four groups of commercial chickens (ATAK-S) 0, 5, 10 and 15 g on egg production and egg quality of laying hens at the beginning of the laying period. They were fed diets containing DCL/kg. The results showed that dietary DCL had no effect on feed intake, egg mass (EM) and egg production parameters (P>0.05). As a result of the study, the addition of feed propolis extract did not have a significant effect on performance values among the experimental groups. The yolk of the eggs in the groups coated with propolis extract was found to be lighter. On the other hand, the effect of propolis coating on the specific gravity values of the eggs was found to be significant. In addition, a decrease was observed in TMA values. In the electron microscope picture examination, it was observed that the propolis coating created a closing/occlusive effect on the eggs. As a result, when propolis application was added to the feed of chickens in the chicken pasture, there was no difference in terms of the performance parameters examined. However, it has been observed that coating the eggs with the extract has an effect on increasing the shelf life. No statistically significant difference was observed in the performance results during the experiment with the addition of alfalfa juice. However, it was observed that egg mass values tended to increase as age and yield increased. No statistical difference was observed in the first 4 weeks in the examined external quality parameters. 25-28. At the age of week, the effect of interaction was found to be significant in egg weight, shell break resistance and shell ratio. It was determined that the difference observed in egg weight and shell ratio was due to the pasture effect. It was observed that the statistical difference observed in the shell cracking resistance was caused by the addition of alfalfa juice and was positively affected. In the last 4 weeks, the effect of the interaction was found to be statistically significant only on the shell weight and shell thickness parameters
Key Words: *Phytase Enzyme, Red Pepper, Propolis Extract, Egg Quality, Free Range*

Serbest Yetiştirilen Yumurta Tavuk Yemlerine Bazı Bitki Ekstraktlarının İlavesinin Yumurta Kalite Parametrileri Üzerine Etkileri

Özet
Günlük 16 saat aydınlatma yapılarak, fitaz enzimi ilave edilmesi yumurta verimi, yem tüketimi ve yumurta ağırlığını önemli düzeyde (P<0,01) arttırdığı belirlenmiştir.Yumurta ağırlığı yumurta ak ve sarı ağırlıkları ile yumurta kabuk ağırlığı ve kırılma direnci artmıştır.Fitaz enzimi ilavesinin performans ve yumurta kalite kriterleri üzerine etkisi olumlu olmuştur. Rasyona %0,75 kırmızıbiber ilavesi yumurta sarılarının kırmızılık değerleri daha yüksek saptanmıştır (P<0,001). farklılık istatistiki olarak önemli bulunmuştur. Yürütülen bu çalışma ile kırmızı biber ilavesinin, serbest yetiştirilen yumurta tavuklarının yumurta sarısı rengi üzerine olumlu etkisi olduğu ortaya konmuştur. Kuru Kapari (Capparis spinosa) yaprağının diyete eklenmesinin etkisini belirlemek için bir in vivo deney yapılmıştır.Yumurtlama döneminin başında yumurta tavuklarının yumurta üretimi ve yumurta kalitesi üzerine toz (DCL) dört grup ticari tavuklar (ATAK-S) 0, 5, 10 ve 15 g DCL/kg içeren rasyonlarla beslendi.Sonuçlar göstermiştir ki,diyet DCL'nin yem alımı,yumurta kütlesi (EM) ve yumurta üretim parametreleri (P>0.05) üzerinde hiçbir etkisi olmamıştır.Çalışma sonucunda deneme grupları arasında performans değerleri açısından yem propolis ekstraktının ilavesinin önemli bir etkisi bulunmamıştır. Propolis ekstraktının kaplandığı gruplardaki yumurtaların sarısı daha açık renk bulunmuştur.Diğer yandan propolis kaplanmasının yumurtanın özgül ağırlık değerlerine etki önemli bulunmuştur. Ayrıca TMA değerlerinde düşme görülmüştür. Yapılan elektron mikroskobu resim incelemesinde propolis kaplanmasının yumurta üzerindeki gözenekleri kapatıcı/tıkayıcı bir etki yarattığı görülmüştür. Sonuç olarak propolis uygulaması tavuk merasındaki tavukların yemlerine ilave edildiğinde incelenen performans parametreleri açısından herhangi bir farklılık ortaya çıkarmamıştır. Ancak yumurtaların ekstraktla kaplanmasının raf ömrünü arttırıcı etkisi olduğu görülmüştür. Yonca suyu ilavesinde deneme boyunca performans sonuçlarında, istatistiki olarak önemli bir farklılık gözlenmemiştir. Bununla birlikte yumurta kütlesi değerlerinin, yaş ve verim arttıkça yükselme eğiliminde olduğu görülmüştür.İncelenen dış kalite parametrelerinde ilk 4 hafta istatistiki bir farklılık gözlenmemiştir.25-28. Haftalık yaşta ise yumurta ağırlığı, kabuk kırılma direnci ve kabuk oranında ise interaksiyonun etkisi önemli bulunmuştur.Yumurta ağırlığı ve kabuk oranında gözlenen farklılığın mera etkisinden kaynaklandığı saptanmıştır. Kabuk kırılma direncinde gözlenen istatistiki farklılığın ise, yonca suyu ilavesinden kaynaklandığı ve olumlu etkilendiği görülmüştür. Son 4 haftalık dönemde ise, sadece kabuk ağırlığı ve kabuk kalınlığı parametrelerinde interaksiyonun etkisi istatistiki olarak önemli bulunmuştur.
Anahtar Kelimeler: *Fitaz Enzimi,Kırmızı Biber,Propolis Extratı,Yumurta Kalitesi,Free Range*

ID: 374

Biological And Ecological Characteristics of Freshwater Lobster (*Astacus Leptodactylus* Eschscholtz, 1823)

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Abstract

Freshwater lobster, which is obtained from inland waters and is among the export products with high commercial value; Crayfish, known in Türkiye, have an important place in aquaculture. The most important crayfish species cultivated are in three different families as Astacidae, Parastacidae and Cambaridae. In Türkiye, the narrow-clawed crayfish (*Astacus leptodactylus* Eschscholtz, 1823), which is called Turkish crayfish in the Astaciade family, is distributed as a single species. Crayfish are ecologically important benthic organisms of the aquatic ecosystem in fresh waters and are catalysts of organic matter conversion. In this study, it was aimed to determine the biological and ecological characteristics of crayfish.

Key Words: *Crayfish, A.leptodactylus, biological, ecological features*

Tatlısu Istakozu (*Astacus Leptodactylus* Eschscholtz, 1823)'Nun Biyolojik Ve Ekolojik Özellikleri

Özet

İç sulardan elde edilen ve ticari değeri yüksek ihraç ürünleri arasında yer alan tatlısu ıstakozu; Türkiye'de bilinen adıyla kerevitler, su ürünlerinde önemli bir yere sahiptirler. Yetiştiriciliği yapılan en önemli kerevit türleri Astacidae, Parastacidae ve Cambaridae olmak üzere üç ayrı familya içerisinde yer almaktadır. Türkiye'de ise Astaciade familyasında bulunan Türk kereviti olarak adlandırılan dar kıskaçlı kerevit (*Astacus leptodactylus* Eschscholtz, 1823) tek tür olarak dağılım göstermektedir. Kerevitler ekolojik olarak tatlı sularda akuatik ekosistemin önemli bentik organizmalarından olup, organik madde dönüşümünün katalizörlerindendir Bu çalışmada, kerevitlerin biyolojik ve ekolojik özelliklerinin belirlenmesi amaçlanmıştır.

Anahtar Kelimeler: Tatlısu ıstakozu, *A.leptodactylus*, biyolojik, ekolojik özellikler

Giriş

Türkiye'de kerevit ismiyle de bilinen tatlısu ıstakozu Dünya'da 1830'lu yıllardan sonra önemli bir ticari ürün olarak değerlendirilirken, Türkiye'de ise II. Dünya savaşından sonra su ürünleri içerisinde önemli ihraç ürünleri arasında yer almıştır (Harlıoğlu, 2008).

Türkiye'de yaygın olarak bulunan tek kerevit türü *Astacus leptodactylus* (Eschscholtz, 1823)'tur. Astacidae ailesi içerisinde yer alan tatlısu ıstakozlarının, doğal yaşam alanı kuzey yarım kürenin iç sularıdır. Türkiye iç sularında Türk kereviti olarak adlandırılan dar kıskaçlı kerevit (*Astacus leptodactylus* Eschscholtz, 1823) tek tür olarak dağılım göstermekte ve iki alttürü bulunmaktadır (*Astacus leptodactylus leptodactylus* Eschscholtz, 1823 ve *Astacus leptodactylus salinus* Nordmann, 1842) (Geldiay ve Kocataş, 1970). *Astacus leptodactylus* Türkiye, Ukrayna, Güneybatı Rusya, İran, Kazakistan, Belarus, Slovakya, Bulgaristan, Romanya ve Macaristan'ını da kapsayan geniş bir yayılım alanı bulan bu tür, dünya genelinde doğal olarak 27 ülkede yaşamaktadır. Bununla beraber 14 ülkeye de nakil edilmiştir. Çek Cumhuriyeti, Polonya, Almanya, Finlandinya, Danimarka, Hollanda, İngiltere, Litvanya ülkelerinde bulunmaktadır (Diler, 2013).

Avrupa ve Amerika'da lüks bir besin maddesi olarak tüketilen tatlısu ıstakozunun ülkemizde tüketimi oldukça azdır. Bu nedenle üretimin tümü Avrupa ve İskandinavya ülkelerine ihraç edilmekte ve ülkemiz için önemli bir gelir sağlamaktadır (Halver, 2002).

Ülkemizde kerevit üretiminde ve ekonomik değerinde yıllara göre dalgalanmalar görülmektedir. Kerevit üretimi 1979 yılında 500 ton iken, 1982 yılında bu değer 6.500 tona yükselmiştir (Köksal, 1988). 1985'ten sonra kerevit üretimi aşırı avcılık, kirlilik ve kerevit vebası (*Aphanomyces astaci*) nedeniyle 5.000 tonlardan 200 tona kadar gerilemişken şu an ülkemizde 1 233 tona yükselmiştir (TÜİK, 2022). Ayrıca bazı Avrupa ülkeleri, kerevit vebası nedeni ile azalan stoklarını desteklemek için Amerika'dan kerevit vebasına dirençli olan *Pacifastacus leniusculus* ve *Procambarus clarkii* türü kerevitleri kendi iç sularına aşılamışlardır (Sağlamtimur, 2007).

Tatlısu ıstakozu yetiştiriciliği günümüzde iki yöntem ile gerçekleştirilmektedir. Birinci yöntem, yumurtalı dişilerden yavru üretimi, diğer yöntem ise bu yavruların doğal sulara atılacak boya kadar büyütülmesidir (Berber ve Palaz, 2000; Kumlu, 1998). Kültür şartlarında üretilen ve beslenen yavru ıstakozların stoklamada kullanılması tercih edilmektedir. Doğal ortamın stoklanmasında ergin tatlısu ıstakozlarının kullanılması ucuz ve teknik açıdan kolay olması avantaj olurken, yem seçme alışkanlıkları, çevreye uyum sağlamalarının zor olması, hastalık taşıyabilecek riskleri olmasından da dezavantaj sağlamaktadır. Bu nedenle doğal sulara ergin dişi ve erkek, yumurtalı dişi ve yavruların yerine ilk yazını bitirmekte olan veya bitirmiş bireylerin atılmasının daha uygun olacağı belirtilmiştir (Berber ve Palaz, 2000).

Tatlısu Istakozlarının Sistematikteki Yeri

Türkiye'de kerevit adıyla bilinen tatlısu ıstakozu türünün sistematik açıdan sınıflandırılması aşağıdaki gibidir (NCBI, 2019).

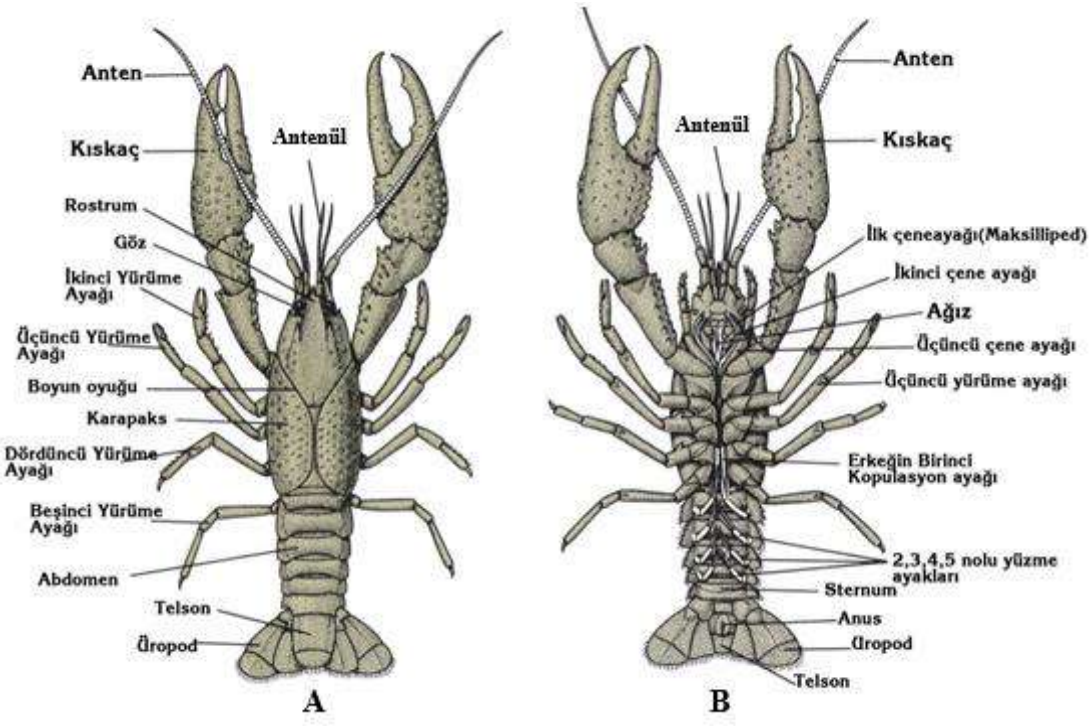
Şube	: *Arthropoda*	: Eklem bacaklılar
Sınıf	: *Crustacea*	: Kabuklular
Alt Sınıf	: *Malacostraca*	: Gelişmiş kabuklular
Takım	: *Decapoda*	: On ayaklılar
Familya	: *Astacidae*	: Istakozlar (Kerevitler)
Cins	: *Astacus*	: Istakoz (Kerevit)
Tür	: *Astacus leptodactylus*	: Göl Istakozu

Tatlısu Istakozlarının Biyolojisi

Tatlısu Istakozlarının Morfolojik Özellikleri

Dar kıskaçlı kerevit (narrow-clawed) crayfish olarakta adlandırılan *Astacus leptodactylus*'un toplam uzunluğu genellikle 15 cm olmakla birlikte bazen 30 cm'ye kadar ulaşabilmektedir (Köksal, 1988). Tatlısu ıstakozlarının şekil ve renkleri oldukça değişken olduğu için tatlısu ıstakozlarının alt türleri bu özelliklere bakılarak tanımlanmaktadır. Genel renkleri zeytin yeşili, ancak birçoğu hafif kırmızı bir belirti ile kahverengimsi, sarımsı yeşil rengindedir. Karapaks ve kıskaçları genellikle beneklidir (Pöckl ve Eder, 1998). Karapaksın şekli geniş ya da dar olabilmekte ve rostrum genellikle uzundur.

Tatlısu ıstakozlarında vücut, sefalotoraks ve abdomen olmak üzere iki kısımdan meydana gelmiştir. Sefalotoraks kısmı karapaks olarak adlandırılan sert bir kabukla örtülmüştür. Tatlısu ıstakozları 19 çift segmentten oluşmuş olup bunlar, gözler, 2 çift anten, 2 çift maksil, 3 çift maksilliped, 1 çift mandibular uzantı, 5 çift pereopod (yürüme ayakları), 5 çift pleopod (yüzme ayakları) ve telsondan oluşmuştur (Şekil 1). Kuyruk kısmı telson ve üropod bölümlerinden oluşmuştur (Hobbs, 1989).



Şekil 1. Tatlısu ıstakozunun dorsal görünüşü (A) ve ventral görünüşü (B) (Holdich ve Reeve, 1988)

Tatlısu Istakozlarının Anatomik Özellikleri

Sindirim Sistemi

Tatlısu ıstakozlarında sindirim sistemi ağız, yemek borusu, mide ve bağırsaktan oluşur. Tüketilmek üzere alınan besinler ağız parçaları ve çenelerle parçalanmaktadır ve sonrasında yemek borusu vasıtasıyla mideye ulaşır. İki bölümden oluşan midede sindirilen besinler orta bağırsağa ve ardından son bağırsağa geçerek anüsten dışarıya atılır. Tatlısu ıstakozlarında bağırsaklar mavi renkli olup su regülasyonunu düzenlerler (Diler, 2013).

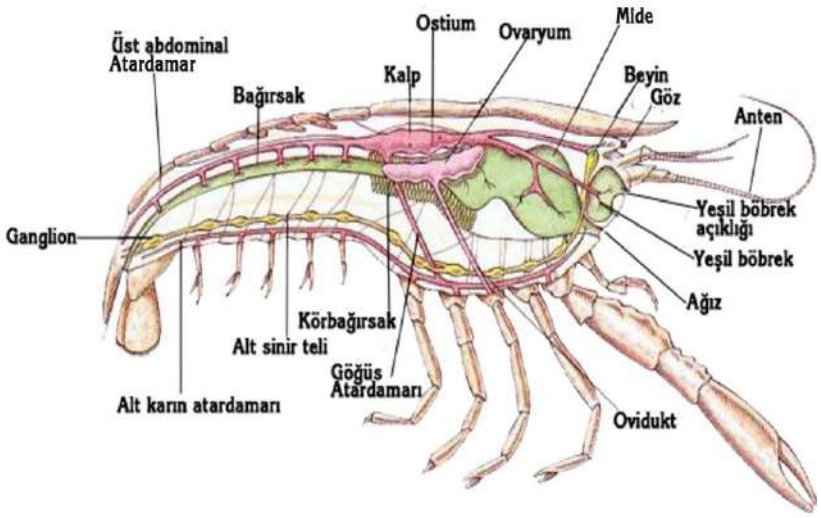
Solunum Sistemi
Istakozların solungaçları 18 çifttir ve sillerle kaplıdır. İki ile üçüncü çene ayağı (maksilliped) ve ilk dört yürüme ayağının bazal segmentinden çıkarlar (Diler, 2013).

Dolaşım Sistemi
Tatlısu ıstakozlarının dolaşım sistemi "açık dolaşım sistemi" dir. Kalpten arterlere pompalanan kan, iç organlar vasıtasıyla kaslara oksijen ve sindirilen besin maddelerini taşır. Kirlenen kan tekrar damarlar yoluyla solungaçlara ulaşır ve buralarda temizlenir. Solungaçlar ile temizlenen kan gövde boşluğuna (sülom) geçer. Tatlısu ıstakozlarının kanı renksizdir. Açık hava ile temas ettiğinde oksitlenir. Böylelikle kan rengi maviye doğru dönen bir renk alır. Kan renginin mavi olması oksijende demir yerine bakır içeren pigmentin yani hemosiyaninin varlığını gösterir (Diler, 2013).

Boşaltım Sistemi
Istakozlarda ana boşaltım organı anten bezleridir. Mercimek boyutlarındaki bir çift böbrek antenlerin tabanından dışarı açılır. Böbrekler üre ve ürik asiti, solungaçlar ise amonyağı boşaltır (Diler, 2013).

Sinir Sistemi
Istakozlardaki sinir sistemi ip merdiven şeklinde olup ganglionlar ve sinir tellerinden oluşur (Şekil 2). Sinir kordonu üzerinde 6 çift ganglion vardır ve her ganglionda ise 3 çift sinir bulunur (Diler, 2013).

Kas Sistemi
Tatlısu ıstakozlarında kas sistemi bükücü ve açıcı kaslar olarak iki tiptir. Bükücü kaslar, bağlı oldukları bölgeyi bedene doğru veya yakınındaki bir ekleme doğru çeken kaslardır. Açıcı kaslar bağlı bulundukları bölgeyi uzatan kaslardır (Diler, 2013).



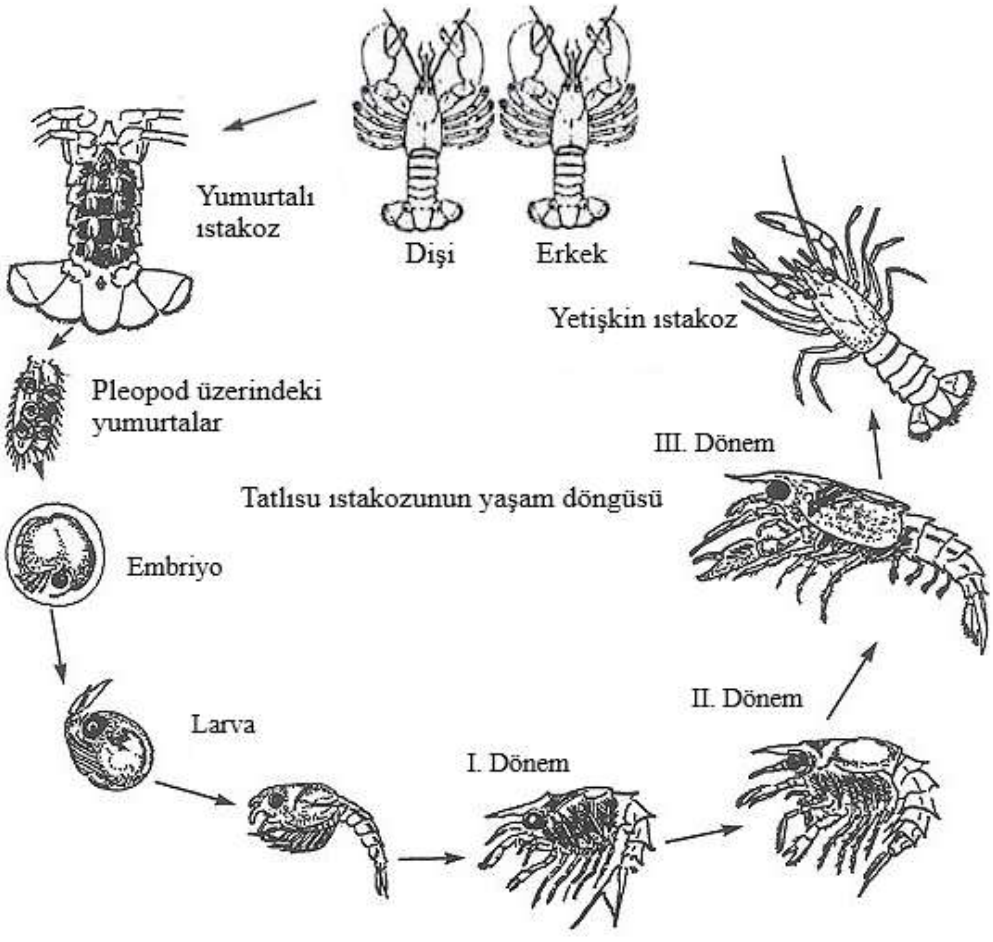
Şekil 2. Tatlısu ıstakozunun iç organlarının görünümü (Anonim, 2020a)

Tatlısu Istakozlarında Üreme ve Yaşam Döngüsü
Istakozlar ayrı eşeylidir. Dişilerin yumurta kanalları üçüncü çift yürüme ayaklarında bulunurken, erkeklerin vas deferensleri ise beşinci çift yürüme ayaklarının koksasına açılır. Erkeklerde, birinci ve ikinci pleopodlar spermatoforların dişi ıstakozların seminal reseptaculum kısmına transferinde rol oynar bunlara gonopod denir. Dişi ıstakozlarda ise böyle bir yapı yoktur. Istakozlarda üreme sonbaharda su sıcaklığının düşmesi ile başlar. Istakozlarda çiftleşme su sıcaklığının 7-12 ºC olduğu ekim, kasım ve aralık aylarında meydana gelir. Erkek tatlısu ıstakozları spermalarını dişinin üçüncü çift yürüme ayakları arasındaki cinsiyet deliğine bırakır. Çiftleşmeden sonra boşalan spermalar dişinin son üç yürüme ayaklarına ve kuyruğu üzerine yapışır. Su ile temas eden spermalar sertleşerek bu bölgede şekilsiz ve beyaz leke halinde bir görüntü oluşturur. Dişiler genel olarak çiftleşmeden 4-6 hafta sonra yumurtalarını gece bırakır ve döllenme işlemi gerçekleşir. Su sıcaklığı 6-11 ºC'ye düştüğünde tatlısu ıstakozlarında yumurtalar gözükür. Yumurtalar genital delikten çıkarlar. Yumurtlama sırasında yumurtalarla beraber abdomenin altında bulunan bezlerden yapışkan ve sarı renkte salgılanan salgı, sertleşmiş sperma paketlerini yumuşatarak spermaların serbest kalmasında görev yaparlar. Yumurtaları spermalar döller. Yumurtlama ile döllenme arasında 14-15 gün geçer. Döllenmiş yumurtalar herhangi bir tabiat olayı veya suni ayırma olmadığı sürece üzüm salkımı gibi, kış boyunca annenin kuyruk kısmının altındaki yüzme ayakçıklarında asılı olarak gelişme sürecine devam ederler. Yüzme ayakçıklarının diğer bir görevi de yumurtaların taze sularla devamlı temasını sağlamak ve oksijene olan ihtiyaçlarını gidermektir. Yumurtaların kuluçka süresi kış ve ilkbahar boyunca sürer. Güney bölgelerde dişiler yumurtalarını 5-6 ay taşırken, kuzey bölgelerde 6-8 ay taşırlar.

Yumurtaların açılması mayıs ya da haziran ayının sonuna kadar sürebilmektedir (Köksal, 1988; Alekhnovich ve Kulesh, 1996; Stucki, 1999).

Tatlısu ıstakozlarının yaşam süreleri çevresel şartlara ve türlerine göre değişim göstermekle birlikte, Astacidae familyasına ait türler 8 yıla kadar yaşayabilmektedir. Tatlısu ıstakozlarında büyüme süreci, vücutlarından eski kabuğun atılıp, yeni kabuğun oluşup sertleşmesiyle gerçekleşmektedir. Bu işleme kabuk değiştirme (molt) denir. Kabuk değiştirme işlemi zor ve zahmetli bir süreç olup, tatlısu ıstakozları bu süreçte savunmasızdır (Hobbs, 2001; Reynolds ve Souty-Grosset, 2012; Cumberlidge ve ark., 2015). Tatlısu ıstakozlarında dış iskeleti oluşturan kutikula tabakası, epikutikula, ekzokutikula ve endokutikula olmak üzere 3 katmandan oluşmaktadır. Kabuk değiştirme süreci premolt, molt, postmolt ve intermolt dönem olmak üzere 4 safhadan oluşmaktadır. Premolt dönemde proteolitik enzimler vasıtasıyla kutikula parçalanır, eski dış iskelet ayrılır, yeni dış iskeletin oluşması için eski kabuğun tamamen vücuttan atılmasıyla molt döneme geçilir. Endokutikula katmanı ise postmolt dönemde oluşur. İntermolt dönemde ise tatlısu ıstakozları sert yeni dış iskelete sahip olur (Lachaise ve ark., 1993; Denny ve Gaines, 2007).

Istakozların yaşam döngülerinde, yetişkin ıstakozlar havalar soğumaya başladığında sonbaharda çiftleşirler ve dişi ıstakozlarda spermatofor görülür. Çiftleşmeden 4-6 hafta sonra yumurtlama gerçekleşir ve inkübasyon başlar. İlkbahar sonunda yumurtalar açılır, juveniller (karapaksı yuvarlak, gelişmemiş, üropodları yok) görülür. Telson ile anneye yapışık kalırlar sonra serbest hale geçip, kıskaçlarıyla anneye tutunurlar ve bu süreç birinci dönemdir. İkinci dönemde ise, 6-8 gün sonra kabuk değiştirilir, karapaks tam gelişir ve üropodlar hala gelişmemiştir. Üçüncü dönemde, ıstakozlar beş gün sonra kabuk değiştirirler ve üropodlar oluşur. İlk yılda juveniller 6-7 kez kabuk değiştirirler. Yetişkin olana kadar yılda 2-3 kez kabuk değiştirirler (Kumlu, 2001) Şekil (3).



Şekil 3. Tatlısu ıstakozlarının yaşam döngüsü (Anonim, 2020b)

Yaşam Alanları ve Beslenme Özellikleri

Istakozlar geniş bir habitat alanına sahiptir. Yaşamlarını sığ ve derin göllerde, nehirlerde, akarsularda, çeşitli dip yüzeylerde sürdürürler. Derin göllerde 50 m'den daha sığ derinliklerde yaşarlar. Istakozlar kıyıları oyuk, bol bitkili, taşlıklı, balçıksız suları severler. Yuvalarını toprağı oyarak yaparlar, bu çukurlar genellikle 15-20 cm derinlikte olabilir. Istakozlar yuvalarda kıskaçları dışarıda olmak üzere saklanır ve düşmanlarını kolaylıkla ve

küçük canlıları kendilerini göstermeden tüketebilirler (Şekil 4) (Köksal, 1988; Cherkashina ve ark., 1999). Istakozların yaşadıkları sular bol kalkerli ve akıntılı sulardır. Kabuklarının gelişimi için kalker gereklidir. Yaşadıkları suların temiz ve oksijen bakımından zengin olması gereklidir (Çizelge 1) (Cukerzıs, 1973; Köksal, 1988).



Şekil 4. Tatlısu ıstakozlarının saklanmaları (Anonim, 2020c)

Çizelge 1. Tatlısu ıstakozları için uygun çevresel koşullar (Cukerzıs, 1973; Köksal, 1988)

Çevresel Koşullar	
Sıcaklık	
Üreme için	4-13 ºC
Büyüme için	14-22 ºC
pH	6.5-8.5
Kalsiyum	50-100 mg/L
Oksijen	>3.97 mg/L
Tuzluluk	‰0-5

Astacus cinsine ait tatlısu ıstakozları gece ve akşamüstü avlanırlar. Genellikle besinlerini güneş battıktan sonra aramaya çıkarlar. Omnivor beslenme özelliği göstermekle birlikte besin kaynaklarının temelini suda yaşayan ve yarı suda yaşayan bitkiler, bentik omurgasızlar ve detrituslar oluşturmaktadır. Bunlar hayvansal kaynaklı da (kurtlar, böcekler, mollusklar ve zooplankton) olabilir (Hessen ve Skurdal, 1986; Köksal, 1988; Skurdal ve ark., 1992; Nyström ve ark., 1999). Omnivor beslenmelerine rağmen seçici tüketicilerdir. Makrofitlerin seçimi genellikle bitkinin yapısı tarafından belirlenir ve bu nedenle suya batmış yerleşik makrofitleri tercih ederler. Omurgasızlar arasından özellikle salyangozları severler ve ince kabuklu türleri kalın kabuklu türlere göre daha çok tercih ederler. Fakat mollusk olmayan omurgasızları daha az tüketirler (Nyström ve Strand, 1996; Nyström, 1999). Istakozların en iyi beslendiği dönem ilkbahar başlangıcından sonbahara kadar olan dönemdir. Nehir ve göl ıstakozlarının en iyi 20-25°C sıcaklıktaki sularda iyi beslenmektedirler. Kabuk değiştirme safhasında ıstakozların besin alımı bir müddet durmaktadır. Juvenil aşamada fito ve zooplanktonlarla beslenebilen yavru tatlısu ıstakozları, yetiştiricilik esnasında ciğer ve dalak verilir.

Sonuç

Tatlısu ıstakozları, iç sularda ekolojik dengenin sağlanmasında önemli etkileri bulunan kabuklu canlılardır. Çürümüş organik maddeler üzerinden beslenen, detritusun işlenmesi ve mineralizasyonunda, bentik çeşitlilik ve partikül organik madde birikiminde önemli rol oynayan bu canlılar için "ekosistem mühendisi" benzetmesi yapılmaktadır (Zhang ve ark., 2004).

Ülkemizde, ihracat değeri yüksek olan tatlısu ıstakozları populasyonunun kerevit vebasından korumak için kontamine olmuş her türlü tekne, çizme ve avcılık malzemesinin başka bir su kaynağına götürülmeden önce birkaç gün boyunca tamamen kurutulması ya da mantara karşı etkili dezenfektanlarla dezenfekte edilmesi, ayrıca hastalığın bulunduğu kaynaktaki ıstakozların henüz bulaşımın olmadığı başka bir su kaynağına taşınmaması hususunda gereken hassasiyetin gösterilmesi gerekmektedir.

Ülkemizde iklim koşulları dikkate alınarak tatlısu ıstakozlarının zirai bitkilerle ve diğer sucul canlılarla polikültür şeklinde üretilmeleri daha ekonomik bir kazanç sağlayabilir. Bu durum dikkate alınarak, azalan tatlısu ıstakozu stoklarımızın güçlendirilmesi ve diğer sucul türlerle entegrasyonunun sağlanmasının ülkemiz ekonomisine katkıda bulunacağı muhakkaktır.

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The Importance Of Nutrition, Stock Density And Shelter Use İn Juvenile Period İn Freshwater Lobster *Astacus Leptodactylus* (Eschscholtz, 1823) Breeding

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Abstract
Freshwater lobster *(Astacus leptodactylus* Eschscholtz, 1823) (crayfish), which is an ecologically and economically important species worldwide, is a species obtained from inland waters, which is among the export products of our country. Crayfish production in Türkiye is based on hunting from natural water resources, dam lakes and ponds. Insufficient food, stock density and low use of barns in crayfish farming adversely affect farming. The aim of this review is to contribute to the development of freshwater lobster breeding by examining the importance of feeding, stock density and shelter use in the juvenile period in freshwater lobster breeding.
Key Words: Crayfish, *A.leptodactylus*, juvenile, stocking density, feed

Tatlısu Istakozu *Astacus leptodactylus* (Eschscholtz, 1823) Yetiştiriciliğinde Yavru Dönemde Beslenme, Stok Yoğunluğu ve Barınak Kullanımının Önemi

Özet
Dünya çapında ekolojik ve ekonomik olarak önemli bir tür olan tatlısu ıstakozları (*Astacus leptodactylus* Eschscholtz, 1823) (kerevit) ülkemiz içinde ihraç ürünleri arasında yer alan iç sulardan elde edilen bir türdür. Türkiye'de kerevit üretimi doğal su kaynakları, baraj gölleri ve göletlerden yapılan avcılığa dayanmaktadır. Kerevit yetiştiriciliğinde besin yetersizliği, stok yoğunluğu ve barınak kullanımının az olması yetiştiriciliği olumsuz yönde etkilemektedir. Bu derlemenin amacı, tatlısu ıstakozu yetiştiriciliğinde yavru dönemde beslenme, stok yoğunluğu ve barınak kullanımının önemi incelenerek, tatlısu ıstakozu yetiştiriciliğinin gelişmesine katkı sağlamaktır.
Anahtar Kelimeler: Tatlısu ıstakozu, *A.leptodactylus*, juvenil, stok yoğunluğu, beslenme

Giriş

Dünya çapında ekolojik ve ekonomik olarak önemli bir tür olan tatlısu ıstakozları (*Astacus leptodactylus* Eschscholtz, 1823) (kerevit) ülkemiz içinde ihraç ürünleri arasında yer alan iç sulardan elde edilen bir türdür (Kozák ve ark., 2015; Yazıcıoğlu ve ark., 2018). Tatlısu ıstakozları dünyada 737 tür ve alt tür ile temsil edilmektedir (Crandall ve Buhay, 2008; Crandal ve De Grave, 2017) ve bu türlerin yaklaşık olarak 15'i ekonomik öneme sahiptir (Holdich, 1993; Ackerfors, 2000). Oldukça fazla türün varolmasına rağmen genellikle avcılık ve yetiştiricilik alanlarında ekonomik olarak önem arz eden familyalar (Parastacidae, Cambaridae, Astacidae) olarak bilinmektedir. Amerika'da çoğunlukla kırmızı bataklık ıstakozu (*Procambarus clarkii*), beyaz nehir ıstakozu (*Procambarus zonangulus*) ve *Orconectes* spp., türlerinin yetiştiriciliği yapılmaktadır.

Avrupa'da sanayileşmeyle beraber ortaya çıkan su kirliliği ve bilinçsiz avcılık yüzünden kerevit vebası olarak adlandırılan bir mantar türü *(Aphanomyces astaci*) doğal sularda büyük hasarlara sebep olmuştur. Bununla beraber hastalık yapan bu mantar türü, 1860'lı yıllarda Amerika'dan ilk önce İtalya'ya, oradan da diğer Avrupa ülkelerine ve Rusya'ya yayılmıştır (Ackefors, 2000). Dolayısıyla, Avrupa ülkeleri giderek artan ihtiyaçlarını karşılayamaz duruma gelmiş ve tatlısu ıstakozlarının fazla tüketildiği Avrupa ülkelerindeki ıstakozlar hastalık yüzünden büyük zarar görmüştür. Bu aşamada artık tatlısu ıstakozu yetiştiriciliği önem kazanmış ve ilk çalışmalar, 1860'lı yıllarda Fransa'da başlamıştır. Yapay yollarla yavru üretimi ise ilk olarak 1912 yılında Rus araştırmacı Cukerzis tarafından yapılmıştır (Köksal, 1986).

Tatlısu ıstakozları protein kaynağı olarak düşük kaloriye sahiptir, bununla beraber B grubu vitaminleri, sodyum, potasyum, kalsiyum ve magnezyum yönünden zengin bir besindir (Goddard, 1988). C vitamini ve karoten içeriği birçok ticari balık türünden daha fazladır. Besin değerinin yanısıra, çoğu ülkede tatlısu ıstakozunun beğenilerek tüketilmesi ve geçen süre içerisinde ekonomik değerinin artması bu ürünün kültür şartlarındaki üretimine hız kazandırmıştır (Harlıoğlu ve Köprücü, 2000).

Astacidae ailesi içerisinde yer alan tatlısu ıstakozlarının, doğal yaşam alanı kuzey yarım kürenin iç sularıdır. Ülkemiz iç sularında Türk kereviti olarak adlandırılan dar kıskaçlı kerevit (*Astacus leptodactylus* Eschscholtz, 1823) tek tür olarak dağılım göstermektedir. Türkiye tatlısularındaki doğal tatlısu ıstakozu türü olan bu türün, iki alttürü bulunmaktadır (*Astacus leptodactylus leptodactylus* Eschscholtz, 1823 ve *Astacus leptodactylus salinus* Nordmann, 1842) (Geldiay ve Kocataş, 1970). *Astacus leptodactylus* Türkiye, Ukrayna, Güneybatı Rusya, İran, Kazakistan, Belarus, Slovakya, Bulgaristan, Romanya ve Macaristan'ını da kapsayan geniş bir yayılım alanı bulan bu tür, dünya genelinde doğal olarak 27 ülkede yaşamaktadır. Bununla beraber 14 ülkeye de nakil edilmiştir. Çek

Cumhuriyeti, Polonya, Almanya, Finlandinya, Danimarka, Hollanda, İngiltere, Litvanya ülkelerinde bulunmaktadır (Diler, 2013).

Ülkemizde kerevit yetiştiriciliğine ilişkin çalışmalar çok az olup, bu konuda önemli bir uygulama bulunmamaktadır (Alpbaz, 2005). Bu çalışmalarda doğal ortamlardan avcılık yolu ile elde edilen yumurtalı anaçlardan yavru elde edilmesi ve bu yavruların doğal suların restorasyonu ve stokların takviyesi gibi amaçlar için belli bir boya kadar büyütülmesi ve sonra doğal sulara bırakılması yada su kaynaklarında pazarlanabilir boya gelinceye kadar büyütülmesi gibi konularda üretim ve beslemeye yönelik çalışmalar yapılmış ve halende yapılmaktadır. Ülkemizin doğal türü olan *Astacus leptodactylus* stokları özellikle aşırı avcılık, su kirliliği ve kerevit vebası nedeniyle pek çok su kaynağında azalmıştır ve doğal stokların takviyesi için yetiştiricilik çalışmalarının yapılmasına ihtiyaç duyulmaktadır. Bu derlemede, jüvenil dönemde kerevit yetiştiriciliğinde beslenme, stok yoğunluğu ve barınak tipinin önemi vurgulanarak kerevit yavru yetiştiriciliği konusunda katkı sağlamak amaçlanmıştır.

Kerevit yavrularında beslenme, stok yoğunluğu ve barınak tipi

Beslenme

Kerevit yetiştiriciliğinde yavruların hayatta kalmalarını ve büyümelerini etkileyen en önemli faktörlerden biri beslenmedir. Omnivor beslenme özelliğine sahip olan kerevitlerin besin kaynaklarının temelini mikrobiyal açıdan zengin olan detrituslar oluşturur. Bunlar hayvansal kaynaklı (kurtlar, böcekler, mollusklar ve zooplankton) olabileceği gibi, bitkisel kaynaklı da olabilir. Yeşil bitkilerle beslenen kerevitlerin asıl besin olarak yararlandıkları kaynaklar, dekompoze olmuş bitki saplarının üzerinde bulunan bakteri, mantar ve diğer mikro organizmalardır (James ve Huner, 1985). Başarılı bir yavru üretimi için kerevitlere canlı yem, alabalık pelet yemi, haşlanmış patates gibi besinler verilebilir. Kerevitlerin beslenmesinde kullanılacak yapay yemlerin besin madde içerikleri; protein %18-44, lipit %1-5 ve mineral madde miktarının %7-10 civarında olması önerilmektedir (Lee ve Wickins, 1992). Yavruların ideal bir şekilde büyümesi için başlangıçta vücut ağırlıklarının %1-4 oranında, daha sonraki aşamalarda ise %0.3-1 oranında yem verilmesi önerilir. Juvenil aşamada zoo ve fitoplanktonlarla beslenebilen yavru kerevitlere, yetiştiricilik esnasında ciğer ve dalak verilir. Genç yavrular için en elverişli olan fitoplanktonun diatomlar olduğu ifade edilmiştir (Atay, 1997). Alderman ve Wickins (1990), kerevit yavrularının, özellikle su bitkileri arasında yaşayan krustaselerle beslendiği, yetişkinlerin ise besin kaynaklarının %70'inin bitkisel orjinli olduğunu bildirmişlerdir. Kerevitlerde planktonik ve epifitik organizmalarla başlayan beslenme, juvenil ve yetişkinlerde yeşil otlar, detrital besin zinciri, dekompoze olmuş bitki saplarıyla devam edip şeker kamışı ve çiftlik gübreleride besin kaynağı olarak kullanılmaktadır.

Köksal (1985), değişik rasyonların *A.leptodactylus* yavrularının büyümesi ve yaşama oranına etkileri araştırmış ve en yüksek büyümenin, *Artemia salina* nauplii ile hazırlanan rasyon ile beslenen yavrularda elde edildiğini ve erkek bireylerin dişilere göre daha iyi geliştiğini belirtmiştir. En düşük büyümenin ise, haşlanmış patates ve kızılağaç yaprağı ile hazırlanan rasyon ile beslenen yavrularda olduğu saptanmıştır.

Alderman ve Wickins (1990), yaptıkları deneme sonunda, kerevitlerin laboratuar koşullarında, patates ve havuç ile iyi beslendiklerini ancak üretimde sürekliliğini sağlamak için kerevitlerin bulundukları ortamlarda doğal besin kaynaklarının olması gerektiğini belirtmişlerdir.

Köksal ve ark. (1992), Eskişehir (Çifteler)'de *A. leptodactylus* yavruları ile 4 farklı yem kullanarak beton ve toprak havuz da 4 ay süresince besleme yaptıkları çalışmada, en yüksek büyümeyi, günlük olarak 1220 mg (taze balık+su teresi) ile beslenen yavru tatlısu kerevitlerinde tespit etmişlerdir.

Aydın (1998), beton havuzlarda çiftleştirilmiş bireylerden elde edilen başlangıç total uzunluğu 11.12 mm, karapaks uzunluğu 6.6 mm ve ağırlıkları 67 mg olan kerevit juvenillerini 436 juvenil/m^2 oranında stoklayarak, başlangıçta *Artemia* sp. ve *Daphnia* sp., üç hafta sonra alternatif olarak doğranmış taze alabalık eti ve alabalık peleti ile beslemiştir. Denemenin başlamasını takiben, 2, 3, 4 ve 5. aylarda juvenillerde ortalama ağılıklar sırasıyla, 0.482 g, 0.684 g, 0.973 g ve 1.038 g olmuştur. Juvenillerdeki hayatta kalma oranı ise 5. ayda % 55.99 olarak tespit etmiştir.

Berber (1999), 200'er adet *A. leptodactylus* yavrusunun bulunduğu iki toprak havuzda, havuzların birine çiftlik gübresi diğerine ise alabalık pelet yemi kullanarak 7 ay boyunca denemeye tabi tutmuştur. Deneme sonunda, alabalık pelet yemi kullanılan havuzdaki bireylerin hem boy hem de ağırlıkça daha iyi geliştiğini belirtmiştir.

Zaikov ve ark. (2000), II. dönem kerevit yavrularının beslenmesinde 30 gün süreyle soya unu, et unu, pelet yem (protein %30.7) ve zooplankton (*Daphnia magna*) kullandıkları denemelerinde en iyi gelişim oranı ve en yüksek yaşama oranının (%68,13) *Daphnia magna* ile besleme yapılan yavrularda olduğunu bildirmişlerdir.

Ulikowski ve Krzywosz (2004), yemleme sıklığının kerevitlerin gelişim ve hayatta kalma oranlarına etkilerini araştırdıkları çalışmalarında, başlangıç vücut ağırlıkları 30,2 mg total vücut uzunlukları 9,8 mm olan II. dönem *A. leptodactylus* yavrularını 300 birey/m^2 stok yoğunluğunda, barınak kullanmadan tanklara stoklamışlardır. Denemede 12, 24, 48 ve 96 saatte bir olmak üzere 4 farklı şekilde 28 gün süreyle beslenen *A.leptodactylus* juvenillerinin gelişimlerini yemleme sıklığının etkilediği saptanmıştır. Yine aynı çalışmada, ilk stok yoğunluğu 300, 600 ve 1200 birey/m^2 olan *A. leptodactylus*'larda, hayatta kalma oranları sırasıyla %70, %58 ve %47,8 olarak

bulunmuştur. Araştırmacılar, bu denemelerden elde ettikleri bulgulardan, yetiştiriciliğin ilk ayları esnasında kerevitlerde hayatta kalma oranlarının başlangıç stok yoğunluğundan etkilendiğini tespit etmişlerdir.
Zahmetkesh ve ark. (2007), yapmış oldukları denemede, *Astacus leptodactylus* yavrularının farklı oranlarda kalsiyum ilave yemlerle (0, 1, 2, 3 ve 4) besleyerek büyüme ve yaşama oranlarını araştırmasında en iyi ağırlık ve boy artışı %3-4 kalsiyum oranlı yemle beslenen grupta, en yüksek büyüme (11,65 g) %4 kalsiyumlu yemle beslenen grupta, en düşük yaşama oranı ise %2 kalsiyumlu yemle beslenen grupta (%30) olduğunu belirtmişlerdir.
Güner (2009) kerevit yavrularını % 55 protein içeren ticari alabalık yemi, % 35 protein içeren sazan yemi, % 18 protein içeren kıyılmış balık eti ve % 3.6 protein içeren saman yemleriyle besledikleri çalışmada, hem ağırlıkça hem de boyca en iyi büyüme alabalık yemi ile beslenen grupta, en yüksek yaşama oranı ise balık eti ile beslenen grupta (% 81.85) tespit etmiştir.
Cilbiz (2010), yapmış oldukları çalışmada yeme kalsiyum %1,5; % 2,0; %2,5 ve %3,0 oranlarında ilave edilmiş ve yüksek oranda kalsiyum içeren yemler (%2,5-%3,0) daha iyi ağırlık ve boy artışı ile yüksek yaşama oranı sağlarken, en düşük veriler kontrol grubunda gözlemlenmiştir. Tatlısu ıstakozların yemlerinde olması gereken en uygun kalsiyum oranı, regresyon analizine göre %2,5-3,0 olduğunu bildirmiştir.
Şirin (2010), kerevit yavru yemine farklı oranlarda kalsiyum (%3, %6 ve %12) kaynağı koyarak oluşturulan bir denemede %6 kalsiyum klorid veya karbonat ilaveli yemlerin kerevitler için en ideal olduğunu önermiştir.
Koca ve ark. (2011) farklı oranlarda (%0, 10, 20, 30 ve 40) kerevit yavru yemlerine karides artık unu ilave etmiştir. Kerevitlere verilen yemlerin büyüme, yem değerlendirme oranı ve yaşama oranı üzerine etkilerinin incelendiği çalışmada en yüksek ağırlık kazanımı %10 karides artık unu içerikli grupta olduğunu bildirmişlerdir.

Stok Yoğunluğu ve Barınak Tipi

Aksu ve Harlıoğlu (2003), *A. leptodactylus'*un barınak tercihlerini ve bu seçimde değişik faktörlerin etkisini incelemişlerdir. Araştırmada barınaktaki ışık geçirgenliğinin, barınak kullanımına etkisi ile bireylerin en fazla siyah barınaklara (%79.3) ve sırasıyla saydam renkli (%13.6), yeşil (%6.4) ve beyaz renkli barınaklara (%0.8) kullandıklarını tespit etmişlerdir. Barınak içinin yapay olarak aydınlatılması durumunda tatlısu ıstakozlarının barınak kullanma oranlarının %56.67 olduğunu; 60 mm, 70 mm ve 80 mm çapındaki barınakların birbirlerine yakın oranlarda kullandıklarını belirlemişlerdir. Ayrıca havalandırma yapılmayan akvaryumlardaki tatlısu ıstakozlarının yüksek oranda barınak kullandıkları, farklı barınak tipi seçiminde ise, en çok boru barınak tipini tercih ettikleri (%64.4) ve çakıl taban üzerindeki barınaklara diğerlerine oranla daha fazla kullandıklarını belirtmişlerdir.
Mazlum (2007), farklı stok yoğunluğunun ortalama II. dönem *Astacus leptodactylus* yavrularının gelişmeleri, yem değerlendirme ve hayatta kalma oranları üzerine etkilerini inceledikleri çalışmada üç farklı stok yoğunluğundan (50, 100 ve 200 birey/m^2) grupları ortalama 22,4 mg ağırlığındaki kerevitler stoklanmış ve deneme 120 gün sürmüştür. Deneme boyunca yavrular ticari alabalık yemi (%50 protein, %6,5 lipid, %12 mineral, %13 yem, %1,2 selüloz) ile beslenmiştir. Deneme sonunda, metrekareye 50, 100 ve 200 adet kerevit olan gruplardaki kerevitlerin ulaştıkları son ağırlıklar sırası ile 1,26±0,06 g, 1,16±0,25 g, 0,91±0,12 g olarak bulunmuştur. Total uzunlukları 16-41 mm arasında değişmiştir. Deneme sonunda, hem ağırlık hem uzunlukla ilgili gelişim artan stok yoğunluğundan negatif olarak etkilenmiştir. Deneme sonunda elde edilen hayatta kalma oranlarının da 50, 100 ve 200 birey/m^2 olarak stoklanan bireylerde sırasıyla %85,4, %73,8 ve %61 olduğu ifade edilmiştir. Sonuç olarak kerevitlerde gelişme ve hayatta kalma üzerinde stok yoğunluğunun önemli bir etkisi bulunmuş, fakat stok yoğunluğunun yem dönüşüm oranını etkilemediği ifade etmiştir.
Uzun (2007), farklı stok yoğunluğunun juvenil tatlısu kerevitlerinin büyümeleri, yem değerlendirme ve hayatta kalma oranları üzerine etkilerini araştırdıkları çalışmada üç farklı stok yoğunluğu (10 kerevit/m^2, 50 kerevit/m^2 ve 100 kerevit/m^2) grupları 1,7 m^2'lik tanklara sırası ile 17, 85 ve 170 adet kerevit olacak şekilde 9 adet tanka stoklanmıştır. Deneme sonunda metrekareye 10, 50 ve 100 adet kerevit olan gruplardaki kerevitlerin ulaştıkları son ağırlıklar ve uzunluklar sırası 15 ile 2,27±1,41 g, 1,400±0,84 g, 1,079±0,6 g ve uzunluklar ise 4,83±0,8 cm, 3,73±0,75 cm, 3,51±0,75 cm olarak bulunmuştur. Deneme sonunda boy ve uzunluk parametrelerinin artışı stok yoğunluğunun artması ile olumsuz etkilendiğini gözlemlenmiştir. Deneme sonunda en iyi büyüme (hem ağırlıkça hem de boyca) stok yoğunluğu en az olan grupta (10 kerevit/m^2) gerçekleştiğini tespit etmiştir.
Harlıoğlu (2008), *P. leniusculus* ve *A. leptodactylus* 2. dönem juvenillerine 12 saat ışık, 12 saat karanlık şeklinde ışık rejimi uygulanan akvaryumlarda ve farklı stok yoğunluklarının (234, 468, 937 juvenil/m^2) hayatta kalma ve gelişime etkisini araştırdığı çalışmasını 2 ay sürdürmüş ve sonuçta artan stok yoğunluğunun daha düşük hayatta kalma oranına neden olduğunu bildirmiştir.
Mazlum ve Uzun (2008), kerevitlerde yapılan farklı bir çalışmada korunak tiplerinin yaşama oranı üzerinde önemli olduğu tespit edilmiştir. Yapılan denemede PVC boru ve ağ materyalinin kontrole göre önemli oranda yaşama oranını arttırdığı belirtmişlerdir.

Sonuç

Kerevit yetiştiriciliği ile ilgili yapılan araştırmalar değerlendirildiğinde;

- Yavrularda canlı yem ile beslemenin büyüme ve yaşama oranını arttırdığı,
- Stok yoğunluğunun artışıyla kerevit yavrularında yaşama oranının azaldığı,
- Barınak kullanımı kerevitlerin birbirleriyle olan temasının azalmasına ve yem alımının artmasına neden olup kerevitlerin büyüme ve yaşama oranını arttırdığı tespit edilmiştir.

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Wide Temperature Range Palm-Based Chocolate Spread

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Abstract

The study screened blended base oils (various ratio of palm superolein (POOo) and sunflower oil (SFO)) and waxes (0% - 3.5% sunflower wax (SFW), carnauba wax (CW) and bees wax (BW)) for the production of chocolate spread at wide range of temperature (5°C-45°C). Main parameters for the blended base oil screening were solid fat content (SFC) as well as hardness and spreadability of the chocolate spread from the blended base oils. Main parameters for the waxes screening were SFC of the selected blended base oil and waxes as well as hardness, spreadability and stability of chocolate spread containing selected blended base oil with different percentage of wax (OSW). Blended oil of POOo: SFO at 50:50 ratio was chosen as base oil as its SFC does not affected by temperature and its chocolate spread was still spreadable at 5°C and projected hardness of below commercial chocolate spread at 5°C. Chocolate spread produced from OSW of 3.5% SFW and 3.5% CW showed promising and positive results of spreadability at 5°C, hardness at 5°C as well as stability structure (no oiling out) at 5°C-40°C after 24 hr of storage. The SFC of OSW with 3.5% SFW showed constant trend at experimental temperatures of 5°C-45°C while the SFC of 3.5% CW showed constant trend at experimental temperatures of 15°C-40°C.

***Key Words**: Sunflower wax, Carnauba wax, Bees wax, spreadability, phase separation*

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Under tropical conditions, dietary supplementation with vitamin C and *Ficus exasperata* leaf powder enhanced broiler chicken growth and meat quality

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Abstract

The performance characteristics and breast meat antioxidative status and cholesterol of broiler chickens fed diets supplemented with vitamin c and *Ficus exasperata* leaf powder (FLP) were assessed. Two hundred and forty day-old Cobb 500 broiler chickens were randomly allotted to four treatment diets. Diet 1 is the control. Diets 2, 3 and 4 were supplemented with 200mg/kg vitamin C, 10,000 mg/kg FLP, and 200mg/kg vitamin c + 10,000 mg/kg FLP, respectively. The broiler chickens' body weight gain (BWG) was considerably ($P<0.05$) improved by vitamin c, FLP, and vitamin c + FLP supplementations, with the broiler chickens given the vitamin c + FLP supplemented diet having a significantly ($P<0.05$) highest BWG. The feed conversion ratio and feed intake were not significant ($P>0.05$). The vitamin c, FLP and vitamin c + FLP significantly ($P<0.05$) reduced the lipid oxidation of the broiler meat, compared to the control. The vitamin c, FLP and vitamin c + FLP significantly ($P<0.05$) increased the glutathione peroxidase activities of the broiler meat, compared to the control. The vitamin c + FLP supplementation improved ($P<0.05$) the catalase activities of the broiler's meat, compared to the control.

***Keywords**: Avian, Antioxidant, Growth, Meat, Oxidative status, Phyto-additives*

Introduction

The expansion in the human population has resulted in increased food consumption and, a large increase in worldwide animal protein production, particularly in tropical countries (Renaudeau et al., 2012). Broiler production is projected to ease the problem of animal protein scarcity that most tropical countries are experiencing (Hatab et al., 2019). Under good management and a thermoneutral zone of 180°C -24°C, broiler chickens reach a market weight of about 2 kg at about 49 days of age (Tallentire et al., 2016).

However, sustainable broiler production is being affected by hampered by climate change, which usually subjects the birds to heat stress and consequently, depressed performance and profitability (Rahimi et al., 2020). Therefore, the adoption of dietary antioxidant supplementation and adaptation of the birds' diets to changing climatic trends while taking into account the economic status of the regions where they are produced has been suggested as a potential ameliorative approach to reduce the negative effects of heat stress on tropical birds (Tawfeek et al., 2014). Heat stress causes pyrexia, poor growth performance, anorexia, and lower feed efficiency in broiler chickens (Ozbey and Ozcelik, 2004). Heat stress causes broiler chickens to have an altered fatty acid composition in their fatty tissues, increasing the quantity of saturated fatty acids. As a result, there will be more fat in the subcutaneous layer, which will have a negative impact on the meat and carcass quality of broiler chickens (Kpomasse et al., 2021).

Vitamin C is a trace element having biological roles, such as antioxidant defence in heat-stressed broiler chicks. It has a high antioxidant capacity, polyphenols, and natural availability (Waseem et al., 2016). Medicinal plants are also good sources of biologically active antioxidants, and they've been examined for their ability to neutralise free radicals (Gul et al., 2011). *Ficus exasperata* leaf powder was found to possess a substantial number of minerals and phytochemicals with strong antioxidant activity, hence it was suggested that it be used as a dietary natural antioxidant supplement (Osowe et al., 2021). Anticonvulsant, antibacterial, hypoglycemic, antiulcer, hypotensive, hypolipidemic, anti-inflammatory, oxytocin inhibitory, antipyretic, and anxiolytic properties are all found in the leaves of *F. exasperate* (Ahmed et al., 2012). The purpose of this study was to see how dietary supplementation with vitamin C and Ficus exasperate leaf powder affected the performance and meat quality of broiler chickens.

Materials and Methods

The Research and Ethics Committee of the Department of Animal Production and Health, Federal University of Technology, Akure (FUTA), Nigeria, approved the experiment's standards and criteria for animals and animal protocol. The experiment was placed in February and March of 2021, at a temperature of 27.77±0.4 degrees Celsius on average. The process for gathering, preparing, and testing Ficus exasperata leaf powder (FLP) was published by Osowe et al., (2021).

Local markets in Akure, Nigeria, were visited to procure vitamin C powder (Avondale Laboratories Limited, Banbury, England) and other feed ingredients. To address the dietetic requirements of the experimental broiler

chickens, a basic experimental diet (Table 1) was compounded for the starting phase (0 to 21 days) and the finishing phase (21-42 days).

The basic experimental diet was divided into four equal portions and called diets 1 to 4 for each phase. Diet 1 is the control. Diets 2, 3 and 4 were supplemented with 200mg/kg vitamin C, 10,000 mg/kg FLP, and 200mg/kg vitamin c + 10,000 mg/kg FLP, respectively.

In Nigeria, the feeding trial was held at the FUTA Teaching and Research Farm. A total of 240 Cobb 500 broiler chicks were randomly assigned to the diets in a completely randomised arrangement for this experiment. Each diet was replicated six times, each time with ten birds (10 birds/replicate). To a depth of 3 cm, wood flakes were spread to blanket the floor of the experimental pen (2m × 1m) that contained each replicate. For the first week, the temperature in the experimental house was maintained at 31±2 degrees Celsius, then lowered by 2 degrees Celsius each week until it reached 26±2 degrees Celsius. The lights were left on for 24 hours on the first day, and then for 23 hours on successive days.

Every seven days, the experimental broiler chicks' body weight (BW) and feed intake (FI) were checked and measured. The difference between the birds' initial and final BW was used to calculate the average body weight gain (BWG). By dividing the amount of feed consumed by the amount of weight gained, the feed conversion ratio was calculated.

On day 42 of the feeding research, 18 birds (3 replications) from each dietary group were chosen at random and sacrificed as reported by Oloruntola et al (2019). About 100g of breast meat was sliced for measuring lipid peroxidation (Tokur et al., 2006), glutathione peroxidase activity (Cichoski et al., 2012), catalase activity (Hadwan and Khabt, 2018), and meat cholesterol (de Almeida et al., 2006).

The model: $Fgh = \mu + ts + \beta gh$, was used in this experiment, where Fgh = any of the response variables; μ = the overall mean; ts = effect of the sth treatment (T = diets 1, 2, 3 and 4); and βgh = random error due to experimentation. SPSS version 20 was used to do a one-way ANOVA on the data. Duncan's multiple range test was used to examine the differences ($P<0.05$) between the experimental treatment averages.

Results and Discussion

The meat quality and performance characteristics of broiler chicken fed vitamin C and *Ficus exasperata* leaf powder supplemented diets are shown in Table 2. The broiler chickens' BWG was considerably ($P<0.05$) improved by vitamin c, FLP, and vitamin c + FLP supplementations, with the broiler chickens given the vitamin c + FLP supplemented diet having the significantly ($P<0.05$) highest BWG. The feed conversion ratio and feed intake were not significant ($P>0.05$).

Table 1: Experimental diets' composition

Ingredients (%)	Starter (1-21 days)	Grower/finisher (22-42 days)
Maize	50.35	58.35
Rice bran	0	3
Maize bran	3	0
Soy oil	1	1
Soybean meal	38	30
Fish meal	3	3
Bone meal	3	3
Limestone	0.5	0.5
Salt	0.3	0.3
Premix	0.3	0.3
Lysine	0.25	0.25
Methionine	0.3	0.3
Nutrient composition (%)		
*Crude protein	22.18	20.03
*Crude fat	4.22	2.39
*Crude fibre	3.51	3.59
Metabolizable energy (Kcal/kg)	3018	3108.1
Lysine	1.12	1.09
Methionine	0.46	0.45
Calcium	1.02	0.95
Available phosphorus	0.47	0.42

*Analysed composition

Table 2: The performance characteristics and meat quality of broiler chicken fed vitamin C and *Ficus exasperata* leaf powder-supplemented diets

Parameters	Diet 1	Diet 2	Diet 3	Diet 4	SEM	P Value
Performance						
Body weight gain (g/bird)	2646.54^{c}	2789.04^{ab}	2764.47^{b}	2870.88^{a}	27.20	0.01
Feed intake (g/bird)	3735.23	3682.92	3928.58	3823.51	77.61	0.75
Feed conversion ratio	1.41	1.32	1.42	1.33	0.03	0.64
Meat quality						
Lipid oxidation (mgMDA/g)	2.27^{a}	1.26^{b}	1.39^{b}	1.35^{b}	0.15	0.02
Glutathione peroxidase (umole/mg)	27.15^{b}	50.06^{a}	56.62^{a}	52.36^{a}	4.15	0.02
Catalase (kU)	35.15^{b}	50.17^{ab}	50.76^{ab}	52.77^{a}	2.89	0.04
Cholesterol (mg//dl)	110.73	109.93	106.78	107.98	4.20	0.99

Means with a different superscript in the same column are significantly (P<0.05) different; FLP: *Ficus exasperate*, leaf powder; Diet 1: Control; Diet 2: 200mg/kg vitamin C; Diet 3: 10,000 mg/kg FLP; Diet 4: 200 mg/kg + 10,000 mg/kg FLP; SEM: Standard error of the means.

High ambient temperature in the tropics constitutes thermal stress that is a major cause of systemic oxidative stress; and consequently poor growth performance (Ahaotu et al., 2019; Hu et al., 2019). As a result, the increased body weight growth seen in the birds fed vitamin C and FLP in this study could be a result of the bioactive components in FLP and vitamin C's actions in lowering the effects of oxidative stress in broiler chickens. The antioxidant characteristics of phytochemicals or phyto-additives were attributed to their therapeutic effects, which included a reduction in antioxidant stress, an increase in antioxidant activity in diverse tissues, and an overall improvement in health (Settle et al., 2014). The antioxidant activities of FLP were reported (Osowe et a., 2021). Vitamin C is also the most abundant water-soluble antioxidant in the cell and extracellular fluids, protecting against phagocyte-derived oxidants by lowering phagocyte adherence to the endothelium, minimising respiratory burst, and avoiding lipid peroxidation (Close et al., 2006). Vitamin c and phytochemicals act as antioxidants, that neutralize free radicals and remove their power to cause damage.

The vitamin c, FLP and combination of vitamin c and FLP significantly (P<0.05) reduced the lipid oxidation of the broiler meat, compared to the control. The vitamin c, FLP and combination of vitamin c and FLP significantly (P<0.05) increased the glutathione peroxidase activities of the broiler meat, compared to the control. The vitamin c + FLP supplementation improved (P<0.05) the catalase activities of the broiler's meat, compared to the control. Heat stress significantly reduces the quality of chicken meat (Hashizawa et al., 2019). As observed in this study; vitamin C and FLP supplementation reduced lipid oxidation and increased glutathione peroxidase and catalase activities in broiler meat, suggesting that the supplements improved the body's defence against oxidative damage by controlling oxidative materials and free radicals through an enzymatic antioxidant system (Suri et al., 2019). Catalase and glutathione peroxidase are prominent enzymes that fight free radicals and alter the degrees of lipid peroxidation in meat and meat quality (Dominguez et al., 2019; Suri et al., 2019). In conclusion, The fed vitamin C (200 mg/kg) and *Ficus exasperata* leaf powder (10,000 mg/kg) supplementation and their combination improved the body weight gain, meat glutathione peroxidase, and meat catalase of the broiler chickens. The meat lipid peroxidation was also reduced by the dietary supplementations used in this study.

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ID: 379

Risks, Regulations and Genetic Engineering: A Way Forward for Commercialization of Gm Crops in Pakistan

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Abstract
The rapid progress in biotechnology has significantly promoted the development and production of Genetically Modified (GM) plants. The extensive global cultivation of GM crops has generated greater benefits that might provide opportunities for solving problems related to food security, however, it has also raised considerable biosecurity concerns worldwide. Major concerns from GM crops are on natural environment, human and animal health and society. The potential environmental consequences due to transgene escape from a GM crop to its non-GM crop counterparts (crop-crop) and weedy or wild relative (crop-weed) via gene flow are the most debated biosafety issues internationally. GM crops are truly biological novelties, their release into the environment poses concerns about the unpredictable ecological and evolutionary responses that GM species themselves and the interacting biota may express in the medium and long term. One of the consequences of GM crop may be a generalized contamination of natural flora by GM traits and a degradation and erosion of the commonly owned genetic resources available today for agricultural development. However, these concerns can be resolved by developing efficient investigative techniques via modern biotechnology and genetic engineering. A systematic risk assessment will facilitate the appropriate prediction of potential environmental consequences caused by GM crops. Moreover, enforcement of National Biosafety Guidelines is highly recommended to avoid potential consequences.

Keywords: *Biosafety, GM crops, environmental issues, biotechnology, gene flow*

ID:382

The Determination of Antibacterial Activities of Peels of Fruits *Punica granatum* L. Against the Crop Spoiling Pathogens

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Abstract

Microbial contamination of food is still an important public health problem for human society, and poses economic concerns due to product losses. Plant secondary metabolites are frequently studied against microorganisms that cause health and economic losses due to their antibacterial, insecticidal, antifungal, acaricidal, and cytotoxic activities, and because they are obtained naturally. In this study, the different extracts (ethanol, methanol) obtained from *Punica granatum* fruit peels were used against *Erwinia caratovora subsp. caratavora* ECC100, *Rathayibacter tritici* DSMZ7486, *Agrobacterium vitis*, *Rathayibacter iranicus* DSMZ7484, *Pseudomonas putida*, *Pseudomonas tomato* Pt52-a. These bacteria are crop spoilage pathogens. The antibacterial activities were carried out using the disc diffusion method. In addition, another activity test was Minimum Inhibitory Concentration (MIC) which was performed with the broth dilution method. At the end of the study, the highest antibacterial activity was determined with a 16.5 mm inhibition zone diameter against *A. vitis* from methanol extract, and the lowest antibacterial activity was determined against *A. vitis* from ethanol extract. The lowest MIC value of *Punica granatum* fruit peel extracts was obtained for *A. vitis* and *Pseudomonas putida* in the 6500 µg/mL concentration, the highest MIC value was determined at 13000 µg/mL for various crop spoiling pathogens. As a result, it is suggested that *Punica granatum* fruit peels have antibacterial activities against crop spoiling pathogens, and can be used in the fight against these pathogens.

Key Words: *Punica, Crop spoiling pathogens, Antibacterial activity, Minimum inhibitory concentration*

Punica granatum L. Meyve Kabuklarının Ürün Bozan Patojenlere Karşı Antibakteriyel Aktivitelerinin Belirlenmesi

Özet

Gıdaların mikrobiyal kontaminasyonu, insan toplumu için hala önemli halk sağlığı sorunudur ve yarattığı ürün kayıplarından dolayı ekonomik kaygılar oluşturmaktadır. Bitki sekonder metabolitleri, antibakteriyel, insektisit, antifungal, akarisit ve sitotoksik aktiviteleri nedeniyle sağlık ve ekonomik kayıplara neden olan mikroorganizmalara karşı ve doğal olarak elde edildikleri için sıklıkla araştırılmaktadır. Bu çalışmada *Punica granatum* meyve kabuklarından elde edilen farklı ekstreler (etanol, metanol) *Erwinia caratovora* subsp. *caratavora* ECC100, *Rathayibacter tritici* DSMZ7486, *Agrobacterium vitis*, *Rathayibacter iranicus* DSMZ7484, *Pseudomonas putida*, *Pseudomonas tomato* Pt52-a*'* ya karşı kullanılmıştır. Antibakteriyel aktiviteler disk difüzyon metodu kullanılarak gerçekleştirilmiştir. Ayrıca sıvı dilüsyon yöntemi ile gerçekleştirilen Minimum İnhibitör Konsantrasyon (MİK) bir diğer aktivite testidir. Çalışma sonunda en yüksek antibakteriyel aktivite metanol ekstresinden *A. vitis*' e karşı 16,5 mm inhibisyon zon çapı ile, en düşük antibakteriyel aktivite ise etanol ekstresinden *A. vitis*'e karşı tespit edilmiştir. *Punica granatum* meyve kabuk ekstrelerinin en düşük MİK değeri 6500 µg/mL konsantrasyonunda *A. vitis* ve *Pseudomonas putida* için elde edilirken, en yüksek MİK değeri 13000 µg/mL konsantrasyonunda çeşitli ürün bozan patojenleri için saptanmıştır. Sonuç olarak, *Punica granatum* meyve kabuklarının ürün bozan patojenlere karşı antibakteriyel aktiviteye sahip olduğu ve bu patojenlere karşı mücadelede kullanılabileceği önerilmektedir.

Anahtar Kelimeler: *Punica, Ürün bozan patojenler, Antibakteriyel aktivite, Minimum inhibitör konsantrasyonu*

ID:383

Determination of Antibacterial Activity of *Helichrysum arenarium* L. Extracts Against Crop Spoiling Pathogens

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Abstract
It is very important that the foods consumed by people are reliable for their healthy growth and development. New foods are being developed every day depending on consumer demand. Many of these foods are produced from the basic food sources we know, and various additives are used to improve their physical, chemical, and microbiological properties and to extend their storage period. However, some of these additives are unhealthy, carcinogenic, or toxic, leading researchers to discover natural and reliable additives. Many *Helichrysum* species are used in traditional medicine. *Helichrysum* has been used in the treatment of various ailments such as skin infections, gallbladder, respiratory and digestive system disorders, and kidney stones. In addition, antioxidant, hepatoprotective, antibacterial, antiviral, and antifungal studies have also been reported. This study, it was aimed to determine the antibacterial activities of different extracts from *Helichrysum* against *Erwinia caratovora* subsp. *caratavora* ECC100, *Rathayibacter tritici* DSMZ7486, *Agrobacterium vitis*, *Rathayibacter iranicus* DSMZ7484, *Pseudomonas putida*, *Pseudomonas tomato* Pt52-a. The antibacterial activity of *Helichrysum* has been tested against crop spoiling pathogens, and the disk diffusion method has been used for this study. The minimum inhibitory concentration (MIC) was determined by the broth dilution method. According to the results of the study, the highest inhibition zone was determined from the methanol extract of the plant, this bacterium is *Pseudomonas tomato,* and the zone is 19 mm. At the end of the minimum inhibitor studies, all MIC values were determined to be higher than 10000 µg/mL. As a result, it is suggested that *Helichrysum* extracts have antibacterial activities against crop spoiling pathogens, and can be used in the fight against these pathogens.

***Key Words**: Helichrysum, Crop spoiling pathogen, Antibacterial activity, Minimum inhibitory concentration*

Helichrysum arenarium L. Ekstrelerinin Ürün Bozan Patojenlere Karşı Antibakteriyel Aktivitesinin Belirlenmesi

Özet
İnsanların tükettiği besinlerin güvenilir olması sağlıklı büyümeleri ve gelişmeleri için çok önemlidir. Tüketici talebine bağlı olarak her gün yeni gıdalar geliştirilmektedir. Bu gıdaların birçoğu bildiğimiz temel gıda kaynaklarından üretilmekte olup, fiziksel, kimyasal ve mikrobiyolojik özelliklerini geliştirmek ve saklama sürelerini uzatmak için çeşitli katkı maddeleri kullanılmaktadır. Bununla birlikte, bu katkı maddelerinin bazıları sağlıksız, kanserojen veya toksiktir, araştırmacıları doğal ve güvenilir katkı maddeleri keşfetmeye yönlendirir. Geleneksel tıpta birçok *Helichrysum* türü kullanılmaktadır. Geleneksel tıpta birçok *Helichrysum* türü kullanılmaktadır. *Helichrysum* cilt enfeksiyonları, safra kesesi, solunum ve sindirim sistemi bozuklukları ve böbrek taşları gibi çeşitli rahatsızlıkların tedavisinde kullanılmıştır. Ayrıca antioksidan, hepatokoruyucu, antibakteriyel, antiviral ve antifungal çalışmalar da bildirilmiştir. Bu çalışma, *Helichrysum'* dan elde edilen farklı ekstraktların *Erwinia caratovora* subsp. *caratavora* ECC100, *Rathayibacter tritici* DSMZ7486, *Agrobacterium vitis*, *Rathayibacter iranicus* DSMZ7484, *Pseudomonas putida*, *Pseudomonas tomato* Pt52-a' ya karşı antibakteriyel aktivitelerinin belirlenmesini amaçlamıştır. *Helichrysum'* un antibakteriyel aktivitesi ürün bozan patojenlere karşı test edilmiş ve bu çalışma için disk difüzyon yöntemi kullanılmıştır. Minimum inhibitör konsantrasyonu (MİK) ise sıvı dilüsyon metodu ile belirlenmiştir. Çalışmanın sonuçlarına göre en yüksek inhibisyon zonu bitkinin metanol ekstraktından belirlenmiştir, bu bakteri *Pseudomonas tomato'* dur ve zon 19 mm'dir. Minimum inhibitör çalışmaları sonunda, tüm MİK değerlerinin 10000 µg/mL'den yüksek olduğu belirlenmiştir. Sonuç olarak, *Helichrysum* ekstratlarının ürün bozan patojenlere karşı antibakteriyel aktiviteye sahip olduğu ve bu patojenlerle mücadelede kullanılabileceği önerilmektedir.

***Anahtar Kelimeler:** Helichrysum, Ürün bozan patojen, Antibakteriyel aktivite, Minimum inhibitör konsantrasyonu*

ID:384

Çay Yetiştiriciliğinde Küçük Aile İşletmelerinin Pazarlama Sorunlarının Belirlenmesi: Rize İli Örneği

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Özet

Dünyada yaklaşık 50 ülkede çay yetiştirilmektedir. Türkiye ise dünya çay üretiminde 5.sırada yer almaktadır. Türkiye çay alanları 2015 yılında 762 bin dekar iken 2019 yılında 849 bin dekara çıkmıştır. Üretim miktarı 1,33 milyon tondan, 1,45 milyon tona; verim ortalaması ise 1.743 kg/da'dan, 1.708 kg/da'a yükselmiştir. Ülkemizde çay tarımı küçük aile işletmeleri tarafından yapılmakta ve çaylık alanların %65'i Rize ilindedir. Bu nedenle çalışma alanı olarak Rize ili seçilmiştir. Çalışmanın amacı Rize ili Derepazarı ilçesinde çay yetiştiriciliği yapan küçük aile işletmelerinin pazarlama sorunlarını ortaya koymaktır. Bu kapsamda 50 çay üreticisi ile yüz yüze anket yapılmıştır. Bu kapsamda çiftçilerin yaşı, eğitim düzeyi, medeni durumu, aile genişliği, tarım dışı bir işte çalışma durumu, kooperatif ortaklığı gibi sosyo-ekonomik özellikleri incelenmiştir. Ayrıca çay tarımı ile ilgili teknik bilgi düzeyleri, çay tarımını tercih nedenleri, arazi ve hayvan varlığı, tarım ve tarım dışı gelir durumları, işletmede işçi çalıştırma durumları ele alınmıştır. Çiftçilerin ürettikleri çayı sattıkları yerler, satış şekilleri, çay fiyatının belirlenmesinde etkili olan kurumlar, çay üretiminde ve pazarlama aşamalarında karşılaşılan sorunlar incelenip ortaya konulmaya çalışılmıştır. Elde edilen veriler istatistik programında ortalama, frekans, yüzde dağılımları tablolar halinde analiz edilerek yorumlanmıştır. Buna göre çiftçilerin %36.2'si çay pazarlamasında yaşadığı en önemli sorunun ÇAYKUR'un uyguladığı kontenjan olduğunu ifade etmiştir. Ayrıca çay fabrikalarında yaşanan yoğunluk nedeniyle bazı günler alım yapılamaması (%33.3), çay alım fiyatlarının düşük olması (%29.7) ve alıcı çeşidinin azlığı (%0.7) diğer yaşanan sorunlar olarak tespit edilmiştir.

Anahtar kelimeler: çay üreticisi, küçük aile işletmesi, pazarlama sorunları

ID:385

Eğiticilerin Eğitiminin Tarımsal Yayım Açısından Önemi: Adana Tarımsal Yayım ve Hizmetiçi Eğitim Merkezi (TAYEM)

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Özet

Bilgi; öğrenme, araştırma ve gözlem yolu ile elde edilen gerçektir. Türkiye'de çiftçilere tarımsal konularda bilgi ve hizmet götüren en önemli kamu kuruluşu Tarım ve Orman Bakanlığı'dır. Bakanlık, bünyesindeki teknik personelin hizmetiçi eğitimler kapsamında Adana ve Aydın Söke'de bulunan Tarımsal Yayım ve Hizmetiçi Eğitim Merkezleri'nde tarımsal konularda yeni bilgiler edinmeleri, kendilerini geliştirmeleri ve varolan bilgilerini pekiştirmeleri amacıyla açılan kurslara katılımlarını önemsemektedir. Bu çalışma ile Adana Tarımsal Yayım ve Hizmetiçi Eğitim Merkezi'nin (TAYEM) kurslarına katılan 120 teknik personelin (kursiyer) görüş ve düşünceleri ortaya konulmuştur. Ayrıca eğiticilerin eğitiminin tarımsal yayım açısından önemi değerlendirilmiştir. Elde edilen verilere göre kursiyerlerin %75.0'ı kursun içeriği ve hedeflenen amacın uyumlu olduğunu, %70.8'i aldıkları eğitimin mesleki/kişisel gelişimlerine katkı sağladığını, %64.2'si eğitimin konusu ile kendi kurumlarında çalıştıkları konuların uyumlu olduğunu, %68.3'ü eğitimlerde kullanılan materyal ve araçların yeterli olduğunu, %65.0'ı kurs sürelerinin yeterli olduğunu ve %78.3'ü eğiticilerin kurs konularına hâkim olduğunu ifade etmiştir.

Anahtar kelimeler: tarım, tarımsal yayım, hizmetiçi eğitim

ID:389

Evaluation of yield decrease in common beans due to anthracnose (*Colletotrichum lindemuthianum*) below sub-temperate environment of Northwestern of Rwanda.

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Abstract
In the field, research was conducted with the aim of assessing the yield loss in common beans due to anthracnose using four cultivars with various levels of resistance. Randomized complete block design as experiment design was used methods where each selected cultivar was grown and the yield loss caused by anthracnose was assessed with the goal of measuring the yield drop in common beans due to anthracnose in Rwanda for data analysis, a level of significance of >0.05 was utilized to accept the hypothesis. Field trials on the particularly susceptible cultivar Gikundiro 2 showed the maximum harm in terms of incidence and severity in both infection circumstances. The severity of pod infection on pods ranging from 3-9 (0-) resulted in reduction in quantity of seeds which contain a pod ranging from 10.52 % -57.76 % and the loss in weight of seeds per pods ranging from 21.93 % - 68.77 %, both demonstrated a direct impact on seed yield. However, determinate cultivars showed a greater drop in yield (58.5%) than indeterminate cultivars (10.52%) although both were sensitive, based on this research, anthracnose causes economic yield loss on variety Gikundiro 2 and vuzimpundu.
Key Words: Incidence, Resistance, Severity, yield loss, Anthracnose.

Introduction

Beans are one of the main crops grown in Rwanda where they are grown in the mid hills of 900-1300 meters above sea level and high hills of 1800-3000 meters above sea level where the total area of beans is 2037 ha with the productivity of 3.5 tones /ha in subtropical to temperate agro-climatic conditions (Musana *et al* 2020). Common beans are often grown during the growing seasons (September 2020 for season A, February and 2021 for season B) and the humid atmosphere makes the crop vulnerable to fungal, bacterial and viral infections. *Colletotrichum lindemuthianum* (Sacc. and Magnus) Lams-Scrib causes anthracnose of beans which is the destructive diseases in tropical and subtropical environments especially under cold and humid settings. The crop is vulnerable to pathogen attack from seedling to maturity depending on the presence of favorable climatic conditions for disease initiation and development (Erdinc *et al*, 2017).

In the northwest of Rwanda, bean anthracnose is a common occurrence with a wide pathogenic variety and Kiryumukwe (RWV 1129) cultivars are susceptible to any race of the pathogen. In susceptible kinds, the disease causes yield and quality losses with yield losses as high as 95% in some cases. Even though various elements of bean anthracnose have been thoroughly investigated, there is little information in the literature stated in the estimation of yield loss as the essential element to consider when conducting inventory on crop production, policies of crop insurance, deployment of gene as well as quarantine variety (Urinzwenimana *et al*, 2017). Under epidemic conditions, the fungus' seed-borne nature can have a devastating effect on both quantity and quality of output. This research presents the results of loss estimation in kidney bean cultivars with differential resistance to bean anthracnose as well as the impact of background contamination (an infection that begins outside the field) on the crop quality and quantity (Imran *et al*, 2021).

Materials and Methods

Area for research

The study took place in Rwanda, Gicumbi and Burera Districts of the Northern province and Rubavu District of the western province, The last to districts share a border with Uganda to the north while Rubavu District shares border with the Democratic Republic of Congo on the west. The area has an altitude averaged of 1,400 m a.s.l with 1°22' 51.6" south latitude as well as 30° 17' 07" east longitude. The rain per year is between 800 and 1000 millimeters while the average of temperature per year is between 25.3ºC -27ºC. The soils in the higher land region are humid ferrasols while that of lower region is vertisols with the pH of 6.3 (Mohammed H.*et al*, 2015).

Experimental Design

Soil analysis revealed that the experimental soil had medium nitrogen and phosphorus concentration as well as high potassium content before field preparation. Before planting, necessary levels of nitrogen and phosphorous of 20 kg and 60 kg per hectare respectively were applied to ensure the proper nutrient status of the soil (**Mojid *et al*, 2021)**. During the growing season 30 plots of 2 x 1.5 m^2 each were planted with four bean cultivars: Vuzimpundu (RWV 3316) (resistant), Mpanguhe (RWV 3317) (moderately resistant), Gikundiro 2 (MAC 49) (highly susceptible) and Kiryumukwe (RWV 1129) (susceptible) in Randomized complete block design (RBD) with 3

replications. To reduce inter-plots interference, guard plots of 1 x 1 m^2 were used. Carbendazim was sprayed three times 0.1 percent at different phases of plant growth in the check plots to keep them disease-free it means control plots along with a seed treatment of 2.5 gm per kg of seed. Because it proved resistant to 103 and 935 races in field settings, the Vuzimpundu (RWV 3316) cultivar was preserved as an overall check. The experiment was repeated for two seasons but because the second year was not an epidemic year, only one-year's data was used to determine yield losses.

The progression of the disease through time

The severity of anthracnose was recorded at 15-day intervals from the arrival of 1st signs of disease through the crop maturity in various cultivars and treatments to study disease progression over time. The infection rate 'r' was determined using Vander Plank's standard equation (1963) and I calculated the AUDPC with referring to Shaner and Finney's method (1977) (Alves *et al*, 2016).

Estimation of yield loss

Infected seed and crop have an impact on common bean yield.

Infected seeds of the susceptible cultivars Gikundiro 2 (MAC 49), Kiryumukwe (RWV 1129), and the moderately resistant cultivar Mpanguhe (RWV 3317) were utilized for investigating the seed-borne inoculum effect on disease development and yield of common beans, while healthy seeds of these varieties were sown to investigate the role of background contamination (external source of inoculum Anthracnose was introduced to the healthy seed plots by planting two border rows of sensitive cultivars. Gikundiro 2 (MAC 49) was infected with a combination of races found in the Gicumbi District area at the primary leaf stage and second trifoliate leaf stage (103 and 935) Plants were sprayed three times with Carbendazim at different stages of plant growth (35 days after planting, pod initiation, and pod development) as well as a seed treatment in control plots of each type. 2.5 grams of seed per kilogram data on disease incidence and severity were collected every 15 days from the onset of symptoms until the crop reached maturity. The plants were monitored for symptom development on a regular basis and 25 of them were labeled to keep track of disease severity and yield. At harvest, the quantity (numbers) of pods in each plant as well as the quantity(numbers) of seed in each plant were counted. After the seeds were sun-dried the yields of various treatments were calculated to calculate yield loss as a percent yield loss in various cultivars, the following formula was used:

Percent yield loss = 100 X (YCP-YDP)/YCP

Where YCP stands for yield in the control plot and YDP stands for yield in the diseased plot.

(Nirmala *et al*, 2015)

On a randomly selected pod, a 0-9 point scale from diseased to healthy was used to investigate the relationship between disease severity and yield, and 25 pods/ response type/ replication were used to quantify disease severity and yield. For the yield comparison, healthy pods from the control plot were chosen the weight of the seeds per pod and the number of seeds per pod were also verified.

Results and Discussion

Anthracnose development on various cultivars

On four bean cultivars with variable resistance, the progression of anthracnose originating from seed-borne infection (infected seed crop) and background contamination (external inoculum) revealed that disease incidence and severity were significantly higher in the highly susceptible cultivar Gikundiro 2 (MAC 49) in the crop raised from infected seed. (Fig1&2) (Binyam Tsedaley,2015). Due to seed-borne infection, the cultivar Gikundiro 2 (MAC 49) had the highest terminal disease severity (79.48 percent), followed by Kiryumukwe (RWV 1129) (26.23 percent), and Mpanguhe (RWV 3317) (3.74 percent). Similarly, significant changes in disease incidence between types were discovered. No disease was recorded in cultivar Vuzimpundu (RWV 3316) (Highly resistant) which was planted as an overall check. The disease initiated about two weeks late (July 2021) in the crop having background contamination as compared to the crop raised from infected seed (Muhammad *et al* 2018).

Seed-borne infection and background contamination were statistically equal in terms of terminal illness severity and apparent rate of infection. However, in seed-borne infection, AUDPC was much greater which could be attributable to the fact that disease began late (2 weeks) in background contamination. (Chang *et al*, 2020). Table 1 shows the AUDPC, terminal severity of disease and apparent infection rate 'r' for several cultivars. For AUDPC, there were very significant variations between the extremely susceptible, susceptible and moderately resistant genotypes between different treatments. In both the crops receiving

inoculum from seed-borne infection and background contamination, the AUDPC was highest in Gikundiro 2 (MAC 49) (2672.69) and lowest in Mpanguhe (RWV 3317) (327.64). Observations on the severity of terminal disease and the apparent rate of infection showed essentially identical trends in different kinds. The results demonstrated that the terminal disease severity of the extremely sensitive, susceptible and moderately resistant cultivars differed significantly (Buerstmay, 2019). There were no significant differences in terminal disease severity or infection rate between crops with a seed-borne infection and those with background contamination while the latter had lower values. The findings demonstrated that the apparent rate of infection differed significantly amongst the cultivars (Krishna *et al*, 2021).

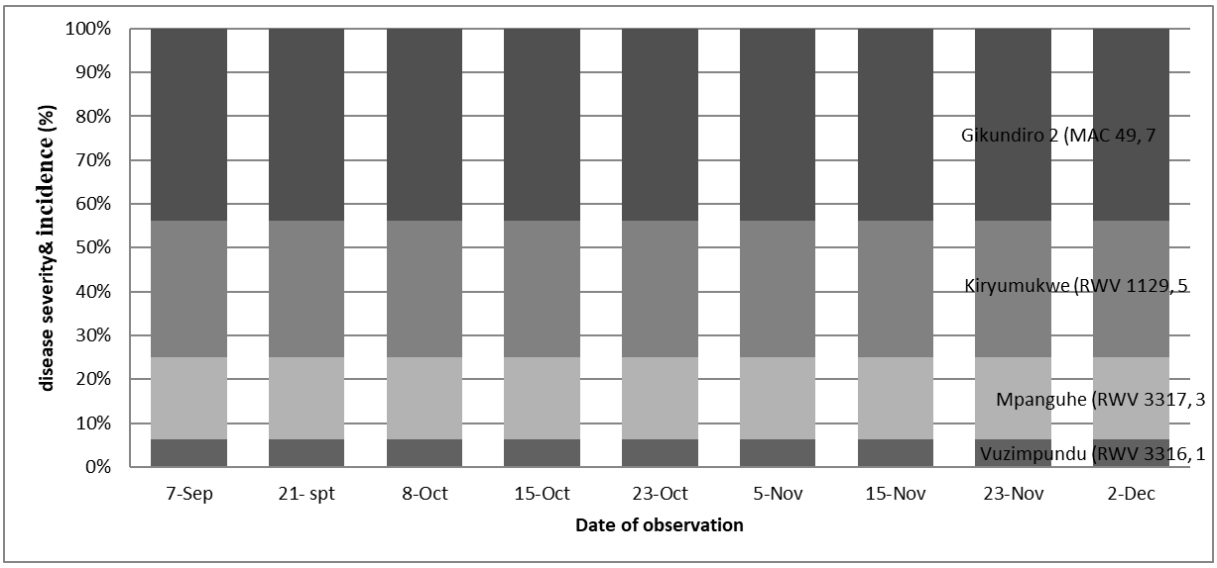

Fig. 1. Bean anthracnose develops on common bean varieties as a result of a seed-borne infection

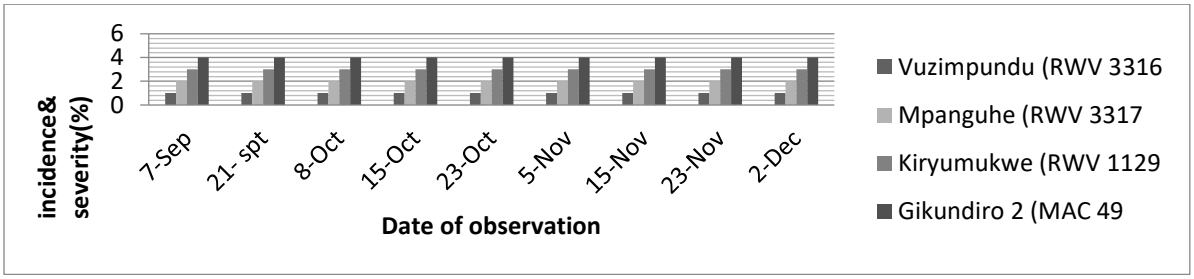

Fig. 2. Enlargement of bean anthracnose on common bean cultivars initiating from background contamination

Table 1: Proportional account of anthracnose initiating from seed-borne contamination and background contamination in different cultivars of common bean under natural epiphytotic conditions*

	AUDPC			Disease severity (%)			Rate of infection (per unit per day)		
Cultivars **	TIS	BC	Mean	TIS	BC	Mean	TIS	BC	Mean
Vuzimpundu (RWV 3316)=R	45	56	50.5	0	1.9	0.95	0	0.011	0.006
Mpanguhe (RWV 3317)=MR	345	178	261.5	3.8	2.8	3.3	0.02	0.023	0.047
Kiryumukwe (RWV 1129)=S	967	643	805	28.5	26.3	27.4	0.04	0.053	0.029
Gikundiro2 (MAC 49) =HS	2652	1764	2208	78.3	73.9	76.1	0.08	0.078	0.079
Mean	1002.25	660.25		27.65	26.22		0.035	0.041	
CD(P=0.05)	Cultivar:105.59 Treatments:86.46 CVx Treat.Interactions:149.81			Cultivar:105.59 Treatments:86.46 CVx Treat.Interactions:149.81			Cultivar:105.59 Treatments:86.46 CVx Treat.Interactions:149.81		

TIS: The infection spread through seeds; BC: Background contamination; *Average of three replication; ** HS stands for Highly susceptible; S stands for Susceptibility; MR stands for Moderate resistants; R stands for Resistants,AUDPC stands for the area under the disease progress curve

Estimation of productivity loss

Disease's impact on yield parameters

Table 2 shows the impact of seed-borne infection and background contamination on yield parameters of various varieties. Amount of pod in each plant and grains per pod per plant decreased by 40% for extremely sensitive (Gikundiro 2 (MAC 49)) cultivars, but was non-significant in susceptible (Kiryumukwe (RWV 1129)) and moderately resistant (Mpanguhe (RWV 3317) cultivars. Cultivar Gikundiro 2 (MAC 49) showed maximum reduction in the amount of pods per plant and the amount of grains per pod in each plant in both the crops raised from infected seed and under background contamination. However, the amount of pod per plant and amount of seed per pod per plant were lower (2.4%) in the plants having the seed-borne infection. In Bavistin sprayed plants of all cultivars, the total number of pods per plant and the amount seed per pod per plant were at their highest (Asif *et al*, 2021). The quantity of pod per plant and quantity of seed per pod per plant decreased most as a result of seed-borne infection in cultivar Gikundiro 2 (MAC 49). (41.90 % and 52.24 %, respectively). Background

contamination caused a similar drop in Gikundiro 2 (MAC 49). (37.44 % and 49.13 %). The production potential of the cultivars differed significantly, with the susceptible cultivar (Kiryumukwe (RWV 1129)) producing the highest yield when anthracnose was managed. The experimental results shows that the seeds yield for all varieties were highest in check plots of 111.6%.

Table 2.A, B, C: Effect of yield parameters of different varieties of common beans under field condition

A. Number of pods per plant

Cultivar **	Infection spread through seeds	Background contamination	Treated#	Mean
Vuzimpundu (RWV 3316) =R	2.5	9	8.6	6.7
Mpanguhe (RWV 3317) =MR	17.6	13.2	15.3	15.4
Kiryumukwe (RWV 1129) =S	37.4	38.3	35.3	37
Gikundiro (MAC 49) =HS	9.8	18.4	17.4	15.2
Mean	16.8	19.7	19.2	3.6
CD (P=0.0 5)	Cultivar: 105.59 Treatments: 86.46			

CVx Treat.Interactions:149.81

B. Number of seeds per pods/plants

Cultivar **	Infection spread through seeds	Background contamination	Treated#	Mean
Vuzimpundu (RWV 3316) =R	1.4	1.9	1.3	1.5
Mpanguhe (RWV 3317) =MR	2.1	6.3	2.4	3.6
Kiryumukwe (RWV 1129) =S	5.3	5.5	6.4	5.7
Gikundiro (MAC 49) =HS	5.6	3.1	5.1	4.6
Mean	3.6	4.2	3.8	0
CD (P=0.0 5)	Cultivar:105.59 Treatments:86.46			

CVx Treat.Interactions:149.81

C. Yield per plant(g)

Cultivar **	Infection spread through seeds	Background contamination	Treated#	Mean
Vuzimpundu (RWV 3316) =R	11.8	23.1	24.2	19.7
Mpanguhe (RWV 3317) =MR	35.3	32.4	35.6	34.4
Kiryumukwe (RWV 1129) =S	96.4	97.4	112.6	105
Gikundiro (MAC 49) =HS	13.2	39.2	40.8	40
Mean	39.2	48	53.3	0
CD (P=0.0 5)	Cultivar:105.59 Treatments:86.46			

CVx Treat.Interactions:149.81; Note: **R** stands for Resistant, **MR** stands for moderate resistant, **S** stands for susceptible and **HR** stands for highly susceptible

Between the very sensitive, susceptible and moderately resistant genotypes, there were highly significant differences in yield and yield loss. The yield losses were severe for the extremely vulnerable and susceptible bean varieties, but not for the moderately resistant ones. The yield loss was greatest in extremely sensitive and susceptible bean cultivars, with the largest yield drop of 70.59 percent in Gikundiro 2 (MAC 49) and the lowest yield reduction of 2.81 percent in moderately resistant (Mpanguhe (RWV 3317)).

A similar trend of yield reduction was seen in the crop grown in the presence of background pollution with the greatest reduction in cv. Gikundiro 2 (MAC 49). (67.61 %). Although statistically equal yield reduction owing to seed-borne infection was larger in different cultivars than background contamination (Chang *et al*, 2020).

Relationship of disease severity levels with yield

The data on the impact of pod infection in the productivity of the highly susceptible bean cultivar (Gikundiro 2 (MAC 49)) in terms of the quantity of seeds per pod as well the weight of seed per pod revealed significant differences in the quantity of grains per pod and the weight of grains per pod in pods of various severity grades, with the highest amount of grains per pod and weight of grains per pod in pods of zero severity, which served as the control. The number of seeds per pod was reduced by the most, 57.76 percent, in pods graded 9, followed by 52.59 percent in pods graded 7. Similarly, pods with a severity grade of 9 exhibited the greatest reductions in seed weight/pod (68.77%) while pods with a severity grade of 1 showed the least. There were no significant differences between pods graded 1 and healthy pods (control) (Conner *et al*, 2021).

Significance differences at P=0.01 were identified in both disease severity as well as percent reduction in the amount of grains per pod (r=0.97) , the climate in which the current experiments were conducted was sub-temperate with moderate to high and frequent rainfall throughout the season. Anthracnose epidemics have been found to thrive in this type of climate (Salihu *et al*, 2019).

Bean anthracnose development and losses can be far more severe in temperate than in tropical zones. The disease has resurfaced in all of the district's prospective bean-growing areas resulting in significant yield decreases in vulnerable cultivars. Disease levels differed significantly between resistant and susceptible cultivars as well as between sprayed and unsprayed plots. Although the Kiryumukwe (RWV 1129) cultivar was susceptible the disease severity was significantly lower than that of the highly susceptible Gikundiro 2 (MAC 49) (bush type). This could be attributed to the Local variety's trailing type growth habit which may have resulted in infection avoidance and slow vertical spread of the pathogen. In the moderately resistant cultivar (Mpanguhe (RWV 3)) there were no significance difference in disease severity between sprayed and unsprayed plots (Gaudencia J. Kiptoo *et al*, 2020).

Bean anthracnose has a significant impact on bean production due to poor seed germination, seedling vigor, increased plant death, and low yields. Seed spots and blemishes are blamed for marketing losses since they affect the quality rating and salability of the product. Because the terminal disease severity was similar in both treatments (seed-borne infection and background contamination), the non-significant differences in yield reductions per plant in different cultivars could be attributed to maximum disease severity on pods at the growth stage of the pod, which is the greatest susceptible stage in the crop for rapid and fast diseases progression (Abraham Negera and Mashilla Dejene, 2018).

Early pod infection which causes pod death and drops appears to be causing a reduction in the amount of pods per plant and weight of grains /plant insensitive bean varieties resulting in a loss in seed yield. Depending on the situation, anthracnose-related yield losses in susceptible cultivars range from 38 to 100 percent. Because the regression equations revealed substantial correlations between severity grades, the number of seeds per pod and seed weight per pod, yield loss estimations based on severity grade on pods can be made with confidence.

The equations' validity however, will apply to regions where crops are cultivated in epidemic conditions. Anthracnose infection caused a 43.9 percent production loss in French beans and researchers discovered that contamination of pods directly affected the grains yield; however, the magnitude of losses varied depending on severity level. Mohammed *et al*, 2013 investigated the anthracnose severity in beans as well as the influence of it on bean productivity and discovered that the extreme severity of 17.2 -76.6 percent bring out in the average yield loss of 67.2 percent.

Conclusion

In conclusion, in susceptible cultivars of common beans, both seed-borne infection and background contamination can cause nearly identical losses during epidemic years; however, losses are higher in crops where disease originates from infected seed because seed bone infection causes diseased seedling death in addition to early disease initiation in the crop. Seed yield is similarly affected by pod infection, also the scale for loss varies depending on severity of contamination. Indeterminate type varieties also have higher losses than indeterminate type types.

Acknowledgement:

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ID:390

Reduction in cold induced sweetening of potato through knock out of vacuolar invertase gene

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Abstract

CRISPR-Cas9 mediated knock out of vacuolar invertase (VInv) gene was carried out using two single gRNAs in potato cultivar AGB purple. The overall transformation efficiency of potatoes was found to be 11.7%. The primary transformants were screened through PCR, Sanger sequencing, Digital PCR, and ELISA. The amplicon sequencing data showed maximum indel frequency for potato plant T12 (14.3 %) While for plant B4 the maximum indel frequency of 2.0 % was found which resulted in 4.4% knock out and 4% frameshift as analyzed by geneious. qRT-PCR data revealed that mRNA expression of VInv gene was reduced 90-99 folds in edited potato plants when compared to the control. The results obtained from titration method determined that the tubers of B4 transgenic line had five folds fewer reducing sugars when compared to the control. The genome edited potatoes behaved like their conventional counterpart when analyzed on physiological basis. The CRISPR based constructs resulted in successful knock out of VInv gene and ultimately resulted in increased tolerance of potatoes against cold induced sweetening with minimum accumulation of reducing sugar.

Key Words: *Genome editing, knock out, vacuolar invertase, cold induced sweetening*

ID:392

Pollination of *Brassica campestris* (Cruciferae) by Male vs. Female *Andrena savignyi* (Andrenidae: Hymenoptera)

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Abstract

Male and female solitary bees generally differ in their morphological and behavioral characteristics and thus in their pollination effectiveness. The present study was carried out at the research farm of The Islamia University of Bahawalpur, Pakistan to compare the foraging behavior and pollination efficiency of male and female *Andrena savignyi* Spinola, 1838 on *Brassica campestris*. The effect of different environmental abiotic factors i.e., relative humidity, ambient temperature, wind velocity and light intensity on foraging behavior was also studied. *Andrena savignyi* was the most abundant floral visitor comprising 52.17 % of the total floral visitors of *B. campestris*. Male individuals solely fed on nectar while females fed on both nectar and pollen. Females had a higher visitation rate, visitation frequency, pollen deposition and pollen harvest than the males because of their larger size and more dry weight. The maximum abundance of females was recorded at 12:00 pm followed by a sharp decline until 4:00 pm whereas males attained their maximum abundance at 2:00 pm. The female pollinated flowers resulted in greater pod length, pod weight, number of seeds per pod, seed weight per pod and germination percentage than the males. Our results suggest that females of *A. savignyi* deliver better pollination of *B. campestris* than males in terms of its reproductive success and germination percentage. Future studies should emphasize exploring the biology and ecology of *A. savignyi* with a special focus on its artificial nesting.

Keywords: *Pollination effectiveness, Andrena savignyi, male, female, Brassica campestris.*

ID:393

The Effects of Betulinic Acid Administration on Protein and Lipid Profile in Liver Damaged Rats*

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Abstract
This study was conducted to investigate the effects of betulinic acid (25 mg/kg, day) on protein and lipid profile in rats with acetaminophen-induced liver damage.Forty male Wistar rats were used in experiment. The animals were divided into four groups, one of which was a control, and five animals were kept in each cage. The experiment lasted 15 days. At the end of the experiment, serum, AST, ALT, ALP, triglyceride, cholesterol and total protein levels were analyzed. Protein and lipid profiles were analyzed in serum samples and liver tissue samples. In acetaminophen-induced liver toxicity group, ALT, AST and ALP levels increased significantly ($P<0.001$) compared to control group, while these values were close to control levels in the treatment group treated with betulinic acid. Serum triglyceride and cholesterol levels were determined to be higher ($P<0.001$) and total protein levels were lower in the toxicity group compared to the control group. Serum triglyceride levels were significantly lower and total protein values were higher in the treatment group compared to the toxicity group. Total oxidant status was significantly higher in the toxicity group compared to all other groups ($P<0.001$). Liver tissue total protein level was found to be lower in the toxicity group compared to the other groups, while total protein level in the treatment group was close to the control group. In conclusion; it was observed that serum and liver tissue lipid and protein profile were adversely affected in acetaminophen induced liver damage and betulinic acid application could have an improvement in these negative effects.

Key Words: *Acetaminophen, betulinic acid, liver damage, protein profile, lipid profile*

Karaciğer Hasarı Oluşturulmuş Sıçanlarda Betulinik Asit Uygulamasının Protein ve Lipid Profili Üzerine Etkileri

Özet
Bu çalışma asetominofen ile karaciğer hasarı oluşturulmuş ratlarda betülinik asidin (25 mg/kg gün) protein ve lipid profili üzerine etkilerini araştırmak amacıyla yürütülmüştür. Çalışmada, toplam kırk adet, Wistar cinsi erkek sıçan kullanılmıştır. Hayvanlar biri kontrol olmak üzere dört gruba ayrılmış ve her kafeste beş hayvan bulunacak şekilde muhafaza edilmiştir. Deneme 15 gün sürmüştür. Deneme sonunda sakrifiye edilen hayvanlardan alınan serum örneklerinde AST, ALT, ALP, trigliserit, kolesterol ve total protein düzeyleri analiz edilmiştir. Serum örneklerinde ve karaciğer dokusu örneklerinde protein ve lipid profilleri analiz edilmiştir. Asetominofen ile karaciğer toksisitesi oluşturulan grupta kontrole göre ALT, AST ve ALP düzeylerinde önemli derecede ($P<0.001$) artış gözlenirken, betülinik asit uygulaması yapılan tedavi grubunda söz konusu değerlerin kontrole yakın düzeylerde olduğu gözlenmiştir. Serum trigliserit ve kolesterol değerleri toksisite oluşturulan grupta kontrole göre yüksek ($P<0.001$), total protein düzeyi ise düşük tespit edilmiştir. Tedavi grubunda serum trigliserit düzeyi toksisite oluşturulan gruba göre önemli derecede düşük, total protein değeri ise yüksek bulunmuştur. Total oksidan durum değerinin toksisite oluşturulmuş grupta diğer tüm gruplara göre önemli derecede ($P<0.001$) yüksek olduğu gözlenmiştir. Karaciğer dokusu total protein düzeyi toksisite oluşturulan grupta diğer gruplara göre düşük bulunurken, tedavi grubunda total protein düzeyinin kontrole yakın olduğu gözlenmiştir. Sonuç olarak; Asetominofen ile oluşturulan karaciğer hasarında serum ve karaciğer dokusu lipid ve protein profilinin olumsuz etkilendiği, betülinik asit uygulamasının bu olumsuz etkileri iyileştirme etkisinin bulunabileceği gözlenmiştir.

Anahtar Kelimeler: *Asetominofen, betulinik asit, karaciğer hasarı, protein profili, lipid profili*

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Giriş
Protein, yağ ve karbonhidrat metabolizmalarında önemli fonksiyonları olan karaciğer, ayrıca birçok plazma proteinini üretme, vücuda alınmış toksik maddelerin detoksifikasyonu, vücut için gerekli birçok vitamin ve minerallerin depolanması gibi hayati görevleri olan bir organdır[1,2]. Yağ asitlerinin sentez ve yıkımı bununla birlikte yağ asitlerinden trigliserid oluşumu, fosfolipit, lipoprotein, keton, kolesterol sentezi, safra asitleri ve safranın

üretilmesi karaciğerde meydana gelen en önemli olaylardır[1, 3, 4]. Karaciğer aynı zamanda protein sentezi ve yıkımlanmasında önemli rolü olan bir organdır, serum proteinlerinin çoğunun ana kaynağıdır[5]. Karaciğer fonksiyon bozukluğunun en önemli nedenlerinden biri, asemptomatik transaminit, akut hepatit, kronik hepatit, kolestaz ve karaciğer yetmezliği gibi geniş bir semptom yelpazesine yol açabilen ilaca bağlı karaciğer hasarıdır[6, 7]. Steroid olmayan anti-enflamatuar ilaçlar, anti-enfektif ilaçlar (anti-tüberküloz ilaçlar), anti-kanser ilaçları, hormonal ilaçlar, immünosüpresif ilaçlar, sedatif ve nöropsikiyatrik ilaçlar dahil olmak üzere ilaca bağlı karaciğer hasarına neden olan birçok ilaç sınıfı vardır[8]. İlaca bağlı karaciğer hasarında en sık adı geçen ilaç asetaminofen'dir[9]. Asetaminofen (Parasetamol, N-asetil-P-aminofenol, APAP), analjezik ve antipiretik özelliklere sahip, orta derecede lipit ve suda çözünebilen bir asetanilit türevidir[10, 11]. Diğer ilaçların çoğu doza bağımlı hepatotoksisite paternine neden olurken asetaminofen genellikle doza bağlı bir şekilde karaciğer hasarına neden olmaktadır[12].

Betulinik asit (BA) yaygın olarak huş ağaçlarından (Betula Pendula) izole edilebilen fakat birçok bitki türünde de bulunabilen, 3β-hidroksi-lup-20(29)-en-28-oik asit yapısında bir pentasiklik lupan tipi triterpendir[13-15]. Betulinik asit çok çeşitli farmakolojik özellik sergilemekte olup, antioksidan, antienflamatuar, anti-tümör, anti-anjiyojenez, anti-viral, anti-HIV, anti-neoplastik ve anti-plazmodial özelliklerinin olduğu bildirilmektedir[16-21]. Betulinik asidin hepatoprotektif etkinliği ile ilgili sınırlı sayıda çalışma mevcuttur. Yi et al.[22] betulinik asidin farelerde hepatoprotektif aktivitesini ve in vivo alkolün neden olduğu karaciğer hasarını önleme potansiyelini ve mekanizmasını araştırdıkları çalışmalarında, betulinik asidin doza bağlı bir şekilde alanin transaminaz, aspartat transaminaz, toplam kolesterol ve triasilgliseritlerin serum seviyelerini önemli ölçüde azalttığını, hepatoprotektif etkisinin altında yatan mekanizmanın, esas olarak doku redoks sisteminin iyileştirilmesi, antioksidan sistemin bakımı ve karaciğerde lipid peroksidasyonunun azalması yoluyla, antioksidan kapasiteyi arttırmasından kaynaklanabileceğini bildirmişlerdir. Quan et al.[23] insüline dirençli HepG2 hücreleri, primer sıçan hepatositleri ve yüksek yağlı diyetle beslenen ICR farelerinden karaciğer dokuları kullanarak yaptıkları çalışmalarında betulinik asidin, karaciğer hücrelerinde hücre içi lipid birikimini etkili bir şekilde iyileştirdiğini ve böylece yağlı karaciğer hastalığının önlenmesi için potansiyel bir terapötik madde olduğunu bildirmişlerdir.

Zheng et al.[24] farelerde betulinik asit ile ön muamelenin, serum aspartat aminotransferaz ve alanin aminotransferaz artışlarını önemli ölçüde önlediğini, belirgin antioksidan etkiler gösterdiğini ve D-GalN/LPS kaynaklı akut karaciğer yetmezliğini önlediğini bildirmişlerdir.

Yi et al.[25] betulinik asidin deksametazonun neden olduğu timosit apoptozisi üzerine in vivo koruyucu etkisini araştırdıkları çalışmalarında, farelere betulinik asit ile ön muamelenin, doza bağlı olarak Dex kaynaklı oksidatif hasarı hafiflettiğini bildirmişlerdir.

Jain et al.[26] betulinik asit içeren Tecomella undulata kök kabuğunun ve betulinik asidin hepatoprotektif etkisini araştırdıkları çalışmalarında, betulinik asit ile ön tedavi uygulanan sıçanlarda hepatosit hasarının önlendiğini bildirmişlerdir. Karaciğer fonksiyonunu uyarabilen ve hepatik koruma sağlayabilen veya hepatik hücrelerin yenilenmesinde yardımcı olabilecek az sayıda geleneksel ilaç vardır, ancak bunların belirli bir dozda hepatotoksik olduğu bilinmektedir[27]. Doğal bileşiklerin etkili alternatifler olarak değerlendirilmesine ihtiyaç vardır. Çalışma, yaygın olarak huş ağaçlarından izole edilebilen fakat birçok bitki türünde de bulunabilen betulinik asidin (25 mg/kg gün) asetaminofen ile karaciğer hasarı oluşturulmuş ratlarda protein ve lipid profili üzerine etkilerini araştırmak amacıyla yürütülmüştür

Materyal ve Yöntem

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Çalışmada, 40 adet, 250-300 gr ağırlıkta, Wistar cinsi erkek sıçanlar kullanıldı. Deney gruplarının oluşturulması ve çalışma dizaynı Tablo 1'de verilmiştir.

Tablo 1. Deney Gruplarının oluşturulması ve çalışma dizaynı

Gruplar	Grup Adı	Hayvan Sayısı	Uygulama
Grup I	Sağlıklı (Kontrol)	(n=10)	-
Grup II	Asetaminofen	(n=10)	15. günde: 1 g/kg Asetaminofen (tek doz, i.p.)
Grup III	Tedavi	(n=10)	14 gün 25 mg/kg/gün (gavaj) BA, 15. günde: 1 g/kg Asetaminofen (tek doz, i.p.)
Grup IV	BA	(n=10)	14 gün 25 mg/kg/gün (gavaj) BA

Sıçanlar, araştırma süresince 19-21 °C sabit sıcaklıkta ve 12 saat aydınlık/ karanlık sürelerin olduğu özel hazırlanmış odalarda korundu. Deneysel uygulamalar süresince ratlara standart ticari yemi (pellet yem) ve normal içme suyu verildi. Deneme 15 gün sürmüştür. Çalışma sonunda, asetaminofen uygulamasından 24 saat sonra tüm sıçanlar aynı gün isoflurane ile anesteziye alındıktan sonra kalplerinden kan alınarak sakrifiye edildi, kan ve karaciğer doku örnekleri alındı. Alınan serum örneklerinde AST, ALT, ALP, trigliserit, kolesterol ve total protein düzeyleri analiz edilmiştir. Serum örneklerinde ve karaciğer dokusu örneklerinde protein ve lipid profilleri analiz edilmiştir. Lipid profili analizi 20x10 cm Silika Jel 60 F254 Yüksek Performans İnce Tabaka Kromatografı (YPİTK) plakası kullanılarak gerçekleştirildi. YPİTK plakaları Epson Perfection V700 foto-tarayıcı ile fotoğrafı

alındıktan sonra, her bir örneğe ait lipid bantlarının kapladığı alan Phoretix 1D (TL120) yazılımı kullanılarak tespit edildi ve toplam karışımdaki % olarak ifade edildi[28]. Protein profili analizi sodyum dodesil sülfat poliakrilamid jel elektroforez (SDS-PAGE) metodu ile gerçekleştirilmiştir[28]. Analiz sonucunda her bir protein bandının total protein konsantrasyonu içindeki "bireysel yüzde" değerleri kullanılarak, Lowry[29] yöntemiyle total protein miktarları hesaplanmış olan örneklerde "g" olarak bireysel protein miktarları belirlenmiştir.
İstatistik analizler için SPSS Statistics 20.0 programı (IBM SPSS statistics for Windows, New York: IBM Corp)66 programı kullanılmış olup, her grubun istatistiki hesaplamaları ve bu gruplara ait ortalama değerler arasındaki farkın önemliliği için tek yönlü varyans analizi (ANOVA), gruplar arasında bulunan farkın önemini kontrol etmek için Duncan testi uygulanmıştır.

Bulgular ve Tartışma

Karaciğer, organizmanın çeşitli metabolik ve fizyolojik homeostazları ile ilişkili ana organdır. İlaçlar, serbest radikaller, alkol, ksenobiyotikler besin takviyeleri ve kirleticiler, hepatit, siroz ve alkolik karaciğer hastalıklarına neden olan başlıca risk faktörleridir[30, 31]. Karaciğer fonksiyonunu uyarabilen ve hepatik koruma sağlayabilen veya hepatik hücrelerin yenilenmesinde yardımcı olabilecek az sayıda geleneksel ilaç vardır, ancak bunların belirli bir dozda hepatotoksik olduğu bilinmektedir[27]. Doğal bileşiklerin etkili alternatifler olarak değerlendirilmesine ihtiyaç vardır.
Asetaminofen toksisitesi sıçanlarda bitki ekstraktlarının ve doğal bileşiklerin hepatoprotektif aktivitesini değerlendirmek için yaygın olarak kullanılan deneysel modellerden biridir[32-34]. Çalışmada ratlarda karaciğer hasarı oluşturmak için 1 g/kg, tek doz asetaminofen intraperitoneal olarak kullanılmıştır. Hepatik hasarın açık bir işareti, hepatositlerin taşıma fonksiyonlarında meydana gelen rahatsızlıktan dolayı ALT, AST ve ALP gibi hücresel enzimlerin plazmaya sızmasıdır[35]. Karaciğer hasarında serumda söz konusu enzim düzeyleri yükselmektedir[1]. ALT karaciğere daha spesifiktir ve hepatik hasarı analiz etmek için daha iyi bir parametredir[35]. Çalışmamızda da asetaminofen grubunda ALT düzeylerinin kontrole göre önemli derecede ($P<0.001$) arttığı gözlenmektedir (Tablo 2). Yüksek AST seviyeleri, hücre sızıntısının yanı sıra karaciğerde hücre zarının işlevsel yetenek kaybını göstermekte ve ALP düzeyinin yüksekliği ayrıca karaciğer hücre hasarı ile ilişkilendirilmektedir[35]. Elde ettiğimiz sonuçlar her iki enzim düzeyininde aseaminofen gurubunda kontrole göre önemli derecede ($P<0.001$) arttığını göstermektedir (Tablo 2). Bu sonuçlara göre uygulanan asetaminofen dozu ile karaciğer hasarı oluşturulduğu düşünülmektedir. Asetaminofen ile deneysel karaciğer hasarı oluşturulan çalışmalarda AST, ALT ve ALP düzeylerinin kontrole göre yükseldiği bildirilmektedir[32-34].

Tablo 2. Asetominofen ile indüklenen karaciğer hasarında betülinik asidin karaciğer enzimleri üzerine etkisi.

	Gruplar			
Parametreler	Kontrol	Betulinik	Asetominofen	Tedavi
AST, U/L	45.25 ± 4.17^{c}	48.63 ± 3.10^{c}	178.88 ± 13.65^{a}	75.88 ± 7.79^{b}
ALT, U/L	45.88 ± 2.43^{b}	46.75 ± 2.21^{b}	191.25 ± 16.22^{a}	70.88 ± 5.17^{b}
ALP, U/L	72.63 ± 4.58^{b}	78.38 ± 2.90^{b}	362.63 ± 30.14^{a}	184.50 ± 14.42^{b}

a, b, c: Aynı satırda farklı harf bulunduran değerler arasındaki farklılıklar istatistiki olarak anlamlıdır, ($P<0.001$). AST; Aspartat aminotransferaz, ALT; Alanin aminotransferaz, ALP; Alkalen fosfataz.

Tablo 3. Asetominofen ile indüklenen karaciğer hasarında betülinik asidin total antioksidan durum, total oksidan durum üzerine etkileri.

	Gruplar			
Parametreler	Kontrol	Betulinik	Asetominofen	Tedavi
TAS, nmol/L	1.64 ± 0.09	1.65 ± 0.04	1.50 ± 0.06	1.59 ± 0.05
TOS, μmol/L	0.53 ± 0.03^{b}	0.57 ± 0.03^{b}	0.79 ± 0.03^{a}	0.59 ± 0.03^{b}

a, b: Aynı satırda farklı harf bulunduran değerler arasındaki farklılıklar istatistiki olarak anlamlıdır, ($P<0.001$). TAS; total antioksidan durum, TOS; total oksidan durum.

Tablo 4. Asetominofen ile indüklenen karaciğer hasarında betülinik asidin serum protein, trigliserit ve kolesterol düzeylerine etkisi.

	Gruplar			
Parametreler	Kontrol	Betulinik	Asetominofen	Tedavi
TG, (mg/dL)	138.82 ± 4.72^{c}	143.26 ± 4.55^{c}	190.27 ± 6.09^{a}	163.01 ± 4.83^{b}
COL, (mg/dL)	127.20 ± 3.87^{c}	136.64 ± 2.31^{b}	149.24 ± 3.33^{a}	141.89 ± 2.58^{ab}
TP, (g/dL)	5.38 ± 0.04^{a}	5.28 ± 0.06^{a}	4.77 ± 0.06^{c}	4.98 ± 0.04^{b}

a, b, c: Aynı satırda farklı harf bulunduran değerler arasındaki farklılıklar istatistiki olarak anlamlıdır, ($P<0.001$). TG; trigliserit, COL; kolesterol, TP; Total protein.

Tablo 5. Asetominofen ile indüklenen karaciğer hasarında betülinik asidin karaciğer protein, trigliserit ve kolesterol düzeylerine etkisi.

	Gruplar			
Parametreler	Kontrol	Betulinik	Asetominofen	Tedavi
TG, umol/g	49.24±1.09[a]	48.30±1.20[a]	44.93±1.16[b]	44.01±0.97[b]
COL, umol/g	5.34±0.30	5.52±0.36	4.71±0.17	5.14±0.22
TP, mg/g	138.00±1.72[a]	136.22±1.18[a]	125.26±1.39[b]	134.37±1.08[a]

a, b: Aynı satırda farklı harf bulunduran değerler arasındaki farklılıklar istatistiki olarak anlamlıdır, (P<0.05). TG; trigliserit, COL; kolesterol, TP; Total protein.

Tablo 6. Asetominofen ile indüklenen karaciğer hasarında betülinik asidin total karaciğer homojenatı lipit profili üzerine etkisi.

	Gruplar			
Parametreler	Kontrol	Betulinik	Asetominofen	Tedavi
CE,%	32.11±0.32	32.28±0.3	30.56±0.33	31.42±0.84
TAG,%	21.62±0.65[a]	19.35±0.22[b]	19.44±0.58[b]	20.62±0.41[ab]
FFA, %	5.92±0.19[b]	5.98±0.39[b]	7.57±0.35[a]	6.92±0.23[a]
COL, %	18.17±0.53[b]	19.92±0.57[a]	20.95±0.70[a]	19.79±0.46[ab]
PL, %	16.38±0.27[a]	16.53±0.40[a]	13.49±0.55[c]	15.18±0.37[b]
AG, %	5.82±0.14[b]	5.95±0.09[b]	8.00±0.37[a]	6.09±0.73[b]

a, b, c: Aynı satırda farklı harf bulunduran değerler arasındaki farklılıklar istatistiki olarak anlamlıdır, (P<0.05). CE:kolesterol esteri, TAG; triaçil gliserol, FFA; serbest yağ aside, COL; kolesterol, PL; fosfolipit, AG; açil gliserol.

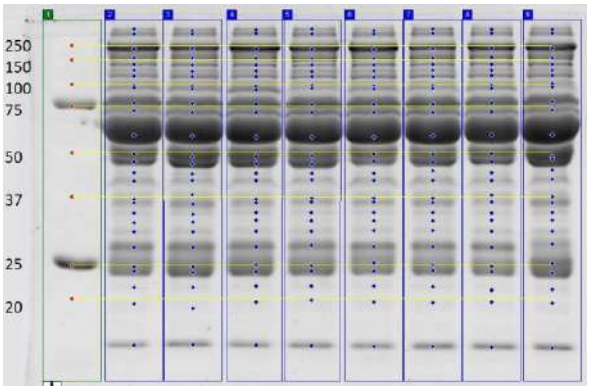
Betulinik asit ile ön tedavi gören betulinik asit gurubunda ALT, AST ve ALP düzeylerinin asetaminofen uygulanan gruba göre önemli düzeyde (P<0.001) düşüş gösterdiği tespit edilmiş olup bu sonuç ratların 25 mg/kg dozda betulinik asit ile ön tedavisinin AST, ALT ve ALP enzimlerindeki artışı engellediğini, betulinik asidin asetominofenin oluşturduğu karaciğer hasarını önlemede etkin olabileceğini göstermektedir.

Serbest radikaller metabolik ve fizyolojik işlemlerde üretilmekte ve organizmalarda zararlı oksidatif reaksiyonlar oluşturmaktadır. Organizmalar enzimatik ve enzimatik olmayan antioksidan mekanizmalar yoluyla oksidatif strese karşı korunmaktadır. Normal şartlar altında serbest radikal oluşum oranları ile bunların antioksidan enzimler ve moleküller tarafından uzaklaştırılması arasında hassas bir denge vardır. Biyolojik örneklerin oksidatif durumu oksidatif stresin bir göstergesi olarak kabul edilmekte ve toplam oksidan durumu (TOS) ile toplam antioksidan durumunun (TAS) ölçümü oksidatif stresin öngörülmesi için en yaygın prosedürler olarak bilinmektedir[36]. Çalışmada TAS değerleri bakımından guruplar arasında anlamlı bir fark bulunmazken, TOS değerlerinin asetaminofen uygulanan grupta diğer gruplara göre önemli düzeyde (P<0.001) artış gösterdiği gözlenmiştir (Tablo 3). Aksit ve Bildik[37] ve Hismiogullari ve ark.[38] çalışmalarında, CCl4 ile karaciğer hasarı oluşturdukları ratlarda, TOS seviyelerinin kontrole göre arttığını, TAS seviyesinin ise azaldığını bildirmişlerdir. Çalışma sonuçları TAS seviyesi bakımından gruplar arasında istatistiki olarak anlamlı bir fark bulunmamasına ragmen asetaminofen grurubunda rakamsal olarak düşüş olduğunu göstermektedir. Betulinik asit ile ön tedavi gören gurupta TOS ve TAS seviyelerinin kontrole yakın olduğu görülmekte olup, bu sonuçlar asetaminofen uygulamasının karaciğerde oksidatif strese neden olduğunu, betulinik asidin toksik dozda asetaminofenin karaciğerde oluşturacağı oksidatif strese karşı koruyucu rolü olduğunu düşündürmektedir. Benzer şekilde Yi et al.[25] betulinik asit ile ön muamelenin deksametazonun neden olduğu oksidatif stresi hafiflettiğini bildirmişlerdir.

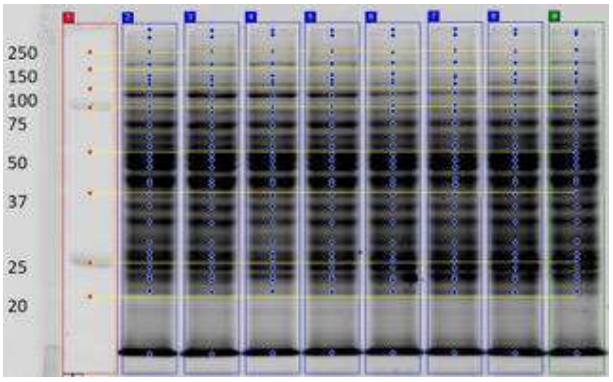
Önceki çalışmalar betulinik asidin karaciğer hasarlarında değişen serum parametreleri üzerinde düzeltici etkilerinin bulunduğunu göstermektedir[22, 23, 26]. Bu çalışmada serum trigliserit ve kolesterol değerleri toksisite oluşturulan asetaminofen gurubunda kontrole göre yüksek, total protein düzeyi ise düşük tespit edilmiştir (P<0.001) (Tablo 4, Şekil 1)). Tedavi grubunda serum trigliserit düzeyi toksisite oluşturulan gruba göre önemli derecede düşük, total protein değeri ise yüksek bulunmuştur (P<0.001). Murali et al.[34] ve Jain et al.[26] karaciğer hasarında serum TP değerlerinin düştüğünü bildirmektedirler. Elde edilen veriler karaciğer hasarının neden olduğu, serum TG ve kolesterol düzeylerindeki artışı ve TP düzeylerindeki azalışı, ön tedavi olarak uygulanan betulinik asidin düzelttiğini göstermiştir. Asetaminofen toksisitesine bağlı olarak serum TP düzeyinde olduğu gibi karaciğer dokusunda da TP düzeyinde azalış olduğu görülmektedir (P<0.05) (Tablo 5, Şekil 2). Betulinik asit ön tedavisinin asetaminofen kaynaklı hasara bağlı, karaciğer dokusu TP düzeyindeki bu azalışı önlediği tespit edilmiştir.

Asetominofenle indüklenmiş karaciğer hasarında betulinik asidin lipid profilleriyle ilgili etkisine bakıldığında; karaciğer dokusunda incelenen parametrelerden kolesterol ve açil gliserol oranlarının karaciğer hasarında artış gösterdiği, buna karşın serbest yağ asidi, fosfolipid ve triaçilgliserol oranlarının kontrole göre azaldığı tespit edilmiştir (P<0.05) (Tablo 6, Şekil 3). Fosfolipidler fosfor içeren kompleks lipidler olup hücre membranlarının başlıca bileşenleridir. Özellikle serum fosfolipidlerin tanımı karaciğer hastalıklarının tanısında, önemli bir klinik testtir4. Betulinik asitle ön tedavinin karaciğer hasarına bağlı açil gliserol oranında ki yükselişi ve fosfolipid oranında ki düşüşü önlediği gözlenmiştir. Bununla birlikte betulinik asit ön tedavisinin, karaciğer hasarına bağlı triaçil gliserol ve kolesterol oranlarında ki değişimleri önlemede anlamlı bir etkisinin olmadığı ancak rakamsal

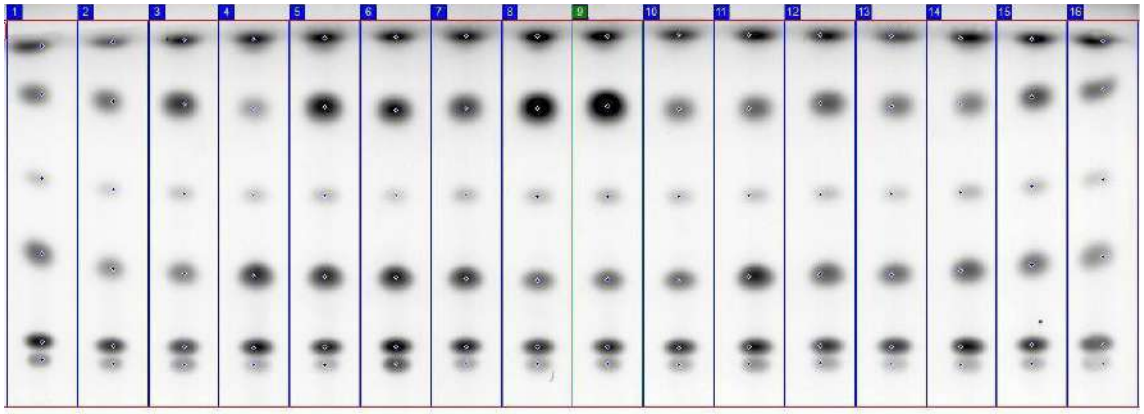
olarak iyileşme sağladığı görülmüştür. Ayrıca asetominofen uygulamasının ve betulinik asit ön tedavisinin karaciğer dokusunda kolesterol esterleri oranı üzerinde bir etki oluşturmadığı da tespit edilmiştir.
Sonuç olarak; asetaminofen kaynaklı karaciğer toksisitelerinde, betulinik asidin koruyucu ve karaciğer hasarına bağlı olumsuz etkileri giderici potansiyelinin bulunduğu, karaciğer toksisitelerinde tedaviye ve korunmaya yardımcı olarak kullanımının yararlı olacağı düşünülmektedir.



Şekil 1. Serum protein elektroforetogramı. Lane 1 Moleküler ağırlık markeri, Lane 2-3 Kontrol, Lane 4-5 Betulinik asid, Lane 6-7 Asetominofen, Lane 8-9 Tedavi.



Şekil 2. Total karaciğer homojenatı protein elektroforetogramı. Lane 1 Moleküler ağırlık markeri, Lane 2-3 Kontrol, Lane 4-5 Betulinik asid, Lane 6-7 Asetominofen, Lane 8-9 Tedavi.



Şekil 3. Total karaciğer homojenatı lipid ince tabaka kromatogramı. Lane 1-4 Kontrol, Lane 5-8 Betulinik asit, Lane 9-12 Asetominofen, Lane 13-18 Tedavi

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Physiological Variations of Tomato Varieties (*Solanum lycopersicum* L) Grown in The Environmental Conditions of Busogo, Musanze District, Rwanda

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Abstract

The tomato (*Solanum lycopersicum* L) remains an important horticultural crop in Rwanda and its domestic demand is increasing with the population growth. However, the knowledge of Rwandan farmers on the variety that can increase yield in different production circumstances stays also unidentified. For this reason, the performance of five determinate tomato varieties (Assila F1, Sifa F1, Roma VF, Rionex and Cal-J) was evaluated at College's farm. They were cultivated under low temperatures (11-12.5°C minimum and 20-23°C maximum). All varieties showed differences in height, number of leaves and stem diameter. The varieties that supported a high number of leaves limited the light distribution along the whole plant and therefore resulted in low chlorophyll content. The nutritional value characteristics were significantly different for all varieties. A positive relationship between number of clusters per plant and fruits yield was observed. The highest yield was obtained on Assila F1 (35.8tha^{-1}) and Roma VF (27.4tha^{-1}). Therefore, Assila F1 could be chosen as the best hybrid that can be grown by farmers under low temperature areas due to the yield and fruits' quality observed. Roma VF could also be selected as the best performer among the evaluated homozygous genotypes for their acceptable characters.

Key words: *Solanum lycopersicum*, temperature, growth, fruit yield, nutritional quality.

Introduction

The tomato (*Solanum lycopersicum* L) is reported as the most vegetable crop grown in home garden and the second greatly consumed after potato (*Solanum tuberosum* L.) worldwide (Ebert, 2020). According to the Food and Agriculture Organization (2017), tomato crop is grown in open field, greenhouses and screenhouses. The open-field production may be for the fresh market or the processing industry, while the greenhouse production is only for the fresh market. The leading producers worldwide are China, India, Turkey, USA, Egypt, Iran, Italy, Spain, Brazil and Nigeria respectively (FAOSTAT, 2017).Ideally, tomato requires a relatively cool and dry climate for high yield and premium quality but it is also adapted to a varied range of climatic conditions (CABI, 2019).

The optimum temperature range for growth and development is 21-24°C while long exposure of tomato plants to the temperatures below 12°C can produce the chilling injury (CABI, 2019; Eisa *et al.*, 2018). The temperature has a large effect on all aspects of crop development (Hatfield and Prueger, 2015). Leaf and truss initiation rates reduce linearly with reducing temperature (Van Der Ploeg and Heuvelink, 2005). The production of thicker leaves for young plants grown at sub-optimal temperatures result in reduced light interception and therefore cause the plant to have a lower relative growth rate (Ferrante and Mariani, 2018). At that type of temperature, fruit set is reduced as a result of poorer pollen quality (Thakura *et al*., 2010).

In Rwanda, tomato crop is an important horticultural crop. It is produced on a total area of 6,800ha and comprises 24% of the total area on which the vegetables are grown. This crop is primarily grown in the open field and the production is bound by seasonality (Van Dijk *et al.*, 2017). The yield of tomato crop is 8.6tha^{-1} while the world yield is 37.6tha^{-1} (FAOSTAT, 2017). Its cultivation covers 28.4% as compared to other vegetables such as onions (14.2%) and cabbages (12.8%), of the volume of total horticulture production (Clay and Turatsinze, 2014). The domestic demand of tomato in Rwanda is increasing because of tomato processors and consumers; for this reason, Rwanda is a net importer of tomatoes from the neighboring countries (Feed the Future, 2018). The projected area under cultivation from 2016 was 28262ha and will continue to be the same until 2050 and the consumption requirement will continue to increase with the population growth (MINAGRI, 2018). This indicates how efforts should be put to increase the production per unit area.

The government's intention remains to increase the vegetables production by increasing the use of greenhouse technology in combination with other agricultural technologies. However, the knowledge of varieties that can increase yield in different tomato production areas remains unidentified to the farmers since Rwanda Agriculture and Animal Resources Development Board (RAB) has no seed accreditation system for tomatoes, nor seed multiplication programs specifically for tomato crop (Feed the Future, 2018). It is therefore, important to assess the responsiveness of different tomato varieties to the environmental conditions in order to recommend the high yielding variety/varieties to the farmers in the study area. This study has dual objectives: to determine the effect of temperature on vegetative growth and yield parameters of tomato varieties as well as evaluating the effect of temperature on nutritional value of tomato varieties.

Materials and Methods

The field where the experiment was conducted is located at University of Rwanda, College of Agriculture Animal Sciences and Veterinary Medicine, in Busogo sector, Musanze district, Northern Province of Rwanda. The site is characterized by 2300m of altitude, latitude of 1°33'26'S and the longitude of 29°32'39'E and the precipitations ranging between 1400 and 1800mm. The soils are classified into the andisol or andosol type, also known as volcanic soils, with the pH ranging between 5.7 and 5.8 (Uwiringiyimana *et al.*, 2019).

Five determinate tomato varieties: Roma VF, Cal-J, Rionex, Sifa F1 and Assila F1 were used in the experiment. The experimental design was randomized completely block design (RCBD) with five treatments and three replicates. The experiment was composed of 15 plots and each had $9m^2$ while each plot contained 9 plants. The experiment was conducted from September 2019 up to March 2020. Tomato varieties were grown in open field to evaluate their responsiveness to low temperatures of 11-12.5°C minimum and 20-23°C maximum.

Seedlings were prepared by sowing seeds in the appropriate seed trays and covered with plastic cover to increase the temperature in soil and favor germination (Motsa *et al.*, 2015). Re-potting was performed after 30 days from the sowing date in order to improve the seedling's vigor. 80-100 seedlings were re-potted in a pot of 35cm of diameter. Easy gro, a foliar fertilizer composed by 27% N, 10% P_2O_5, 16% K_2O with trace elements 0.03% Boron, 0.05% Copper, 0.1% Iron, 0.05% Manganese, 0.001% Molybdenum, 0.06% Zinc and 0.007% of amino acid was applied onto the seedlings in order to boost their growth. The rate of application was 20g of fertilizer per 20l of water. In order to prevent the attack of early blight (*Alternalia solani*) and late blight (Mildew) in young tomato seedlings, chlorothalonil $500gl^{-1}$ was applied at a rate of 30ml per 15l of water. Tomato seedlings to be transplanted in an open field were acclimated for two weeks before planting. The plots were well ploughed and levelled. The seedlings of about 4-5 fully opened leaves were transplanted at 1.0m spacing between plants in the same row and 1.0m between rows. Farmyard manure ($8tha^{-1}$) was applied and inorganic fertilizer was applied to all varieties in both experiments using NPK 17-17-17 and Urea (46% N) at the rate of $120kgha^{-1}$ of Nitrogen, $90Kgha^{-1}$ of Phosphate and $90Kgha^{-1}$ of potash (Alhrout *et al.*, 2018).

Mulching and staking were also practiced in order to reduce the likelihood of plants with contact of humid soil. Pruning was performed after 60 days from transplantation date. The daily temperatures and precipitations were collected from Rwanda Meteorology Agency. After transplantation, the fungi were controlled by using metalaxyl 8% combined with mancozeb 64% WP alternated with chlorothalonil $500gl^{-1}$ SC. The whiteflies and aphids were controlled by interchanging abamectin $18gl^{-1}$EC with cypermethrin 4% combined with profenofos 40%.

The plant growth parameters mainly height, number of leaves, number of branches, stem diameter and chlorophyll content in leaves were measured at 60 days after transplantation (DAT) for each variety for three randomly selected crops. The plant height was measured from the ground surface to the tip of plant. The number of leaves and branches per plant were counted on the same day interval. The stem diameter (mm) was measured using the vernier caliper, SPAD 502 instrument was used to measure the chlorophyll value of tomato leaves and the chlorophyll contents (μgcm^{-2}) were estimated using Uddling *et al.* (2007) method. The weight of fruits was measured using laboratory scale for grams from Denver instrument Co., USA.

The number of clusters per plant, number of flowers per cluster and number of fruits per plant were also measured on selected three crops while average weight of individual fruit, the total yield per variety and marketable yield percentage was estimated at harvest on all nine crops of each treatment. In order to get the dry matter(DM), fresh tomato fruits were sliced to make the uniform size. 100g of fresh tomatoes were distributed on trays in oven and exposed to 80°C for 8hours (Mawardii *et al.*, 2017). The DM in tomatoes was calculated following the standard steps and the percentages of DM were calculated using Buckmaster's (2020) formula.

The determination of total soluble solids (TSS) in tomato, fruits were harvested and well ripened ones were selected and cleaned using distilled water. The tomato juice was prepared using a blender HGB55E (Model HGBSSSS6) from Waring, USA. Eclipse Professional Optical Refractometer 45-02 (UK) was cleaned using distilled water and dried thoroughly. A couple of juice drops were deposited onto the prism of the refractometer. By aid of outdoor light, the soluble solid was recorded through the eyepiece. The activity was repeated three times to get the accurate results for each treatment (Dobrin *et al.*, 2019).

pH and titratable acidity were measured following the method of Garner *et al.* (2003). To obtain a clear juice, tomato fruits were cleaned, sliced, blended and centrifuged using standard equipment. pH was measured using a pH meter at room temperature and records were taken. 6ml of juice for each sample were put into a 100ml beaker and 50ml of distilled water was added for making a dilution. Titration was performed using 0.1N NaOH to an end point of 8.2. The quantity of NaOH used in milliliters was finally recorded.

For determining the quantity of ascorbic acid in tomato fruits, the method used has been proposed by the International Fruits and Vegetable Juice Association (IFU, Method No.17, 2019) using dichlorophenol-indophenol sodium salt dehydrate (DCPIP) and Mohr's salt**.**

Lycopene content of tomato samples were obtained following the method of Anthon and Barrett (2007) with slight modifications. Tomato samples for each variety were prepared. Red tomatoes were harvested, cleaned and blended in order to get a juice. From that juice, 100mg were dissolved in 1ml of distilled water and kept out of blight light. Lycopene extraction was performed by adding 8ml of solution prepared by mixing 4ml of hexane, 2ml of ethanol

and 2ml of acetone. Distilled water (1ml) was added to the solution after 10minutes and vortexed with a magnetic stirrer at 3000rpm for one minute. The samples were allowed to stabilize for 10minutes in order to allow phases to separate and all air bubbles to disappear. The upper layer (hexane) was collected in cuvette. Distilled water was used as blank sample to zero spectrophotometer at 503nm. The hexane extracts were put in spectrophotometer adjusted at 503nm wavelength. This wavelength was chosen in order to minimize any interference that might be caused by the amount of β-carotene in tomato samples as determined by Davis *et al.* (2002). Finally, the analysis of variance (ANOVA) were obtained using Genstat statistical expert. The treatment effects were compared to F-test of 5% level of significance. Significance differences between tomato varieties were detected using Duncan Multiple Range Test (DMRT).

Results and Discussion

Growth characteristics of tomatoes

The significant difference in plant height, number of leaves and number of branches were observed in all varieties at $p \leq 0.05$ (table 1). Assila F1 was the tallest (64.4cm) followed by Cal-J (56.0cm) while Sifa F1 was the smallest (49.3cm). The highest number of branches was found on both Roma VF and Rionex (7.3) though the lowest number of branches was counted in Sifa F1 (6.0). The latter showed the largest stem diameter (13.7mm) while Assila F1 had the smallest width (11.0mm).When number of leaves were counted, Cal-J had the highest number (62.0) and the lowest number was counted in the plots where grown Sifa F1(32.3). The chlorophyll content in tomato leaves were also estimated and the results showed that Roma VF accumulated the highest amount of chlorophyll in leaves (61.3µgcm^{-2}) whereas Assila F1 accumulated less (45.7µgcm^{-2}). In addition, the results revealed a strong relationship between chlorophyll content with SPAD value at R^2=0.84.

The temperature has a large influence on growth and development in tomato (Deribe et al., 2016). The varieties that beared a high number of leaves limited the light distribution along the whole plant and therefore resulted in low chlorophyll content (Feng et al., 2016).In general, the tomato varieties were not significantly affected by low temperatures. This might be due to acclimation of seedlings before their transplantation to the open field. The current results are in agreements with OECD (2017) which reported that tomato requires minimum temperature above 18°C for vegetative growth and can also survive the lower temperatures (12°C).

Table 1. The growth characteristics of tomato varieties

Varieties	Plant height (cm)	Number of leaves	Number of branches	Stem diameter (mm)	SPAD value	Chlorophyll (µgcm^{-2})
SIFA F1	49.3±2.9^{b}	32.3±9.6^{b}	6.0±0.6^{a}	13.7±1.7^{a}	70.0±23.1^{a}	60.4±20.0^{a}
ASSILA F1	64.4±4.7^{a}	58.7±10.0^{a}	6.7±1.5^{a}	11.0±1.0^{b}	53.0±4.2^{a}	45.7±3.6^{a}
ROMA VF	51.8±2.5^{b}	44.0±11.1^{ab}	7.3±1.5^{a}	12.3±0.6^{ab}	71.1±31.0^{a}	61.3±26.6^{a}
RIONEX	53.0±2.5^{b}	61.3±12.9^{a}	7.3±1.2^{a}	13.0±0.7^{a}	69.9±14.0^{a}	60.2±12.0^{a}
CAL-J	56.0±7.3^{ab}	62.0±13.0^{a}	7.0±1.0^{a}	12.2±1.1^{ab}	57.8±10.0^{a}	49.8±8.5^{a}
GM	55.0	51.7	6.9	12.5	64.4	55.5
L.S.D	8.6	21.9	2.5	1.8	38.1	32.9
C.V (%)	5.0	9.2	6.1	5.3	8.7	8.7

^{z} The means for factors that are followed by the same letters in column are not significantly different, according to DMRT at P≤0.05.

Yield characteristics of tomato varieties

The yield characteristics of tomato varieties used in experiment showed significant difference in number of clusters per plant, number of flowers per cluster, average fruit weight, total yield as well as marketable yield at $p \leq 0.05$ (table 2). The highest total yield was estimated in Assila F1(35.8tha^{-1}) while Sifa F1 had the lowest (24.3tha^{-1}). Assila F1 produced the highest average weight of individual weight (109.5g) though Cal-J weighed less (45.0g).

The positive relationship between the number of clusters per plant and tomato yield was observed with exception on Cal-J that required a heavy pruning due to its canopy architecture that bear a high number of branches and leaves and therefore limit the light entrance throughout the plant. Chen et al., 2014 reported that tomato cultivated at low temperature produced higher canopy density and more clumped caused by higher leaf area and shorter internodes.The number of flowers per cluster had an effect on total yield of tomato varieties. Nevertheless, there was a slight deviation to Sifa F1 and Cal-J.The highest total yield was estimated in Assila F1(35.8tha^{-1}) and these findings are close to the statistics of Food and Agriculture Organization which reported in 2017 that tomato yielded 37.6tha^{-1}. Hussain et al. (2001) also reported that Tanja cultivar produced highest yield of 41.45tha^{-1} while Nadir produced the heaviest fruits (88.3g/fruit). However, Heuvelink and Dorais (2005) reported that tomato grown outdoors has the potential to produce between 40 and 100tha^{-1}.

The number of flowers per cluster had also an effect on total yield of tomato varieties. Nevertheless, there was a slight deviation to Sifa F1 and Cal-J and might be due to flowers abortion. This may also explain their

responsiveness to lower temperatures that caused those varieties to shed their flowers as they were exposed to the minimum temperatures ranged between 11 to 12.5°C (Ozores-Hampton et al., 2012).The results of the current study showed that higher yield may depend on both number of fuits per plant and the average weight of individual fruit. The lower the weight of a fruit, the lower the total yield will be (Souza et al., 2012).

Table 2. The yield characteristics of tomato varieties

Varieties	Number of clusters per plant	Number of flowers per cluster	Number of fruits per plant	Average fruit weight (g)	Total yield (tha^{-1})	Marketable yield	
						(t/ha)	%
SIFA F1	14.3±3.8^{b}	6.7±1.2^{a}	42.8±0.6^{a}	84.4±0.0^{b}	24.3±4.8^{b}	20.4±4.5^{b}	84
ASSILA F1	24.3±5.9^{ab}	8.7±2.5^{a}	60.4±5.6^{a}	109.5±0.0^{a}	35.8±2.5^{a}	31.7±2.2^{a}	89
ROMA VF	19.3±5.9^{ab}	7.3±1.2^{a}	53.4±2.9^{a}	80.3±0.0^{b}	27.4±6.6^{b}	24.0±5.6^{b}	88
RIONEX	18.0±6.1^{b}	6.0±1.0^{a}	57.0±3.0^{a}	78.3±13.1^{b}	25.4±0.8^{b}	22.5±1.1^{b}	89
CAL-J	30.3±6.1^{a}	7.7±1.5^{a}	60.2±5.1^{a}	45.0±19.4^{c}	25.1±5.2^{b}	20.4±5.8^{b}	81
GM	21.3	7.3	54.8	79.5	27.6	23.8	
L.S.D	10.6	3.0	16.8	21.2	7.4	6.8	
C.V (%)	11.7	9.7	16.1	3.7	10.1	11.9	

[z] The means for factors that are followed by the same letters in column are not significantly different, according to DMRT at P≤0.05.

Laboratory analysis of nutritional content

Tomato varieties showed significant difference in titratable acidity (TA), total soluble solids (TSS), ascorbic acid(L-AA), lycopene and dry matter (DM) content at p≤0.05 (table 3). The highest DM (7.1%) was obtained in Assila F1 while Roma VF synthesized less (5.7%). The highest TSS were observed in Rionex followed by Roma Vf while Sifa F1 and Assila F1 had the lowest proportions. The highest TA (0.66%) was recorded in Roma VF with the pH of 4.1 while Assila F1 had the lowest proportions (0.52%) with the pH of 4.3. The L-AA content of tomato fruits were significantly different among different tomato varieties. The highest average quantity of L-AA (14.3mg/100g FW) was obtained in Assila F1 while the lowest quantity (11.4mg/100g FW) was estimated in both Sifa F1 and Rionex. The results of the current study, showed a significant difference for lycopene content in all tomato varieties. Lycopene content varied from 8.1 to 11.0mg/100gFW and the highest amount was obtained in Assila F1 while the lowest were found in Rionex.The difference in pH between all treatments ranged between 0.2-0.3 and the higher the pH was increased; the lower TA was recorded. This could be a result of the loss of citric acid in juice with high pH as explained by Anthon et al. (2011).

The justification of low ascorbic acid obtained in the current study could be associated with low temperature and light intensity to which tomatoes were exposed. Agamy (2016) reported that the L-AA was 12.79 mg/100g of fresh tomatoes while Cantwell (2000) reported 22.5mg/100g FW in red-ripe tomatoes. There was a significant difference in lycopene content for all tomato varieties. Davis et al. (2002) analysed tomatoes and obtained the lycopene content that varied from 3.3 to 12.3mg/100gFW using spectrophotometry at 560nm wavelength while Suwanaruang (2016) obtained 10.4699mg/100g FW at 503nm wavelength.

However, the results of current study showed that low temperatures did not affect the production of DM for all varieties grown. This is correlated to the findings of Van Der Ploeg and Heuvelink (2005) who stated that the low night temperature (NT) set-point from 15°C to 11°C from anthesis until picking of the first fruits, resulted in a 6% increase in yield after 18 weeks of fruit picking and caused in an increase mean fruit weight. Though TSS is regarded as an important quality characteristic in tomato, according to the current findings, the varieties with higher TSS content resulted in lower yield. OECD (2017) also reported that the wild tomato species with high TSS produced low yield.

Table 3. Nutritional value of tomato varieties

Varieties	pH	TA (%)	TSS (%)	L.AA (mg/100g FW)	Lycopene (mg/100gFW)	DM (%)
SIFA F1	4.0±0.0^{a}	0.54±0.01^{c}	3.6±0.01^{d}	11.4±1.8^{b}	8.7±0.0^{c}	6.1±0.1^{c}
ASSILA F1	4.3±0.1^{a}	0.52±0.02^{d}	3.7±0.02^{d}	14.3±0.6^{a}	11.0±0.0^{a}	7.1±0.1^{a}
ROMA VF	4.1±0.1^{a}	0.66±0.01^{a}	3.9±0.02^{c}	12.0±1.7^{b}	9.1±0.2^{b}	5.7±0.0^{d}
RIONEX	4.3±0.0^{a}	0.61±0.02^{b}	4.8±0.02^{a}	11.4±1.2^{b}	8.1±0.1^{e}	6.2±0.1^{c}
CAL-J	4.1±0.1^{a}	0.61±0.01^{b}	4.7±0.02^{b}	14.1±0.3^{a}	8.4±0.0^{d}	6.4±0.1^{b}
GM	4.2	0.59	4.1	12.7	9.0	6.3
L.S.D	N/A	0.01	0.04	2.0	0.18	0.18
C.V (%)	0.0	1.9	0.1	6.4	0.1	0.6

[z] The means for factors that are followed by the same letters in column are not significantly different, according to DMRT at P≤0.05.; [y] TA stands for titratable acidity (TA); TSS: Total soluble solids; L-AA: L-ascorbic acid; DM: Dry Matter; FW: Fresh weight.

Conclusions

Despite flower and fruits abortion that may occur when growing tomatoes at relatively low temperatures, number of flowers, number of fruits per plant and average weight of individual fruit showed a positive relationship with plant yield. Therefore, Assila F1 could be chosen as the best hybrid that can be grown by farmers under low temperature areas as it has shown the ability to reward a higher yield, fruit dry matter, L-ascorbic acid, lycopene content and acceptable palatability. Similarly, Roma VF should be selected as the best performer among the evaluated homozygous genotypes for their acceptable characters. In addition, Roma VF could be an important plant material in future when selecting the cold tolerant tomato varieties and mapping their trait loci associated with these genes for further breeding program.

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Medicinal Potential, Health Benefits and Bioactivity of *Mentha piperita* L. (Peppermint)

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Abstract
Mentha piperita L. (Peppermint) is a medicinal plant that has gotten a lot of attention from the industrial sector (food and pharmaceutical) because of its wide range of health benefits. Since peppermint is a single ingredient that is commonly used in conventional medicines around the world for a variety of health problems. With the assistance of this review paper, an effort has been made to investigate the nutritive, biochemical, and health potentials of Mentha piperita. In this study, we discussed the key basic components found in Mentha piperita, as well as their behavior against various diseases such as antimicrobial and nervous system actions. They have cardiovascular and hypotensive benefits, as well as antitumor activity and nutritional benefit. In conclusion, this plant is a simple goal for scientists and researchers to investigate, and the materials that have been tested should be used to deter human diseases.
Key words: *Mentha piperita, peppermint, medicines, health benefits and disorders.*

Introduction

Today population across the globe mainly depend directly or indirectly on traditional remedies for their basic health disorders along with the primary food needs. These traditional medicines mainly involve plant material extracts and mostly aqueous solutions, which can be prepared by heating or soaking plant materials and has prevailed basic healthcare form ancient times. *Mentha piperita* L. (Peppermint) is significant therapeutic herb belongs to family Lamiaceae. It is also known as the oldest herbal plant almost first explained by Carolus Linnaeus in 1753. M. piperita is considered among the hoariest curative plants in human history also famous in almost in every culture (Egyptian, Roman and Greek cultures) since ancient times. (Xu et al, 2003) In present era, due to the multidimension uses of M. piperita, its consumption is astounding. Due to the presence of various constituents and compounds obtained from this plant and the essential oil extracted from its various portions has enormous use in our daily life areas like pestisides, cosmetics, confectionary pharmaceuticals beverages (Yang et al., 2010). The economic importance of mint is well evident from the fact that its various compounds and constituents obtained from the desiccated and fresh plants and their essential oils forms part of numerous items of daily use like confectionary, cosmetics, oral hygiene products, medications, insecticides, and as a flavor enhancing agent in toothpastes, chewing gums and beverages, to name but a few (Patel et al., 2007).
Besides medicinal potentials it uses as flavoring agent and as a single ingredient in dinners. Action of M. piperita as a traditional therapy or substitute remedy that includes: bilious problems, stomach ache, gastritis, intestinal cramp, antiviral, antibacterial, antifungal inflammation, fustian, hard cell of the bile duct, gall-bladder and gastro-intestinal region, antimicrobial activity and respiratory diseases (Capecka et al., 2005).

Distribution

The peppermint plant is native to Europe and extensively spread out in farming all over across the globe. It is wildly originated occasionally with its inheritance. It is an offensive species in Australia, the Galapagos Islands, New Zealand and United States.

Nomenclature

Different names based on local culture and customs across the globe are presented in Table 1. There are more than 100 local names in various countries.

Phytochemical Properties

Various studies show that essential oil extracted from peppermint plant are mainly composed of different secondary metabolites. Peppermint chemical constituents are varying from in leaves and other parts also mainly depend on plant maturity, processing environments, geographical conditions and variety as well (Xu et al, 2003). According to a study conducted by (de Almeida Muradian et al, 1998) fresh leaves of peppermint (Brazil) comprised of 940–1016 retinol equivalents (RE)/100 g β-carotene. The evidence also shows that chlorophylls, carotenoids, ascorbic acids and tocopherols were also reported in various concentration in peppermint oil (Capecka et al., 2005).

Table 1. The most popular local names of mint across the globe

Country	*Local name*	*Country*	Local name
Iran	Nanafelfeli	Turkey	Nane
Brazil	Nortela pimento	Russia	Myata perechnaya
USA	Lab Mint, mint	Uruguay	Menta
Norway	Peppermynte	French	Menthe
Poland	Pepparmunta	Iraq	Nana
Spain	Mentainglesa	Bogota	Yerba Beuna
Portugal	Hortelana pimentosa	Denmark	Pebermynte
Swedish	Pepparmynt	Germany	Peppermint
China	Po Ho	England	Brandy Mint
India	Urdu, mint, Pudina, Pudyana, Puthina	Mexico	Menta piperita

Nutrient Contents

Various studies and researches show that mineral contents from mint foliage are additional wide-range and relating to that of vitamins. Dried peppermint leaves contain major minerals are as g per kg: Potassium 33, Calcium 15.3, Magnesium 5.8 and small quantity of sodium, with smaller amounts as mg per kg of iron 239, Manganese 188, Zinc 51 and Copper 12. Minor amounts as µg per g of Chromium 941, iodine 325 and Selenium 147 are also existing (Zimna and Piekos, 1988, Lozak et al., 2002).

Antioxidant Properties

Recently, interest has been increasing in the consumption of essential oil (Eos) as natural antioxidants. The oxidant species can be produces in the body as a result of different metabolic process and the excess of nitric oxide production may cause failure or damage of different vital organs in our body, thus antioxidant pathways activated in order to neutralize these harmful responses (Nathan et al., 2013). mint is an important medicinal plant and also rich source of many vital antioxidants. Schmidt et al., (2015) mentioned that EOS extracted from mint herb has antiradicals functions with respect to DPPH and hydroxyl (OH^-) radicals, while it is also stated by some researchers that the extracted essential oils possess radical scavenger activity against the ABTS radical (Yang et al., 2010). The antioxidants action of mint is basically the presence of phenolic compounds in their leaves like rosmarinic acid and flavonoids like hesperidin, naringin, luteolin and eriocitrin (Dorman et al., 2009).

Anti-bacterial Properties

Therapeutic plants have been widely used in common traditional remedies and hence, secondary metabolites from plants are of great interest as anti-microbial mediators today (Mahboubi and Kazempour 2014). Currently, scientists and researchers working on different infectious illnesses, the compounds extracted from peppermint are increasingly interests (Mucciarelli et al., 2007). The essential oils and aqueous solutions from peppermint plant showed excellent anti-microbial action against the following bacteria: *Proteus vulgaris, Staphylococcus aureus, Streptococcus faecalis, Escherichia coli, Streptococcus pyogenes, Salmonella pullorum, Yersinia enterocolitica Comamonas terrigena, Acinetobacter sp, Shigella dysenteriae Serratia marcescens, Mycobacterium avium, Salmonella typhi, Lactobacillus bulgaricus, Streptococcus thermophiles, Staphylococcus pyogenes, Enterobacter aerogenes, and Escherichia coli* (Bohnert et al., 2016). It has been also shown by various studies that mint oil along with menthol having slight anti-bacterial action against Gram-positive and negative bacteria (Shaikh et al., 2014). According to (Inouye et al., 2001) stated the main respirational pathway pathogens *Staphylococcus aureus Haemophilus influenzae, Streptococcus pyogenes and Streptococcus pneumoniae* were found susceptible to peppermint oil and to its component's menthol and menthone. From research analysis it appears peppermint can become a major novel target for synthesis of various plant derived drugs against a large spectrum of multi-drugs resistance bacteria.

Anti-headache Activity

From the ancient times, herbal remedy has been used as a major treatment for headache complaints (Levin, 2012). Intake of peppermint and its derivatives in daily diet is the best target for headache cure. Gobel et al., (1994) presented about benefits in combination of peppermint and eucalyptus oil in relieving patients headache problem. While, parallel results were also stated by Levin (Maliakal and Wanwimolruk, 2001).

Nervous system Actions

The and peripheral nervous system along with central nervous system function can be affected by the action of peppermint plant. Atta and Alkofahi during 1998 studied the painkilling mode of actions on an ethanoic quotation of peppermint plant on Swiss rats. Retaining 0.7 percent acetic acid vaccinated to prevail upon the ache observed by squirming. The rats were 1st cured for 30 minutes with 200 or 400 mg/kg (oral dose) of the mint extracts.

Squirming movement in mint cured pests remained meaningfully lowered by 38–44 percent related with saline vaccinated controls. According to (Umezu et al., 2001) that 400 – 800 mg/kg of EOS vaccinated intraperitoneal in rats meaningfully improve ambulatory actions 10–40 minutes afterwards administration. The elements sequestered from peppermint like pulegone, caryophyllene, 1,8-cineole, menthone, isomenthone, menthol and methyl acetate also meaningfully improved ambulatory behavior (Umezu, 2002; 2003).

Cardiovascular and Hypotensive Effects

Today, in developed world, utmost attention is given to the prevention of cardiovascular problems. For such reason massive attention is paying towards a diet plan containing food with antithrombotic effects, as a daily intake of such a diet delivers an easy and controlling way of protection from cardiovascular diseases. An investigation done by Lahlou et al., in (2002) showed that essential oils from peppermint plant has an element called pipertenone oxide, which shows positive effect on cardiovascular system and slow down the heart rat which seems to independently be occurring.

Antitumor Activity

A study carried out by Ohara and Matsuhisa (2002) in which edible plants (120) were screened for anti-tumour encouraging activities against Okadaic acid (OA) and non-12-O-tetradecanoylphorbol13-acetate (TPA)-type promoter that promotes tumor creation by deterring protein phosphatase-2A activity. Among eight plants the peppermint plant was the only one plant that showed up strong activity (85% to 100%) in overwhelming the action of okadaic acid.

Therapeutic Uses

Presently, the oils from peppermint plant have become most measured agent as treatment for a human disorder (Alankar, 2009). Key health benefits of mint oils are shown in (Figure 1). In addition to therapeutic uses, its extract is largely used in food industries as a flavoring agent. As among all chemical compounds that extracted and purified from mint oils, mentholic is the most mutual element and extensively is used for respiratory congestion (Eccles, 2003), headache pain, and skeletal muscles problems (Patel et al., 2007). For adults the best dosage of peppermint oil was reported 0.2 to 0.4 mL three times daily in enteric-coated capsules (Khanna et al., 2014).

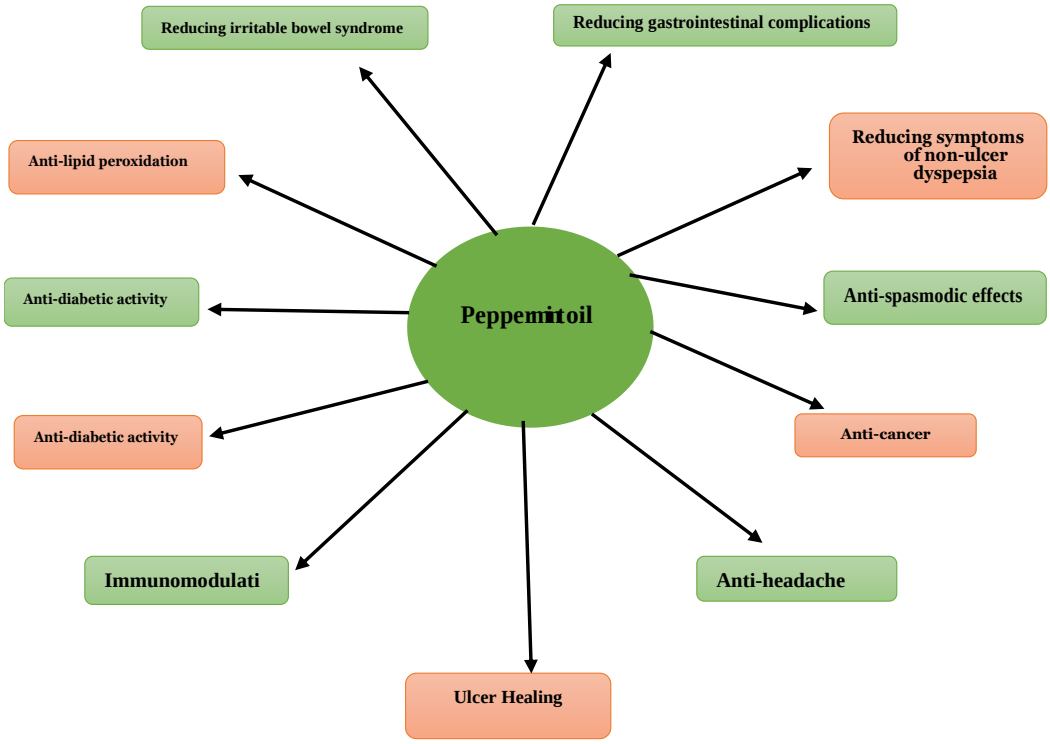

Figure 1. The major health benefits of Peppermint Oil.

Conclusion

Peppermint is the most popular single ingredient and traditional herb around the world and contain strong position in market in future. It offers several benefits ranging from the medical ground to other areas like cosmetics, toiletries, and flavoring etc. also to other sides that having a solid links with health: straddling from the food sector to insecticides and repellents. In this current review the nutritive, phytochemical and health potential of peppermint are considered. Moreover, additional researches are required in order to explore the cellular and molecular mechanisms of peppermint and its compounds well known effect on human body.

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A review on Economics importance of ginger production in Pakistan, comparison with major Asian countries

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Abstract

Ginger (*Zingier officinale*) is a tropical herbaceous plant; its rhizome is a common ingredient around the world. They were cultivated in soil and other modern farming methods. The economic impact of ginger, market value addition and socio-economic factors that influence ginger economic benefits in Asia as compare to Pakistan was explored in this research. It exists in a range of pharmaceutical and commercial as green ginger (fresh ginger), dry ginger, ginger powder, and ginger oil and herbal medicine. A worldwide outbreak of ginger remedy to different disease has prompted to focus their efforts on this region. This review also includes its export and import value and SWOT analysis significance in producing ginger that is more beneficial to the Asian community.

Keywords: *Ginger, market value, socio economic, Agricultural Economics, Ecological Economics, Environmental Economics, Natural Resource Economics*

Introduction

Ginger, Zingier officinale (Zingiberaceae), rhizome called as "ginger root", tropical herb, which found all around the world, about 5-6% consumed as a traditional spice and known for its diverse nutritional qualities. It has a huge demand in pharmaceutical industries because of its antioxidant properties. (Deme, K., *et, all*, .2021). Ginger usually grows in Southeast Asia including tropical and subtropical climates. Consumers demand it as a desired spice crop with medicinal and nutritional worth, and some local farmers in the United States want to cultivate it as a functional crop in a least tropical, limited-season climate. (Devkota, P. (2022)). In addition, research assays to produce ginger in high tunnels or the field have been undertaken in various eastern and southern states of the United States. As ginger grows better under shade, especially in the seedling stage, significant production in few countries has also been done in direct sunlight. (Adebayo, S. A.,et,all.,(2021). This plant is developed in India and many other countries like Bangladesh, Taiwan, Jamaica and Nigeria.

The taste of a fresh, young ginger rhizome is crisp and juicy, without any of the fibers especially in older rhizomes. It has a mild taste and is excellent to eat fresh or making pickled ginger for Japanese cuisine. The harvested rhizomes may also be air dried and will keep for many months before replanting for the next crop or being consumed (Ma, R. H., et,all,.2021).The plant contains pharmacologically active compounds in its rhizomes such as anti-inflammatory gingerols that give ginger its pharmaceutical use. More than a hundred chemical components of ginger have been identified or recognized so far though (Amri M., 2016). Each of these compounds, gingerol has gotten the most attention in research for curing persistent inflammation as asthma and rheumatoid arthritis (Akinyemi AJ, *et, all*.,2015).

According to historical data, ginger exports were $93.29 million in the first two months of 2020, 14.4 percent increase over the same time in 2019. The cost of ginger increased all around the world, especially in the month of March as the Covid-19 overtook globe. Use of ginger increasing an individual's self-defense or immunity which enables human to fight with infection. Until more than 100 compound contents from ginger have been limited or identified at this moment (Akinyemi AJ.,*et, all. 2015*).

As furthermore, the cost of ginger has significantly risen overall the globe. Similarly, most footage of inventions that are made with ginger and other spices were posted on internet, in countries like , Ivory Coast ,Ghana, Nigeria,and Cameroon as a therapy to combat Covidien (Observers, 2020). Chinese ginger detoriation create and trading prompted a huge ascent in costs of import of Chinese ginger in nations like Bangladesh, Pakistan and Vietnam . Due to Vietnam, costs of Chinese ginger took off roughly VND 20K-30K (USD 0.86- 1.29) 1kg toward the start of 2020 in the month of February (Plaza, 2020). As per (Lee, S.,2022) among Bangladesh, Chinese ginger which is hydroponically grown, cost 1kg rose by BDT 180- 220 (USD 1.14-1.39). Additionally, inside around scarcely any time periods the Pakistani costs of Chinese ginger i.e PKR 400 (USD 2.53) per kilogram expanded by PKR 80 (USD 0.51) (Lee, S.,2022; Plaza, 2020). There is a demand to modify ginger production to organic culture because consumer demand for organic products continues to raise USDA Economic Research Service (2019).

In this literature, there was an economic and medical value along with the market value including export, import and ginger production of Pakistan along with the comparison to china India and Bangladesh are discuses. Issues constraints and opportunities associated to manufacturing, harvesting, marketing , storing , trading and processing and recognized the strengths , weaknesses, opportunities and threats (SWOT) of ginger production and value added sequence are identify through on FAO time series analysis and trade map research.

Botanical Specification:
Ginger family (Zinigiberaceae) has perpetual tuberous or rhizomatous roots. The plants produce upstanding, 60 to 90 cm tall yearly tail (pseudo-stem), consist of light green colored leaves.Stalks accompanied with level sheaths that might be shrugged off tail; 8-12 leaves are available on the stem. Thumb sized glomerular is absent.Blossoms are small and light-yellow in colour. Anthers are doubled folded, long coronate in structure , arenose directed and horn formed. This perpetual fills in hot environments (Schauenberg and Paris, 1977).

Genotype
The quality boundaries of ginger, like fullness of rhizome, dry recuperation rate, fiber, oleoresin and oil content are profoundly affected by natural components. For dry ginger creation, diversity with high-rise dry recuperation rate (>20 %), low fiber content (<4 %) are essential. Cochin and Calicut dry ginger traded from various district are cultivated nearby cultivars, for example Kuruppampady, Cheranad, Erenad and Wayand in India (Shanmugavelu et al., 2005). Kuruppampady. Ginger is renowned for its high oleoresin content. Further developed varities are Suruchi, Surabhi, V3 S 1-8, V1E8-2 delivered for new ginger creation (Nybe et al., 2007). Athira and Karthika are two ginger variety delivered by research for huge scope of new and dry ginger creation in subcontinent area (Shylaja et al., 2010).

Active Ingredient
Ginger had active ingridients which manufacture ginger oil i.e terpenes and oleoresin. Ginger also creates approximately 1% - 3% volatile oils and non-volatile pungent components oleoresin. The vital compound i.e terpenes , Sesquiterpenoids hydrocarbons, phenolic compounds that also called gingerol, shogaol and lipophilic rhizome abstracts, produced reasonably active gingerols, which can play significant role in pharmaceutical industries.

Table 1. Composition of ginger rhizome (The following components are involved in the composition of rhizomes. The percentage composition ensures the demand of pharmaceutical industries.)

Particulars	*Fresh Ginger Rhizome*
Dry matter%	92.71
Crude protein%	5.28
Ether extract%	5.54
Crude fiber%	9.74
Ash%	5.97
Total carbohydrate%	66.26
Oxalate mg/g	4.55
Phytin%	28.83
Tannin%	0.26
Phosphorus%	25.70
Sodium%	40.96
Potassium%	37.34
Calcium%	35.66
Manganese%	19.60
Zinc%	4.06
Iron%	1.44

SOURCE: ADANLAWO & DAIRO (2007).

First Ginger Production in Pakistan
Pakistan`s first ginger is harvested in balkasar in the area of chakwal on January 02, 2022. Inaugarated by Special Assistant to the Prime Minister on Poverty Alleviation and Social Safety, Senator Dr Sania Nishtar Ginger is produced only in Sindh province according to Agricultural Statistics of Pakistan (ASP) (2000-2020). The FAOSTAT (FOOD AND AGRICULTURE ORGANIZATION CORPORATE STATISTICAL DATABASE) the country level data of ASP until 2020 (FAOSTAT). These data suggest that during 2020, ginger was grown in Pakistan on 2 ha producing 2 tons of ginger with an average yield of 5000 tons per ha. The data suggest elevated deviation in cultivated area of ginger (ranging 22 ha in 2011 to 291 in 2015) and interrelating variation in its production.

Economic impact of ginger
Ginger is a vital commercialized crop cultivated for its scented rhizomes, that are consumed as medicinal purposes and both for organoleptic and as a spice. The augmentation of cash crops, specifically ginger, provides the opportunity to achieve a complementary commercial resource to the farmers and, allowing them to improve their living quality. The species illustrates an added worth to global trade as it is used all around the world (Meenu G,2020) .



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Ginger is widely farmed throughout the world, with production scattered across nations such as India, Pakistan, China, Nigeria, Nepal, Indonesia, Thailand, and others. In 2018, ginger output was 3,038,120 metric tons. (Kumar, P., Dwivedi, P., 2018). While India controls the production and trading of ginger, then appear the United States of America (19.035 tones), the United Kingdom (10.337 tones), Saudi Arabia (8.248 tones), (Pinson C.et.all,2017). Singapore (7.566 tones), Malaysia (7.652 tones), Korea (6.805 tones), the Netherlands (6.981 tones), and Canada (4.680 tones) (Pinson C.et,all,2017).

As long as crop with secondary significance, experimentation in the selection,(graphs one ,two & three) Indicates the yield per area of ginger cultivated in Pakistan, China, India and Bangladesh and show the overall potential of ginger produce in Pakistan through the last two decade. The data collected from FAOSTAT, where the conclusion can identify the potential of Pakistan as compared to its neighboring countries.

Pakistan is the 2nd biggest importer of ginger in the world, which produce ginger 2.00 percent in 2020 but due to less yield it's not enough to meet consumer need. In 2020, the average ginger export price amounted to $3,125 per ton, picking up by 10% against the previous year. The yield volume of ginger in India from financial year 2015 to 2020, with an approximate for 2021 is 1.89million metric tons increasing from 760 thousand metric tons in financial year 2015. India export almost US$ 31.5 million value of ginger and import US$ 19.6 million approximately. Bangladesh produces about 49,405 m tons of ginger annually from about 19055 hectares of land, Bangladesh exported a total of $41.2B. Regardless, China with the exporting volume up to 578K tons in 2020 which was close by 63% of entire exports. It was indirectly stalked by India that is 102 K tons), China's annual rate of production is at average of 11.87%.

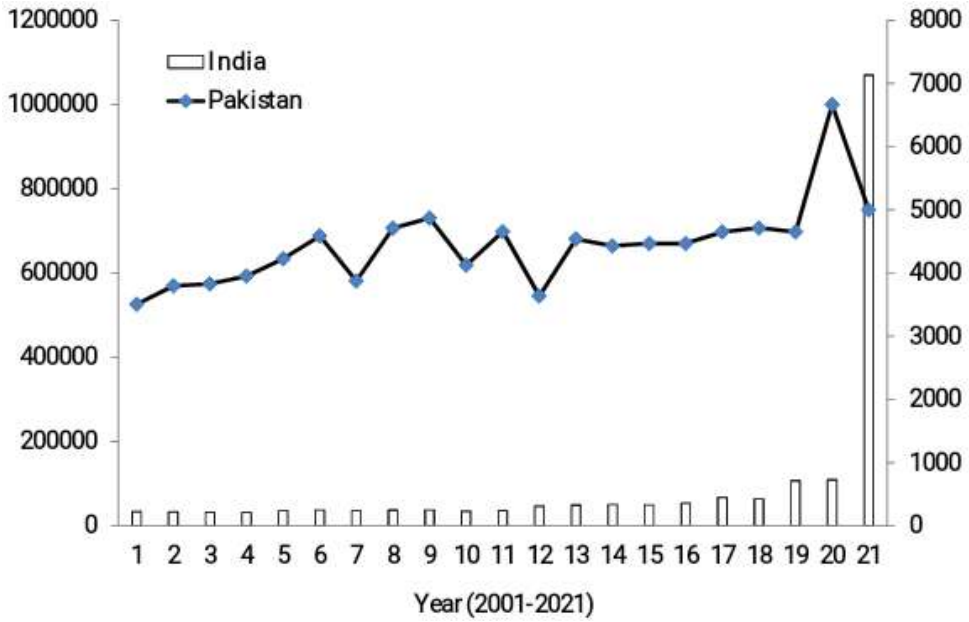

Fig 1. Showing the trend comparsion of Pakistan and India

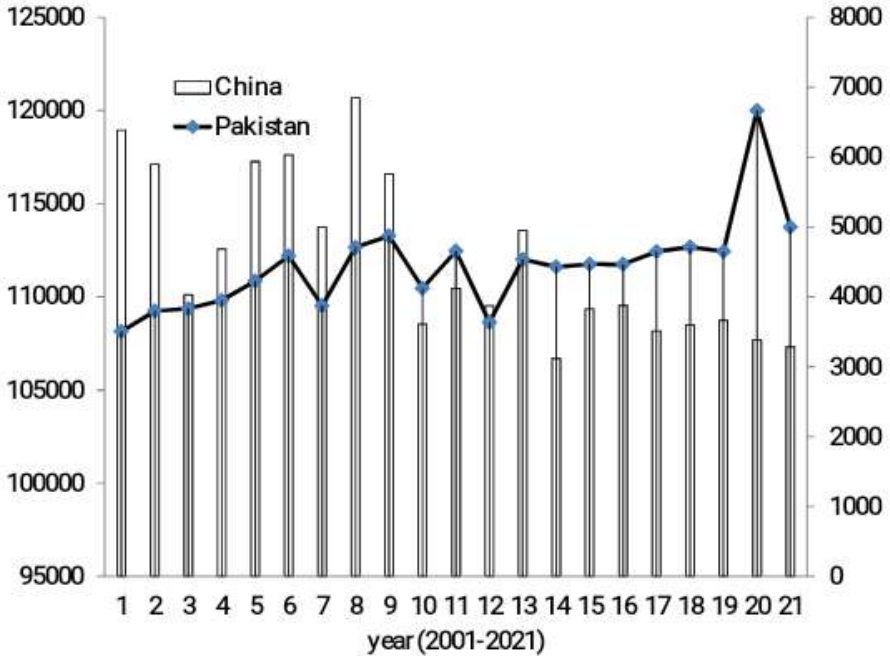

Fig 2. Showing the trend comparsion of Pakistan and China

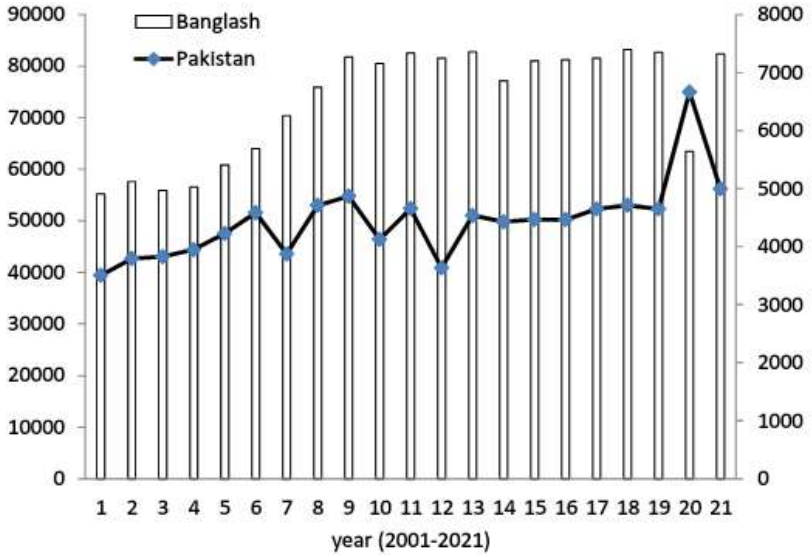

Fig 3. Showing the trend comparsion of Pakistan and Bangldash

Presently, the supply chain of ginger is balanced and is starting to drop down.India, China, Nepal, Nigeria, Thailand, and Indonesia are the top producers of ginger worldwide During the fiscal year 2018, Assam, India's eastern state, was the country's largest ginger producer. This amounted to approximately 168 thousand metric tons or 17.5 percent of the total ginger production in the country. Maharashtra came second, with West Bengal coming third that year. The volume of ginger produced in India for the financial year 2020 was about 1.88 million metric tons. This was higher from 760 thousand metric tons in the previous fiscal year. In that year, spice production in the south Asian country was over 9.7 million metric tons. (Statist Research Department, 2022) .

China

China's ginger industry increased at a mean annual rate of 11.20 percent from 28,742 tons in 1970 to 605,123 tons in 2019. Covid-19's pandemic had economic consequences for countries all around the world. Many countries suffered a decrease in their export commerce. The export of Chinese ginger, on the other hand, has increased massively of its medicinal benefits. During the pandemic, people have started to pay more attention to ginger. In March, China began to reestablish normal commercial activity after the initial lockdown in January and February. While other countries were affected by Covid-19, the market for ginger grew, and China was one of the few countries that could supply it. That is why the export of Chinese ginger increased in volume and value in the first six months of 2020.

Table 1. Ginger production of China

Year	Area/ha	Change%
2016	1109000.00	45.92
2017	1070000.00	-3.52
2018	1762000.00	64.67
2019	1788000.00	1.48

Table 2. Ginger production of Nepal

Date	*production /tons*	*Change%*
2016	573,417.00	10.19 %
2017	568,404.00	-0.87 %
2018	592,892.00	4.31 %
2019	605,123.00	2.06 %

Table 3. Ginger production of Nigeria.

Date	*Production/tons*	*Change%*
2016	271863.00	12.09
2017	279504.00	2.81
2018	284000.00	1.61
2019	297512.00	4.76

Table 4.Ginger production of Thailand.

Date	*production/tons*	*Change%*
2016	774887.00	87.45%
2017	834634.00	7.71%
2018	700000.00	-16.13%
2019	691239.00	-1.25%

Due to the existence of soft rot/rhizome rot disease (loss of up to 30% in the field), a shortage of domestic facilities for industrial extraction and distillation, traditional drying and processing techniques (loss of oil content by 20%), the influence of a single trade outlet in Naxalbari, India, farmers, and traders in East Nepal face extremely low margins. Nepali ginger is the world's fourth-largest producer and 15th-largest exporter, with a total production of 279504 metric tons on 22649ha land (MoAD, 2017; FAO, 2017). Nepali ginger has the highest export potential, given the fact that China and India, the two largest ginger importers are Nepal's neighbors (Workman, 2019).

During the months of October and November 2018, an interview was planned to collect data. According to a compound annual growth study, the area, productivity and yield of ginger have increased at rates of 1.73 %, 1.65 %, and 0.95 % over the last seven years respectively. The B/C ratio of ginger farming in the field of research was 2.42, suggesting that it was a profitable business; farmers earned an additional 1.42 rupees for putting Rs1.0 (0.0088US$) in ginger. (Manuscript received 22 October 2019; accepted for publication, 2020) (Faculty of Agriculture, Agriculture and Forestry University, Rampur, Chitwan, Nepal).

Nigeria produce an average volume of over 400,000 Metric tons of ginger beyond the 36 states yearly. In 2017, we had a production volume of about 349,895 and it was higher in 2016 with 522,096 metric tons. Typically, ginger is exported in three forms fresh, dried, and processed (powdered). The dried rhizome sells for around 900 Naira per kg on the international market, commanding the highest export price. Nigerian farmers can profit from the $3 billion ginger market as the nation looks for ways to expand its non-oil export potential. According to data from the Ministry of Agriculture, Nigeria's ginger production is estimated to be 31 million metric tonnes while consumption is estimated to be 65 million MT, leaving a 34 million MT supply-demand mismatch. Nigeria increased its annual ginger production from 80 tonnes in 1970 to 691,239 tonnes in 2019, expanding at a rate of 26.69% on average.

The Ginger farm continues to increase. The total harvest area is ~ 28,000-36,000 acres. The export of fresh Ginger and preserved Ginger bring revenue ~ 800 million and 1,200 million Baht to Thailand. Though Thailand ginger - yield differed in recent years, it managed to enhance through 1970 - 2019 period ending at 164,976 hg/ha in 2019. Though Indonesia ginger - production differed substantially in recent years, it managed to enhance through 2000 - 2019 period ending at 174,380 tons in 2019. In 2020, approximately 179 million kilograms of ginger were produced in Indonesia. The provinces that produced the most ginger include East Java, West Java as well as Central Java (Statista Research Department).

Table 5. Ginger production of Indonesia

Date	*Production/tons*	*Change%*
2016	166346.00	2.43%
2017	168025.00	1.01%
2018	166196.00	-1.09%
2019	166923.00	0.44%

Table 6.Ginger production of India.

Date	*Area/ha*	*Change%*
2016	340341.00	4.71
2017	216587.00	-36.36
2018	207412.00	-4.24
2019	174,380.00	-15.93

As a result of the closing of land, sea, and air borders due to Covid 19 the ginger supplies in India, the world's second-largest exporter, and Iran, the world's third-largest exporter, faced worsened global scarcity. Prices of ginger began to rise approximately 7-9 percent per from late January to February in China, owing to labor scarcity in farms and distribution networks, as workers were encouraged to stay at home (Plaza, 2020). The increase in demand for ginger resulted in a 17 percent increase in the supply chain in the first two months of 2019 compared to the previous month. (Plaza, 2020; Produce Report, 2020; Wintle, 2020).

Ginger Exporting Countries

The pie chart (1), shows the percentage of Pakistan import throughout the decade. The import throughout decade increasing like 2003 is 3%, 2004 is 5%, 2005 is 7%, 2006 is 9%. The increasing rate from 2003 to 2006 is two. The graph shows that the import increasing 2007 to 2021is one present. But throughout the decade decrease. The increasing one or two percent is economically not well but the percentage rate of enhancement is low so Pakistan is eligible to control and work on its exporting area. Pakistan should work on export area why is it decrease from 2% to 1%.

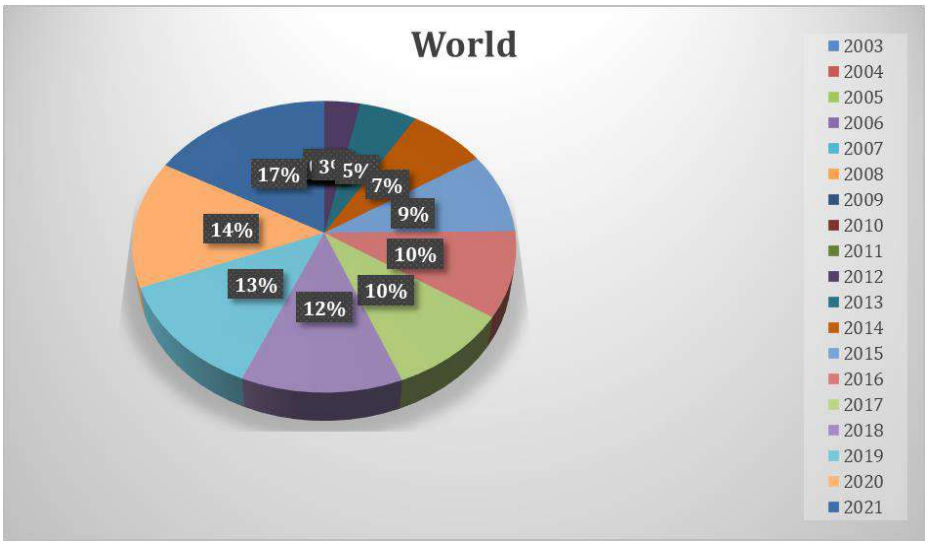

Fig 2. Over the years Pakistan Exports

This research collected data of Ginger through the trade Map. Through trade map we exclude the data throughout the decade and show the market trend of Pakistan importing to top five country. The top highest importing country is China. The imports of china from 2003-2010 is zero but from 2011-2021 throughout the decade is increasing. The top five country 2003-2010 is zero and in the next year from 2011-2021 increasing. In the top five country china import highest then Thailand, Montenegro, Nigeria and Indonesia. The overall import of five country is zero from 2003-2010and then increasing from 2011-2021.

Ginger Importing Countries

The pie chart(2.3), shows the percentage of Pakistan import from 2003-2021. The import from 2003-2011 zero and then increasing in 2012is 52% and then decrease in 2013 is 1%, 2014 is 2% 2015 is 15% 2016 is zero in 2017 is 1% in 20189is 12% in 2020 15% in 2021 is 1%. The overall import from 2003-2021 decreasing and it is economically good and Pakistan work to minimize its importing area and increase its exporting area.

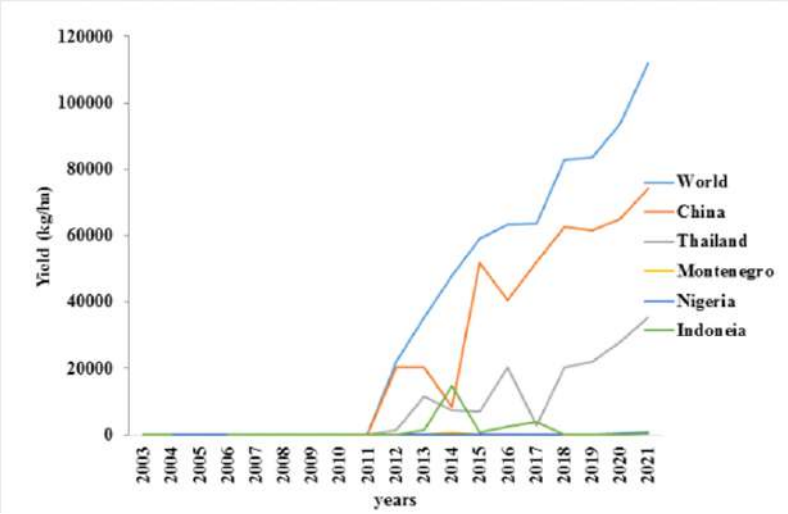

Fig. 2.1. Showing the trend of overall market trend (Export) of Ginger

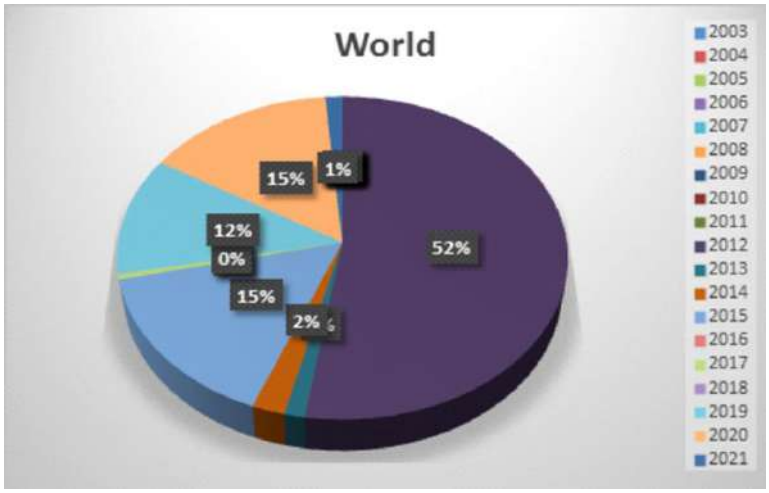

Fig 2.3. Over the years Pakistan Imports

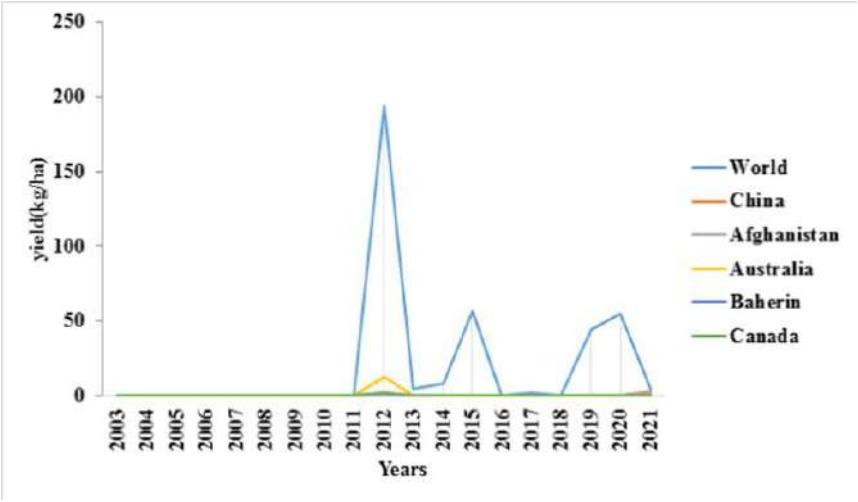

Fig.2.4. Showing the trend of overall market trend (Import) of Ginger

The above research data is collected through the trade Map. Through trade map we exclude the data throughout the decade and show the market trend of Pakistan importing to top five country. The top highest exporting country is china. The export of china is zero 2003-2020 and only export in 2021. The overall export of these five countries is near to zero. Pakistan works its importing area to minimize and work its exporting area.

As a response, ginger is becoming a source of revenue with a high market value, driven by the crops recognized as nutritional and health characteristics. However, despite the fact that its cultivation is growing widespread and huge interest in ginger production, as there isn't much ongoing research on it. Pakistan has to developed cultivars better guide for producers and establishes profitable and sustainable businesses trend line.

SWAT Analysis

Strength	**Weakness**
• Well created potential network in rustic regions and production network of farming ginger • Favorable environment for farming ginger creation and can be developed consistently. • Ginger can be created in all space's country or metropolitan both. • Traditional information and abilities of ranchers can be expanded and modern methods of creation are learn by the ranchers. • High value plant use as household meal and pharmaceutical industry. • Potentials for development in region and efficiency expanded by utilizing tank-farming technique of cultivating. • High interest of aqua-farming ginger in India and China and rest of the world after Coronavirus.	• High rate of Ginger decay because of lack of provision special environment and temperature. • Poor gathering of additional created grouping and producers or consumers retailer's marketers when it comes to modern ways of farming. • Lack of worth expansion exercises like awareness campaigns of hydroponic farming of ginger. • Timely inaccessibility of sources of info (seed, manure, labor, technology, nutrients solution). • Lack of reception of further developed innovation because of not quitting orthodox ways of farming. • Weak in reverse and forward linkage. Or unskilled labor.
Opportunities	**Threats**
• Covid itself is major opportunity for hydroponic ginger as during covid the demand for ginger increased suddenly for health benefits like for boosting up immunity. • Degree for setting up ginger preparing enterprises. • Scope for value added in hydroponic ginger marketing. • Continue creation of hydroponic ginger. For its health benefits. • Government strategy support as hydroponic ginger is high worth income producing crops for all countries particularly Asia countries • Potential to build region and usefulness and its convenience.	• Serious dangers of hydroponic ginger shelf life and sickness due to environmental impacts and expensive treatment. • Decreasing work accessibility because of relocation of hydroponic ginger production in Asian countries. • Price variance such as high prices of hydroponic ginger. • C02 impact and green houses are likewise arising dangers.

Conclusion

Asian's major commercial product, ginger holds a unique place in the nation's economy. The crop has enormous potential for creating agricultural income as well as employment, eventually raising farmers' living standards. Although there has been limited research on the production aspect of ginger cultivation in the region and in-depth examination of the economics potential of ginger cultivation is critical for determining the various investment patterns that are profitable for ginger production.. Moreover, ginger plants are not affected by climatic variations, allowing any crop to cultivate.

Ginger farming is also good for the environment. The production of ginger is profitable in the research areas. Whereas the investment return for ginger producers was high, it fell short of ideal levels. The use of the right

amount of input at the right time is essential for increasing output and profitability, but the farmers' use of technology missed the mark of the recommendations proposed. When farmers have access to modern production techniques and variety seed, yield and production can grow, potentially increasing their revenue. Fair prices for seeds, fertilizers, and insecticides are necessary for farmers. To increase their profit on ginger production, farmers require high-quality seed that is resistant to disease and insects.

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Impact of combined inorganic fertilizers with vermicompost on yield and quality of bio-fortified beans (*Phaseolus vulgaris*) in Rwanda

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Abstract

Beans are known to be highly nutritious and being consumed by almost all Rwandans and therefore considered as a staple food. Therefore, a study was conducted in college's farm to assess the effect of different levels of vermicompost and NPK (17-17-17) on the growth, yield and nutritional content of bio-fortified beans. A randomized completely block design with eleven treatments and three replications was used for two consecutive seasons (A and B). Plant height, leaf area index, number of leaves, number of pods per plant, number of seeds per pod, weight of 100 seeds, total yield as well as nutritional value of beans were estimated. The results proved that the treatment with 150kgs of NPK 17-17-17 combined with 5t/ha of vermicompost improved the yield during both seasons as the highest yield was 3.7t/ha and 3.8t/ha respectively. The combination of both fertilizers at the rate of 50% should be recommended to the growers to improve growth and yield since the mineral content is not adversely affected.

Keyword: *Fortified beans, vermicompost, NPK 17-17-17, yield, mineral content*

Introduction

Beans are known as "meat for the poor" and regarded as a "near complete food" based on their nutritional values. A part from proteins, they provide resistant starch, soluble and insoluble fiber, vitamin B and minerals such as iron, zinc, magnesium, copper and potassium (Hutchins, 2011). Moreover, in East African countries, beans are ranked the second after maize as staple food, it is considered as an affordable source of high and quality protein (20-28%), Fiber (56%), Zinc (33mg/kg), energy (32%), Fe (70mg/kg) and vitamin A (Amongi et al., 2018). In Rwanda, bean is one of the six major staple crops under crop intensification program (Nicola, 2011). The annual consumption rate per capita is 164g/day (Ferris et al., 2016), which is higher than elsewhere in the world as a source of iron intake to human body, and as a source of 40% protein, playing a significant role in human nutrition, food security and income (Larochelle & Alwang, 2014). However, on farm productivity and yield decrease dramatically due to diseases and pests, lack of improved seeds, low use of chemical fertilizers (NPK, DAP and Urea) and lack of cheaper innovations of staking are the main challenges experienced by farmers (Gadi et al., 2017).

Many interventions have been identified by the government of Rwanda and partners who are putting more efforts towards the development of climbing beans program and it is among the selected crops in Crop Intensification Program (CIP), which is more profitable in terms of accessing inputs and value addition to small land holdings (MINAGRI, 2011). Mineral fertilizers are still not efficiently used in terms of rates, time of application as well as choice of the right fertilizer by small scale farmers. Cattle manure has been identified to recover plant nutrient deficiency but it is not well managed in order to transfer its benefits to soils (Azeez & Averbeke, 2010). Moreover, the combination of mineral and organic fertilizers is not well understood by smallholder farmers and yet it results in increased yields and good soil conditions. The increasing cost of chemical fertilizers and growing environmental concern have created considerable interest for search of alternative cheap sources of plant nutrients (Gmaa, 2015). The use of vermicompost as a source of organic manure increases crop growth, yield and soil nutrient status and nutrient uptake (Shashikumar et al., 2013). Vermicompost is not only rich in plant nutrients but also improves the physical, chemical properties of the soil and it enhances the microbial activity in soil. It is rich in microbial populations and diversity, particularly fungi, bacteria and actinomycetes (Wasma et al., 2016). It also contributes to the increase in the amount of soluble, exchangeable and acid-soluble iron in the soil (Manivannan et al., 2007). Vermicompost is mainly applied due to its properties of improving soil texture, structure, aeration and fertility; it similarly contains most of the nutrients in plant-readily available form such as nitrates, phosphates, exchangeable calcium and soluble potassium and magnesium. On the other hand, it increases beneficial microbial population activity and diversity and contains higher amount of humic acid and biologically active substances such as plant growth regulators, and it is also known to improve soil moisture holding capacity (Azarmi, 2008). Therefore, this research aimed to assess the effect of different levels of vermicompost and NPK (17-17-17) on the growth and yield of bio-fortified beans in Rwanda with specific objective to assess the effect of vermicompost and NPK (17-17-17 -17) on the growth and yield parameters of bio-fortified beans and to test the effect of vermicompost and NPK (17-17-17) on mineral contents of bio-fortified, beans and mineral contents.

Material and methods

Experimental materials

The study was conducted in the farm of University of Rwanda located in Northern province, Musanze district (1° 33' 30 S latitude, 29° 32' 36 E longitude and altitude of 2300 meters above mean sea level) from October 2019 until February 2020, and it was repeated from April-June 2020. The soil is volcanic and the rainfall range from 1400 to 1800mm with the mean temperature of 16.7^0C. The recommended vermicompost (10t/ha) and recommended doses (300kgs/ha) of inorganic fertilizer NPK (17-17-17) were used alone and their combination at different proportions. Farmyard manure (10t/ha) combined with 300kg/ha of NPK 17-17-17 was used as control factor to test its efficacy against the vermicompost. Vermicompost was obtained from Golden insects ltd and it was made from mixture of decomposing vegetable, food waste degraded by red wigglers, white worms and earthworms. The inorganic fertilizer and beans' variety known as RWR2245 were purchased from certified agro dealers. Eleven treatments (T) were formulated as follow: T0 as control (no fertilizer applied); T1: 100% NPK 17-17-17; T2 was 100% vermicompost; T3: 100% NPK 17-17-17 +75% vermicompost; T4: 100% NPK 17-17-17 +50% vermicompost; T5: 100% NPK 17-17-17 +25% vermicompost; T6: 100% NPK 17-17-17 +100% vermicompost; T7: 25% NPK17-17-17 +100% vermicompost; T8: 50% NPK 17-17-17 +100% vermicompost; T9: 75% NPK 17-17-17 +100% vermicompost; T10: 100% NPK 17-17-17 + 100% Farmyard manure (10t/ha); T11: 50% NPK 17-17-17 + 50% vermicompost. The experiment was laid out in a randomized completely block (RCBD) design with 11 treatments and 3 replications within two seasons.

Estimating the growth and yield

The sample size was composed of twelve crops per plot. The growth characteristics of beans were assessed at 60th day after sowing (DAS). Plant height, leaf area index (LAI) and number of leaves were estimated. For yield parameters, number of pods per crop were counted at 60 DAS while number of seeds per pod, weight of 100 seeds as well as total yield per each treatment were calculated after harvesting, drying and threshing. The weight of hundred seeds were obtained with aid of electronic balance and total yield (t/ha) was got through extrapolating the yield of each treatment.

Laboratory analysis

Determination of Iron (Fe)

Organic matter in the sample was destroyed by ashing and the resulting ash was dissolved in hydrochloric acid (HCl) and diluted to a known volume with water. Whole of the iron present in the aliquot of ash solution was reduced with hydroxylamine hydrochloride (HONH2·HCl) and the Fe (II) was determined spectrophotometrically. Absorption of the resulting complex was read at 510nm wavelength and reported as mgFe/100g.

Determination of Zinc (Zn)

Organic matter in the sample was destroyed by wet digestion. The trace elements in the sample were quantitatively measured by atomic absorption spectrophotometer (AAS) at a specific wavelength.

Determination of Calcium (Ca), Potassium (K) and Magnesium (Mg)

Calcium and magnesium in the sample, prepared by ashing the sample and quantitatively measured by atomic absorption spectrophotometer (AAS) at a specific wavelength (Prapasri Puwastien et al., 2011).

Determination of proteins

The protein content was determined from the organic nitrogen content by Kjeldahl method. The various nitrogenous compounds were converted into ammonium sulfate ($(NH_4)_2SO_4$) by boiling with concentrated sulfuric acid (H_2SO_4). The ammonium sulphate formed was decomposed with an alkali (NaOH) and the ammonia liberated was absorbed in excess of standard solution of acid and then back titrated with standard alkali.

Data analysis

Data were subjected to analysis of variance (ANOVA) using Genstat statistical software and the significant difference between treatments was assessed at 5%. Moreover, significant differences between treatments were identified using Duncan Multiple Range Test (DMRT).

Results and Discussions

Plant growth

Results showed in table 1 indicated that in season A, there was a significant difference in emergence rate ($p=0.002$). The highest value of emergence rate recorded was 100% in plots fertilized with 50% NPK + 50% vermicompost while the lowest value (31.7%) was recorded in plots fertilized with 100% NPK 17-17-17. For the season B, there was no significant difference in emergence rate ($p=0.705$**)** for all treatments. The highest value (97.5%) was recorded in treatment with half rates of combined fertilizers whereas the lowest value (80%) was recorded in treatment with 100% NPK 17-17-17. The low emergence rate is attributed to low moisture under inorganic fertilizer where it holds the currents of soil moisture to allow dissolution. Furthermore, results in season A is explained by optimal rainfall and vermicompost having high water holding capacity, which stimulated emergence

rate. This is in full agreement with Jung et al. (2020) who reported that the performance of seeds in good environmental conditions depends on their genetic potential and pre- treatments. This concurs with Vengadaramana and Jashothan (2012) who reported that an increase in organic matter increases water-holding capacity of a soil affecting seed development.

Table 1. Effect of vermicompost only and in combination with NPK 17-17-17 on emergence rate

Treatments	Emergence rate (%)	
	Season A	Season B
Control (no fertilizer application)	88.3^{bc}	86.7^{a}
100% recommended NPK (300kg/ha)	31.7^{a}	80.0^{a}
100% vermicompost (10t/ha)	88.3^{bc}	93.3^{a}
100% NPK17-17-17 +75% vermicompost	86.7^{bc}	95.0^{a}
100% NPK17-17-17 +50% vermicompost	70.0^{b}	88.3^{a}
100% NPK17-17-17 +25% vermicompost	71.7^{bc}	97.5^{a}
100% NPK17-17-17 +100% vermicompost	91.7^{bc}	97.5^{a}
25% NPK17-17-17 +100% vermicompost	66.7^{b}	84.2^{a}
50% NPK17-17-17 +100% vermicompost	90.0^{bc}	85.0^{a}
75% NPK17-17-17 +100% vermicompost	66.7^{b}	92.5^{a}
100% NPK 17-17-17 + 100% Farmyard manure 100% (10t/ha)	80.0^{bc}	95.0^{a}
50% NPK (17-17-17) + 50% vermicompost	100^{c}	97.5^{a}
P value (0.005)	0.002	0.705
CV (%)	7.8	6.1
LSD	25.78	16.99

*Means with the same letter are not significantly different

The table 2 depicts the results of beans' growth parameters (plant height, number of leaves and LAI) as influenced by vermicompost and NPK 17-17-17. Results indicated that the tallest crops (54.2cm) were recorded in plots that were fertilized with 50% of inorganic fertilizer combined with of 50% of vermicompost. The smallest crops (36cm) in unfertilized plots. The highest number of leaves (52.4) were recorded in plots that received a half rate inorganic fertilizer in combination with vermicompost whereas the lowest number of leaves (38.7) was obtained in unfertilized plots. All treatments showed no significant difference in terms of LAI (figure 1). Though, the highest LAI (0.18cm^2) was recorded in plots with half combination of inorganic and vermicompost fertilizers and the plots that received a combination of full doses of both fertilizers. The lowest LAI (0.13cm^2) was recorded in unfertilized plots. The combination of inorganic fertilizers with vermicompost affected the plant growth as they work in synergy. The application of nitrogenous fertilizer increased leaf nitrogen content and hence high photosynthesis efficiency (Prsa et al., 2007). This is also in line with the findings of Joshi et al. (2013) who reported a positive correlation between vermicompost and inorganic fertilizers. Similar results were also found by Kashem et al. (2015) who reported an increase in number of leaves per plant by the application of high rates of vermicompost and NPK in tomato (*Solanum lycopersicum)*. Furthermore, **t**he difference in LAI might have been due to the fact that the combination of vermicompost and mineral NPK 17-17-17 promoted cell division in leaves which contributed to the increase in leaf diameter and resulted into high primary photosyntates production and evapotranspiration as an impact of high light intensity captured (Esmaiel et al., 2018).

Plant yield

Results showed that in season A, there was significant difference ($p=0.045$) in number of pods per crop (table 3). The highest mean number (17.9) was recorded in treatment of 100% NPK17-17-17 combined with 75% vermicompost while during season B, the highest number of pods (22.4) was recorded in plots that were fertilized with 75% NPK 17-17-17 combined with 100% vermicompost. However, when considering the mean number of pods for both seasons, the first combination (100% NPK17-17-17 + 75% vermicompost) proved to be the best. The lowest number of pods was recorded in plots that did not receive any fertilizer for both growing seasons (10.5 and 17 respectively). Therefore, the number of pods per crop are influenced by the levels of combined organic and inorganic fertilizers (Javed et al., 2018). These findings are also in agreement with Biswash et al. (2014) who found a higher number of pod per tree (20) by applying MoP at 20 kg/ha and vermicompost at 8t/ha on mung beans.

The results indicated that there was no significant difference ($p>0.05$) in both seasons for number of beans per pod. In season A, the highest number of seeds per pod (5.3) was recorded in treatment of 25% NPK 17-17-17 +100% vermicompost whereas the lowest (4.5) was recorded in unfertilized plots. In season B, the highest mean number (5) was recorded in treatment of 50% NPK 17-17-17 +100% vermicompost while the lowest (3.6) was recorded in unfertilized plots. The results showed that there a positive relationship between individual seed weight and total yield (figure 2). The number of seeds per pod is generally influenced by the genetic difference in crop varieties,

but the increase of crop management and proper input application is also of prime importance. Similar results were reported by Channaveerswami (2015) in groundnut.

Results on weight of 100 seeds indicated that there was highly significance (p=0.001) in season A. The highest mean weight (55g) was recorded in treatment with 50% NPK 17-17-17 + 50% vermicompost and the lowest mean weight (44.5g) was recorded in control. Furthermore, in season B, the highest mean weight (51.5g) was recorded in treatment with 50% NPK17-17-17+100% vermicompost while the lowest weight (40.1g) was observed in plots that did not receive any fertilizer. The release of ready plant nutrients from inorganic fertilizers supplemented by slow release of plant nutrients from vermicompost explained the difference on beans' weight.

Table 2. Effect of vermicompost only and in combination with NPK 17-17-17 on plant growth at 60th days after sowing (DAS) in two seasons pooled data

Treatments	Plant height (cm)	Number of leaves	Leaf Area index (cm^2)
Control (no fertilizer application)	36	38.7	0.13
100% recommended NPK (300kg/ha)	43.4	43.1	0.15
100% vermicompost (10t/ha)	42.1	48.1	0.15
100% NPK17-17-17 +75% vermicompost	43.7	50.4	0.17
100% NPK17-17-17 +50% vermicompost	45.5	43.9	0.16
100% NPK17-17-17 +25% vermicompost	40.2	47.3	0.15
100% NPK17-17-17 +100% vermicompost	47.4	45.7	0.18
25% NPK17-17-17 +100% vermicompost	43.7	46.9	0.16
50% NPK17-17-17 +100% vermicompost	45.7	48	0.16
75% NPK17-17-17 +100% vermicompost	38.7	44.6	0.16
100% NPK 17-17-17 + 100% Farmyard manure (10t/ha)	45.2	47.4	0.17
50% NPK (17-17-17) + 50% vermicompost	54.2	52.4	0.18
S.Em. ±	0.155	0.234	0.4
P value	0.02	0.04	0.08
CV	3.8	2.3	0.2

S.Em. ± (standard error mean); P (P value) and CV

Table 3. Effect of vermicompost only and in combination with inorganic fertilizer (NPK 17-17-17) on yield parameters

Treatments	Number of Pod/Plant		Number of Beans/ pod		Weight of 100 seeds (g)		Yield (t/ha)	
	Season A	Season B	Season A	Season B	Season A	Season A	Season A	Season B
Control (no fertilizer application)	10.5^{a}	17.0^{a}	4.5^{a}	3.6^{a}	44.5^{a}	40.1^{a}	2.3^{a}	2.3^{a}
100% recommended NPK (300kg/ha)	14.6^{a}	20.0^{ab}	5.0^{a}	4.3^{b}	52.3^{bc}	47.3^{a}	2.4^{a}	2.4^{a}
100% vermicompost (10t/ha)	16.1^{a}	19.1^{ab}	5.4^{a}	4.4^{b}	52.3^{bc}	45.5^{ab}	2.8^{ab}	2.5^{ab}
100% NPK17-17-17 +75% vermicompost	17.9^{a}	20.6^{ab}	5.1^{a}	4.6^{b}	53.4^{bc}	54.4^{b}	3.0^{abc}	3.2^{abc}
100% NPK17-17-17 +50% vermicompost	13.1^{a}	22.3^{b}	4.8^{a}	4.4^{b}	52.5^{bc}	46.6^{ab}	2.4^{a}	3.2^{abc}
100% NPK17-17-17 +25% vermicompost	15.9^{a}	20.8^{ab}	4.8^{a}	4.6^{b}	50.6^{bc}	46.8^{ab}	2.3^{a}	2.6^{ab}
100% NPK17-17-17 +100% vermicompost	11.9^{a}	20.7^{ab}	4.8^{a}	4.3^{b}	50.8^{bc}	49.4^{ab}	2.4^{a}	3.4^{bc}
25% NPK17-17-17 +100% vermicompost	12.1^{a}	19.3^{ab}	5.3^{a}	4.4^{b}	51.8^{bc}	47.2^{ab}	3.5^{bc}	2.9^{ab}
50% NPK17-17-17 +100% vermicompost	12.5^{a}	20.4^{ab}	5.2^{a}	5.0^{b}	53.0^{bc}	51.5^{b}	3.3^{bc}	3.2^{abc}
75% NPK17-17-17 +100% vermicompost	15.5^{a}	22.4^{b}	5.2^{a}	4.4^{b}	49.8^{b}	46.7^{ab}	2.8^{ab}	2.4^{a}
100% NPK 17-17-17 + 100% Farmyard manure (10t/ha)	17.3^{a}	21.3^{b}	4.5^{a}	4.6^{b}	52.9^{bc}	48.1^{ab}	3.0^{abc}	2.8^{ab}
50% NPK17-17-17 + 50% vermicompost	15.5^{a}	21.3^{b}	5.1^{a}	4.6^{b}	54.7^{c}	51.4^{b}	3.7^{c}	3.8^{c}
P(0.05)	0.045	0.019	0.425	0.128	0.001	0.242	0.007	0.019
CV (%)	23.2	3.4	4	1.2	2.6	2.7	6.4	6.7
LSD	6.75	3.56	0.86	0.63	3.6	8.9	793.1	852.5

*Means with the same letter are not significantly different

Yet in control the weight was low compared to the rest of treatments.

The results are similar to those of Yatsenko et al. (2019) who found that vermicompost improved yield, nutritional value and antibacterial properties in garlic (*Allium sativum* L.) and those reported by Singh et al. (2010) who found that application of vermicompost resulted in higher marketable fruits. The results showed that there was significance difference (p=0.007) between treatment's effects on total yield in season A. The highest yield (3.7 t/ha) was recorded in treatment with 50% NPK17-17-17 + 50% vermicompost) and the lowest weight (2.3t/ha) was recorded in control. In season B there was significant difference at p=0.019 and the highest mean weight

(3.8t/ha) was recorded in treatment with 50% NPK17-17-17 + 50% vermicompost while the lowest mean weight (2.3t/ha) was recorded in control. The difference might have been due to the fact that synergism of vermicompost and mineral NPK 17-17-17 improve the physical, chemical and biological properties of soils including supply of almost all the essential plant nutrients for the growth and development of plant which affect both growth and yield parameters. Similar results were reported by Meena et al. (2015) who reported the influence of bioinorganic combinations on yield, quality and economics of mung beans.

Nutritional value of fortified beans

Iron content

Results indicated that there was a highly significant difference ($p<.001$) between treatments in season A on iron content (table 4 and figure 3). The highest iron (10mg/100g) recorded in treatment that received 50% NPK 17-17-17 + 50% vermicompost whereas the lowest quantity (4mg/100g) was recorded in control. Furthermore, in season B, the highest iron content (9.4mg/100g) was recorded in treatment with 50% NPK 17-17-17 + 50% vermicompost while the lowest (5.6mg/100g) was found in control. This may be attributed to the fact that during the decomposition process of vermicompost there are release of micronutrients including iron and roots absorb it and translocate it to the rest parts of the crop. Similar results were found by Chandan and Azad (2015) who stated that growth of vegetable transplants was positively affected by addition of vermicompost, perhaps by altering the nutritional balance of the medium.

Zinc content

The results from laboratory analysis indicated that there was no significant difference ($p>0.05$) for zinc, in both two seasons (table 4 and figure 3). In season A, the highest zinc (7.9mg/100g) was recorded in plots where 50% NPK17-17-17 + 50% vermicompost was applied while the lowest (5.1mg/100g) was recorded in control. However, in season B the high mean value (7mg/100g) was recorded in treatment treated with 75% NPK 17-17-17 +100% vermicompost and the low mean value (5mg/100g) was found in control. These results are in line with Chand et al. (2011) who reported an enhanced increase in zinc due the supply of organic and inorganic realizers in rose scented geranium (Pelargonium species).

Calcium content

Results indicated that calcium content in beans was significantly different in seasons A ($p=0.034$). The highest value (187mg/100g) was recorded in treatment that received 50% NPK (17-17-17) +100% vermicompost whereas low proportions of calcium (126.8mg/100g) were recorded in control (table 4 and figure 3). Yet in season B there was highly significant differences ($p <.001$) between treatments in calcium contents of beans, the highest mean value (187mg/100g) was recorded in treatment with 50% NPK 17-17-17 + 100% vermicompost and the lowest value of 127mg/100g was recorded in control.

The difference in calcium content could be attributed to the fact that the decomposition of vermicompost releases macronutrients including calcium which increase the amount of calcium that are absorbed by beans. In addition, the higher content of Calcium in plots treated with 50% NPK17-17-17 +100% vermicompost may be resulted from increased uptake of Ca^{2+} ions from the soil. Similar findings were reported by Kumari and Ushakumari (2006) when they assessed the effect of vermicompost enriched with rock phosphate on the yield and uptake of nutrients in cowpea (*Vigna unguiculata*).

Potassium content

Results indicated that there is significant difference ($p<.001$) in potassium content in beans for both seasons (table 4 and figure 3). In season A, the highest mean value of (177mg/100g) was recorded in treatment with 25% NPK 17-17-17 +100% vermicompost and the lowest value of 129mg/100g in control. The results recorded in season B showed that the highest potassium content (158.7mg/100g) was recorded in treatment with 50% NPK (17-17-17) + 50% vermicompost while the lowest value (150.4mg/100g) was recorded in control. The effect of vermicompost with NPK 17-17-17was observed. Similar results were reported by Arsalan et al. (2016) reported that there was an increase of phosphorus and potassium which enhance mung beans growth and nutrient uptake.

Magnesium content

Results indicated that magnesium content in harvested beans was significantly different ($p<0.05$) in both seasons (table 4 and figure 3). In season A, the highest mean value (127.3mg/100g) was recorded in treatment with 100% NPK 17-17-17 + 100% of farmyard manure while the low mean value (111.5mg/100g) was obtained in plot fertilized with 100% vermicompost + 100% NPK 17-17-17. Contrary, the highest value (121.8mg/100g) was found in treatment with 50% NPK17-17-17 +100% vermicompost and the lowest value of (110.5 mg/100g) was found in control for the results of season B. The effect on magnesium content might have been due the fact that an improved supply of potassium enhances the absorption of magnesium by the crop. This is supported by Altarugio et al. (2017) who reported an increase in magnesium content in rice (Oryza sativa) influenced by potassium application in soil.

Proteins

The results showed that there is a significant difference ($p=0.032$) in protein content for beans cultivated in season A (table 4 and figure 3). The high mean protein content (24g/100g) was recorded in treatment with 50% NPK 17-

17-17 + 50% vermicompost and the low mean value (18.5g/100) was recorded in control. In season B, there was no significantt difference (p>0.05) and the highest value (23.3g/100g) was recorded in treatment with 75% NPK 17-17-17 +100% vermicompost whereas the low mean value (18.3g/100g) was recorded in control. The effect of fertilizer application on protein content may be resulted from the release of nitrate (NO^{3-}) ions from vermicompost plus a fast release of NO^{3-} from mineral NPK which is the more available form of nitrogen for plant absorption. Additionally, nitrogen is the basis of amino acids synthesis that are essential components of proteins. These findings are in harmony with Khaim et al. (2013) on soybean and El-Hassan et al. (2013) on green beans who reported an increase of protein contents after application of vermicompost.

Table 4. Effect of vermicompost only and in combination with NPK 17-17-17 on nutritional content

Treatments	Iron (mg/100g)		Zinc (mg/100g)		Calcium (mg/100g)		Potassium (mg/100g)		Protein (%)		Magnesium (mg/100g)	
	Season A	Season B	Season A	Season B	Season A	Season B	Season A	Season B	Season A	Season B	Season A	Season B
T0	4.0^{a}	5.6^{a}	5.0^{a}	5.0^{a}	126.8^{ab}	126.8^{a}	129.0^{a}	150.4^{bc}	18.5^{a}	18.3^{a}	112.8^{a}	110.5^{a}
T1	6.0^{bc}	7.2^{abc}	6.8^{ab}	5.7^{ab}	156.1^{bcd}	160^{bcd}	143.6^{b}	156.4^{c}	22.7^{a}	22.5^{a}	115.7^{ab}	121.4^{b}
T2	6.0^{b}	7.2^{abc}	5.3^{a}	5.6^{ab}	129.1^{ab}	137.8^{ab}	149.4^{bcd}	152.8^{bc}	22.8^{a}	23.0^{a}	121.5^{ab}	114.6^{ab}
T3	6.7^{bcd}	6.7^{ab}	5.8^{a}	5.8^{abc}	137.5^{abc}	137.5^{ab}	156.4^{cd}	177.3^{d}	21.9^{a}	21.9^{a}	110.6^{a}	118.2^{ab}
T4	6.9^{bcd}	6.8^{ab}	5.4^{a}	5.3^{a}	142.4^{abcd}	142.3^{a}	160.0^{d}	156.3^{c}	22.8^{a}	22.7^{a}	111.2^{a}	111.1^{a}
T5	8.2^{de}	8.2^{bc}	6.2^{ab}	6.1^{abc}	146.9^{bcd}	142.8^{ab}	158.8^{cd}	156.7^{c}	19.4^{a}	22.6^{a}	112.5^{a}	113.0^{a}
T6	7.6^{cd}	7.5^{abc}	5.7^{a}	5.6^{ab}	130.0^{ab}	136.8^{ab}	147.3^{bc}	147.2^{bc}	20.8^{a}	20.8^{a}	111.5^{a}	111.4^{a}
T7	7.0^{bcd}	6.8^{ab}	5.2^{a}	5.5^{ab}	181.3^{cd}	178.6^{de}	177.0^{e}	127.8^{a}	23.1^{a}	22.4^{a}	115.4^{ab}	115.4^{ab}
T8	6.9^{bcd}	6.9^{ab}	5.4^{a}	5.3^{a}	187.0^{d}	186.9^{e}	129.4^{a}	129.4^{a}	22.2^{a}	22.1^{a}	122.4^{ab}	121.8^{b}
T9	7.6^{cd}	7.5^{abc}	5.7^{a}	7.0^{c}	169.7^{bcd}	169.7^{cde}	140.1^{ab}	140.0^{ab}	23.4^{a}	23.3^{a}	117.6^{ab}	117.6^{ab}
T10	9.6^{ef}	7.7^{abc}	6.9^{ab}	5.8^{abc}	95.7^{a}	154.3^{bcd}	150.3^{bcd}	145.7^{bc}	22.9^{a}	24.0^{a}	127.3^{b}	114.1^{ab}
T11	9.9^{f}	9.4^{c}	7.9^{a}	6.7^{bc}	142.6^{abcd}	147.4^{abc}	159.8^{d}	158.7^{c}	24.0^{a}	23.7^{a}	111.7^{a}	112.2^{a}
P(0.05)	<.001	0.096	0.06	0.07	0.034	<.001	<.001	<.001	0.032	0.824	0.023	0.026
CV (%)	3.5	10.2	0.052	4.4	3.3	10.6	0.5	2.3	0.823	5.3	0.117	2.2
LSD	1.413	1.968	1.661	1.147	42.06	22.94	10.94	12.61	6.353	5.851	11.75	7.005

Conclusions

The improvement of crops' yield is generally correlated with plant's growth. However, the application of inorganic fertilizers without complementing them with organic manure or vermicompost resulted in low yield. The same observations were encountered when the plots received solely vermicompost. The rate of fertilizer's application was not associated with the increase of nutritional content of beans. However, the rate of 150kgs/ha of NPK 17-17-17 in combination with vermicompost at the rate of 5t/ha should recommended as it has proven its ability to increase plant growth and yield without disheartening the nutritional content of dried beans.

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Artificial Intelligence Applications In Livestock

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Abstract
Artificial intelligence has begun to be used in almost every field today. One of these areas is animal production. With the help of artificial intelligence in animal production, animal welfare, animal health, disease detection, and classification, yield and performance monitoring, herd management, treatment follow-up, trace and record analysis, epidemiology, herd health, population follow-up, tracking of zoonotic diseases, individual animal behavior, animal It contribute to the access to the most accurate information in a short time on subjects such as interaction, nutrition tracking, and mood. Wearable sensors, functional near infrared spectroscopy measurements, multimode sensors, biometric sensors, video and thermal imaging cameras, microphones and functional near infrared spectroscopy sensors, skin impedance sensors, digital twin modeling, multimode, biometric sensor, respirometers to obtain this information (respiration rate), heart rate monitor, accelerometers and visual sensors are used to obtain information about the animal's condition. This study, it is aimed to give information about artificial intelligence infrastructure applications in animal production.
Keywords: *Artificial intelligence, animal, animal production, data analysis*

Hayvancılıkta Yapay Zeka Uygulamaları

Özet
Yapay zeka günümüzde neredeyse her alanda kullanılmaya başlanmıştır. Bu alanlardan biriside hayvansal üretimdir. Hayvansal üretimde yapay zeka yardımıyla hayvan refahı, hayvan sağlığı, hastalık tespiti ve sınıflandırılması, verim ve performans takibi, sürü yönetimi, uygulanan tedavi takibi, iz ve kayıt analizi, epidemiyoloji, sürü sağlığı, popülasyon takibi, zoonotik hastalıkların takibi, bireysel hayvan davranışı, hayvan etkileşimi, beslenme takibi ve duygu durumu gibi konularda kısa sürede en doğru bilgiye erişimi katkı sağlamaktadır. Bu bilgilerin elde edilmesi için giyilebilir sensörler, fonksiyonel yakın kızılötesi spektroskopi ölçümler, çok modlu sensörler, biyometrik sensörler, video ve termal görüntüleme kameraları, mikrofonlar ve fonksiyonel yakın kızılötesi spektroskopi sensörleri, cilt empedans sensörleri, dijital ikiz modelleme, çok modlu, biyometrik sensör, respirometreler (solunum hızı), kalp hızı ölçer, ivmeölçerler ve görsel sensörler kullanılarak hayvanın durumu hakkında bilgi edinilmektedir. Yapılan bu çalışmada hayvansal üretimde yapay zeka altyapılı uygulamaları hakkında bilgi vermek amaçlanmıştır.
Anahtar Kelimeler: *Yapay zeka, hayvan, hayvansal üretim, veri analizi*

ID:402

Disease Diagnosis In Animals With Artificial Intelligence Based Odor Detection Sensors

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Abstract

Artificial intelligence is used in every field, especially in robots, devices, voice assistants, and health services. In addition to these, artificial intelligence applications in the field of animal production have been increasing in recent years. Determining the characteristics of animals such as nutrition, health, efficiency, and performance, artificial intelligence applications provide access to reliable information both easily and in a short time. Thanks to the developed sensors, it is very easy to obtain information about the condition of the animal. However, the number of commonly used sensors, such as disease diagnosis in animals, is limited. One of the sensors used in the diagnosis of diseases in animals is odor sensors. In odor sensors, odor data collection, data preprocessing, feature extraction-size reduction, automatic encoder, classification, evaluation-verification of prediction by classifiers, data preparation, data preprocessing, normalization, and principal component analysis, feature extraction method, automatic encoder, classification, estimation, and verification stages are used. Thanks to the data obtained from these stages, it helps to control animal diseases of domestic and farm animals, prevent economic losses, and to obtain reliable results in a short time. This study, it is aimed to give information about the ways followed in determining the diagnosis of disease by using odor detection sensors and artificial intelligence in animals.

Keywords: *Animal, sensor, odor perception, artificial intelligence, data analysis*

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Some Digestive Respiratory And Nervous Diseases Observed In Poultry

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Abstract
We consume products of plant and animal origin for a healthy and balanced diet. Among the products of animal origin, products derived from poultry are cheaper than other animal products. Due to its nutrient content and affordable price, its consumption is increasing day by day around the world. With this increasing amount of production, it draws attention to various problems in enterprises. Among these are some digestive, respiratory, and nervous diseases observed in poultry. Diseases such as maw perforation, cloaca prolapse, sinusitis, rupture of the cervicocephalic air sacs, trauma, and Horner's syndrome closely affect the yield and performance of animals. In some cases, it can lead to the death of animals in enterprises. This causes serious economic losses for businesses. This study, it is aimed to give information about some digestive, respiratory, and nervous diseases observed in poultry.
Keywords: *poultry; disease; digestion; respiration; nervous*

ID:404

Macro-Anatomical Studies on the Skeletal System of Mammals. II. Ossa Membri Pelvini

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Abstract

The free part of the hind leg is attached to via the os coxae, called the cingulum membrane pelvis. The os coxae of each side both connect with each other via the symphysis pelvina located in the ventro-median, and articulate with the os sacrum inserted between its craniodorsal ends, thus forming a structure called the pelvis. The os coxae is formed by the union of three bones, os ilium, os ischii, and os pubis. The relevant parts of these three bones are fused with each other to form a central and deep pit called the acetabulum. Tuber coxae; equus, it is in the form of a rectangular shape in the middle, in ruminant it has a high center and flattened sides. Incisura acetabuli; It is wide in equus and carnivores, narrow in ruminants and pigs. Tuber ischiadicum; carnivores and pigs have one, equus with two ridges, and ruminant with three ridges. Articulating with the acetabulum, the femur is the longest and thickest of the skeletal bones. Trochanter major is divided into atta incisura trochanterica and pars cranialis and pars caudalis only. Again, only in the middle 1/3 of the length of the femur in the horse, there is the trochanter tertius on the lateral side. Equus and ruminant have fossa supracondylaris, while carnivores and pigs have tuberositas supracondylaris. The patella is a bone located in front of the trochlea ossis femoris and connected to it by joint. Ossa cruris; It consists of the tibia on the inside and the fibula on the outside. On the Tuberositas tibiae is the sulcus tuberositatis tibiae. Skeleton pedis; It consists of ankle bones (ossa tarsitarsus), metatarsal bones (ossa metatarsi-metatarsus) and toe bones (ossa digitorum pedis).

Key Words: Ossa membri pelvini, acetabulum, femur, ossa cruris, skeleton pedis.

Memelilerin İskelet Sistemi Üzerine Makro-Anatomik İncelemeler. II. Ossa Membri Pelvini.

Özet

Arka bacağın serbest olan kısmı cingulum membri pelvini denilen os coxae aracılığı ile omurgaya bağlanmıştır. Her bir tarafın os coxae'sı hem ventro-medianda yer alan symphysis pelvina vasıtasıyla birbiriyle birleşir, hem de craniodorsal uçları arasına sokulmuş olan os sacrum ile eklem yapar, böylece pelvis denilen bir yapı oluşur. Os coxae, üç kemiğin yani os ilium, os ischii ve os pubis'in birleşmesiyle oluşur. Bu üç kemiğin ilgili bölümleri aralarında acetabulum denilen merkezi ve derin bir çukur oluşturacak şekilde birbirleriyle birleşmişlerdir. Tuber coxae; equus'ta ortadan basık bir dikdörtgen şeklinde, ruminant'ta ortası yüksek, yanları basık bir çıkıntılıdır. İncisura acetabuli; equus ve carnivorda geniş, ruminant ve domuzda dardır. Tuber ischiadicum; carnivor ve domuzda tek, equus'ta iki çıkıntılı, ruminant'ta üç çıkıntılıdır. Acetabulum ile eklem yapan femur, iskelet kemiklerinin en uzunu ve en kalınıdır. Trochanter major, sadece atta incisura trochanterica ile pars cranialis ve pars caudalis diye ikiye ayrılmıştır. Yine sadece atta femurun uzunluğu orta 1/3'ünde, lateral tarafta trochanter tertius bulunur. Equus ve ruminant'ta fossa supracondylaris, carnivor ve domuzda ise tuberositas supracondylaris mevcuttur. Patella, trochlea ossis femoris'in önünde yer alan ve ona eklemle bağlanan bir kemiktir. Ossa cruris; iç tarafta bulunan tibia, dış tarafta yer alan fibula'dan oluşur. Tuberositas tibiae üzerinde sulcus tuberositatis tibiae vardır. Skeleton pedis (Arka Ayak İskeleti); ayak bilek kemikleri (ossa tarsi- tarsus), ayak tarak kemikleri (ossa metatarsi-metatarsus) ve ayak parmak kemiklerinden (ossa digitorum pedis) meydana gelir.

Anahtar Kelimeler: Ossa membri pelvini, acetabulum, femur, ossa cruris, skeleton pedis.

Introduction

The free part of the hind leg is attached to the spine via the os coxae. In the ventro-median, the os coxae unite with each other through the symphysis pelvina, and in the craniodorsal they articulate with the os sacrum, which is inserted between its ends, to form the structure called the pelvis (Dursun, 2008; Bahadır and Yıldız, 2008). Os coxae; It is formed by the union of the os ilium, os ischii, and os pubis. The corpuscles of these three bones fuse with each other to form a central and deep pit between them, called the acetabulum. The acetabulum is a pit that articulates with the caput ossis femoris (Evans and Christensen, 1979). The femur is one of the longest and thickest bones of the skeletal bones. It consists of three parts, the upper end, the body and the lower end. The patella is located in front of the trochlea ossis femoris, which is located at its lower end. Patella, m. It is the largest sesame bone in the body, embedded in the tendon of the quadriceps femoris. Ossa cruris; It consists of the tibia on the inside and the fibula on the outside. Skeleton pedis; ossa tarsi, ossa metatarsi and ossa digitorum pedis are divided into three sections (Dursun, 2008; Getty, 1975; Bahadır and Yıldız, 2008).

Materials and Methods

The methods specified in the literature (Taşbaş, 1966) are applied to the bones of the hind legs so as not to damage the bones from the cadaver. The muscle and tissue parts on it are cleaned and the bones are boiled with 100 milliliters of washing soda in 1 liter of water. During the boiling phase, the bones are checked regularly and the meat and cartilaginous structures on the bones are removed. Then, the bones are boiled until the small pieces of meat are completely removed, the water is drained, then washed with soapy water, cleaned and left to dry. The hind leg bones, which are examined macro-anatomically, are photographed from various angles. The terminology was based on Nomina Anatomica Veterineria (N.A.V.) (Anonymous., 2012).

Results and Discussion

The hind leg articulates with the spine via the os coxae. Left and right, the os coxae unite with each other via the symphysis pelvina located in the ventro-median. Articulating with the os sacrum, which is inserted between the craniodorsal ends, a structure called the pelvis is formed.

Os Coxae

The os coxae is formed by the union of three bones, os ilium, os ischii, and os pubis. The corpus of these three bones are fused with each other to form a central and deep pit between them, called the acetabulum. The acetabulum is a pit that articulates with the caput ossis femoris. Facies lunata on the inner surface of the acetabulum articulate with the caput ossis femoris of the femur.

Os İlium

It shapes the anterior and upper parts of the os coxae. It has two parts: Corpus ossis ilii and ala ossis ilii. There are two shallow areas located ventrolaterally close to the acetabulum. M. rectus femoris to these small, sometimes deep and wide areas, area lateralis m. recti femoris and area medialis m. It is called recti femoris. Ala ossis ilii is the wing-shaped, thin and wide part of the os ileum. It has two faces, called facies glutea and facies sacropelvina, and edges called cranio-dorsal, dorso-medial, and ventro-lateral.

The cranio-dorsal edge of the os ileum is called the crista iliaca. The ventrolateral edge of the os ileum extends to the acetabulum, it is a concave edge. The lateral corner projection between the craniodorsal edge (crista iliaca) and the ventrolateral edge is called the tuber coxae (spina iliaca ventralis), and the medial corner projection between the crista iliaca and the dorsomedial edge is called the tuber sacrale (spina iliaca dorsalis). The third border of the os ileum is the dorsomedial border. It merges with the dorsal edge of os ischii. It has a rough, elongated formation on it. This formation is called spina ischiadica. The notch in front of the spina ischiadica is called incisura ischiadica major, and the notch behind it is called incisura ischiadica minor.

Çevik-Demirkaan et al. (2007) reported that the linea arcuata in chinchillas has a distinct crista shape. Linea arcuata is not prominent in wild boars (Karan, 2012).

Tuber coxae; It is in the form of a rectangular flattened in the horse, a high in the middle and flattened sides in the cattle. Crista iliaca; It is convex in pig and dog, concave in sheep and goat. Spina ischiadica; blunt and low in horse, high in the middle and flattened sides in cattle, spina ischiadica sharp and high in pig, high and sharp in sheep and goat, blunt and low in dog. Incisura acetabuli; It is wide in horse and dog, narrow in ruminant and pig.

Os İschii

The os ischii forms the posterior and lower parts of the os coxae. It has two parts, corpus ossis ischii and ramus ossis ischii. The widest and straightest part of os ischii is called tabula ossis ischii.

Os ischii has two faces and three edges. One of its faces is the inner surface facing the pelvic cavity, the other is the outer surface facing the ventral.

It has three margins, lateral, medial and caudal. Lateral margin extends from acetabulum to tuber ischiadicum, is concave. The caudal edge fuses with the caudal edge of the similar bone of the opposite side, forming a caudale open arch called the arcus ischiadicus. Arcus ischiadicus is narrow and deep in badger (Özdemir and Karan, 2001) and wolf (Girgin et al., 1988), moderately deep in fox (Girgin et al., 1988), porcupine with arrows (Yilmaz et al., 1999) and it has been reported to be superficial in dogs (Girgin et al., 1988). Since arcus ischiadicus is narrow and deep in wild boars, it is similar to badger and wolf.

At the junction of the caudal edge with the lateral edge, there is a protuberance called the tuber ischiadicum. It shapes spina ischiadica at the level of the acetabulum. Tuber ischiadicum; It has two ridges in horses, three in ruminants, and one in pigs and dogs. Tuber ischiadicum has one ridge in porcupine (Yilmaz et al., 1999) and hedgehog (Özkan, 2002), three in ruminants (Getty, 1975), badger (Özdemir and Karan, 2001) and two in domestic pigs (Getty, 1975). has been reported. In wild boars, tuber ischiadicum has three protrusions as in ruminants (Karan, 2012).

Os Pubis

The os pubis forms the anterior and lower parts of the os coxae. It borders the foramen obturatum anteriorly and medially. It has three parts: corpus ossis pubis, ramus cranialis ossis pubis, and ramus caudalis ossis pubis. Corpus ossis pubis is the part of the os pubis that participates in the formation of the acetabulum. It is the body of the bone. The ramus cranialis ossis pubis forms a right angle with the ramus caudalis ossis pubis. It advances to the

acetabulum in front of the foramen obturatum and joins with the corpus ossis pubis, which participates in the formation of this formation. The anterior margin of the ramus cranialis ossis pubis makes a sharp-edged depression. This is called pecten ossis pubis. Again on the same margin, lateral to the pecten ossis pubis and near the acetabulum, there is a ridge on the junction of the os ileum and ramus cranialis ossis pubis, called eminentia iliopubica. Ramus caudalis ossis, there are protuberances on the dorsal and ventral of the angle where the pubis joins with the ramus cranialis ossis pubis, the situations of which vary according to the animal species. The dorsal one is called tuberculum pubicum dorsale, and the ventral one is called tuberculum pubicum ventrale.

Foramen Obturatum

It is a large hole at the base of the os coxae, formed by the os pubis and os ischii. This hole was closed with the membrana obturatoria. Anterior and slightly lateral to the foramen obturatum is the sulcus obturatorius.

Since the mambrana obturatoria does not partially cover this groove, a channel is formed here, it is called canalis obturatorius. From this channel a. obturatoria, v. obturatori and n. obturatorius passes. Foramen obturatum; badger (Özdemir and Karan 2001), marten (Atalar and Özdemir, 2002), squirrel (Özdemir and Atalar, 2003), porcupine (Özkan, 2002), wolf, fox, dog (Girgin et al., 1988) and hedgehogs (Özkan, 2002) and wild boars (Karan, 2012).

Skeleton Femoris

Os Femoris

The femur is the longest and thickest of the skeletal bones. The bone consists of three parts, the upper end, the body, and the lower end. At its upper end (extremitas proximalis), there is a spherical structure that is mostly flat and covered with articular cartilage. This structure is called the caput ossis femoris.

The caput ossis femoris faces upward and medially and articulates with the acetabulum. In the posterior lower part of the articular surface, there is a small pit called the fovea capitis. While the trochanter major is in one piece in the ruminant, it is divided into incisura trochanterica and pars cranialis and pars caudalis in the horse. Trochanter major; It is at the level of the caput ossis femoris in dogs, and slightly above the level of the caput ossis femoris in sheep and goats.

In the dog (Evans and Christensen, 1979), the trochanter major is at the same level as the caput ossis femoris; In otters (Dinç et al., 1999), it has been reported to be below the caput ossis femoris level.

Trochanter minor; It is a long and sharp crista in horses, a minor rounded ridge in cattle, and a flattened, broad ridge in pigs.

At the middle 1/3 of the length of the femur, there is the trochanter tertius on the lateral side. Evans and Christensen (1979) found that trochanter tertius was not found in dogs, Özdemir and Karan (2001) in badgers; Dinc et al. (1999) stated that in otters, Atalar and Özdemir (2002) stated that the trochanter tertius is in the form of a crista in marten.

Fossa supracondylaris; very deep in horse, shallow in cattle, tuberositas supracondylaris in place of fossa supracondylaris in pig and dog. Tuberositas supracondylaris in wild boars (Karan, 2012) in dogs, wolves, foxes (Girgin et al., 1988), otters (Dinç et al., 1999), domestic pigs (Getty, 1975) and badgers (Özdemir and Karan 2001). whereas, the fossa supracondylaris lateralis is located at the site of this formation.

Patella

The patella is a bone located in front of the trochlea ossis femoris and connected to it by joint. It is the largest sesame bone in the body, embedded in the tendon of the quadriceps femoris. Patella has two parts called basis patellae and apex patellae, facies articularis and facies cranialis.

Patella; oblong in horse, triangular in cattle, patella of other animals more or less oval.

Skeleton Cruris

Ossa Cruris

Leg bones correspond to skeleton antebrachii in the forelimb. As in the front leg, there are two bones here. Ossa cruris; It consists of the tibia on the inside and the fibula on the outside.

Tibia

This bone is the longest bone in the body after the femur. It is located on the medial side of the leg skeleton. It articulates with the os femoris above and with the ossa tarsi below.

Extremitas proximalis is more voluminous than extremitas distalis. This end carries two large formations, condylus medialis and condylus lateralis. These two condyles are separated from each other by the anterior and external sulcus extensorius and posterior incisura poplitea.

In front of the upper end of the tibia is a projection called the tuberositas tibiae. Above this protrusion is a groove, sulcus tuberositas tibiae, to which the ligamentum patellae intermedium attaches. Getty (12) reported that the tuberculum intercondylare mediale is higher than the tuberculum intercondylare laterale in the equidae and ruminant. Tuberculum intercondylare laterale is higher in wild boars (Karan, 2012).

Corpus tibiae, three margins particularly prominent on the upper half; margo cranialis, margo medialis, margo lateralis and the three faces bounded by these edges show facies medialis, facies lateralis and facies caudalis.

The distal end of the tibia is called the cochlea tibiae. On the inner side of the lower end of the tibia, there is a protrusion that elongates distally, this protrusion is called the malleolus medialis. There is a longitudinal groove,

sulcus malleolaris, on the outer surface of the malleolus medialis. There is also a protrusion on the outer side of the lower end of the tibia. This is the malleolus lateralis. It has been reported that the articular surface of the tibia of the cochlea is divided into two by a sagittal crista in goats (Taşbaş, 1978) and porcupines (Yilmaz et al., 1999), and by an oblique crista in dogs (Girgin et al., 1988).

The surface of the distal end of the tibia, which articulates with the tarsal bones, is divided into two articular pits by means of an oblique (lateral) axis in the equidae and carnivores, and a sagittal ridge in the ruminant.

Atta, there is sulcus tuberositatis tibiae on tuberositas tibiae. Articular surface at the distal end; It is divided into two articular pits by means of an oblique in horse and dog and a sagittal crista in ruminant. In the ruminant, there is a third articular surface specific to the articulation of the os malleolare.

Fibula

It is a thin, long bone located lateral to the tibia. Although it is present in some of the species completely, in some it has been atrophied and in some it has disappeared completely.

The fibula is fully present only in pigs and carnivores. It extends to the distal end of the tibia, or even a little lower. In these species, the fibula is examined by dividing it into two ends and a body. In the equidaé, the lower half of the fibula fuses with the tibia at an early age. For this reason, the fibula has an upper end called the caput fibulae and a free part of the tibia that can only reach the middle.

The corpus fibulae of the fibula in the ruminant has completely disappeared. The caput fibulae is found as a small protrusion attached to the lateral condylus of the tibia, or even fused. Its distal end forms a small special bone called the os malleolare.

In pig and carnivores, it consists of three parts. Its upper end is called the caput fibulae. Between the caput and corpus of the fibula is an indistinct collum fibulae. The lower end of the fibula is called the malleolus lateralis. Medial to this end is an articular surface, facies articularis malleoli, which articulates with the talus. A groove called sulcus malleolaris is also seen on the outer surface of the malleolus lateralis.

Demirsoy (1992) stated that the tibia and fibula may be separated or fused in rodents. In porcupines with arrows, the fibula fused with the tibia proximally and formed a joint distally (Yilmaz et al., 1999).

Skeleton Pedis

Skeleton pedis; It consists of ankle bones (ossa tarsitarsus), metatarsal bones (ossa metatarsi-metatarsus) and toe bones (ossa digitorum pedis).

Talus

It is the second largest bone of the tarsal bones after the calcaneus. It is divided into three parts: caput tali, collum tali and corpus tali.

In ruminants and pigs, the caput tali forms a depression between two convex sides in the dorsoplantar direction and between these two edges. Collum tali is the neck part that is wide and short in the equidae and not very prominent in other animals.

The trochlea tali is similar to the articular surfaces of the cochlea tibia, that is, it is bordered by two sides oblique in the equidae and sagittal in the ruminant.

It is in the form of two overlapping trochlea, the trochlea tali ruminant and the susta trochlea tali proximalis and trochlea tali distalis. Trochlea subordinate; In horse the body is oblique with respect to its long axis and there is one, in cattle it is limited by two sides parallel to the long axis of the body and there are two on each other.

Calcaneus

It is the largest of the tarsal bones. It is located behind the talus. The free end of the calcaneus, which is raised and not articular, is called the tuber calcanei. Distal to the margin in front of the free segment proximal to the calcaneus, there is a pointed protrusion elongated anteriorly. This protrusion, called the processus coracoidceus, is best seen on the equidae.

Arranged from medial to lateral in the distal row of tarsus bones; There are four bones named os tarsale primum, os tarsale secundum, os tarsale tertium, os tarsale quartum. This number and order only applies to carnivores and sus. Because there is no fusion between bones in these animals. In equidae, os tarsale primum and os tarsale secundum are fused. Therefore, there are three bones in this row. In the ruminant, the distal row bones are two due to the fusion of the os tarsale secundum and the os tarsale tertium and the fusion of the os tarsale quartum with the os tarsi centrale.

It was stated that there is a bone called scaphoide accessoire by Romer and Parsons (1978) in the medial of the os naviculare (os scaphoideum or os tarsi centrale) in the ankle bones of rodents such as Marmota and Myopotamus. The bone in question was also found to be located in the medial of the collum tali and the dorso-medial of the os naviculare in porcupines (Yilmaz, 1999).

Metatarsus

It is located between the tarsal bones and the phalanges. They are arranged parallel to each other and from medial to lateral; It is called os metatarsale primum, os metatarsale secundum, os metatarsale tertium, os metatarsale quartum, os metatarsale quintum.

Equidae has three metatarsus. These are the 2nd, 3rd and 4th metatarsus. The main metatarsus, which is in the middle and number 3 (os metatarsale tertium), and metatarsus number 2 and 4, located on both sides of the plantar surface of the main metatarsus, are the secondary metatarsus. Metatarsus 1 and 5 are absent.
Ruminant has three metatarsus. These are the 2nd, 3rd and 4th metatarsus. Numbers 3 and 4 were fused with each other and a single metatarsus was formed. Metatarsus 2 is attached to the posterior side of the upper end of metatarsus 3 as a small bone. Metatarsus 1 and 5 are absent.
There are four metatarsus in sus. These are the 2nd, 3rd, 4th and 5th metatarsus. The number 1 metatarsus is absent. Metatarsals 3 and 4 are the main metatarsal bones and are adhered to each other, there is no fusion. Metatarsus 2 and 5 are secondary ones.
Carnivores have five metatarsus.

Ossa Digitorum Pedis

These are the bones that come after the metatarsal bones. In species with a full number of fingers (carnivores), they are called the first, second, third, fourth and fifth fingers from the inside out.
The number of fingers is equal to the number of the main metatarsus. Equidae has 1 finger because there is one main metatarsus, and there are 2 fingers because there are two main metatarsus in the ruminant. Each finger has three phalanges. These are phalanx proximalis, phlanx media and phalanx distalis.
Demirsoy (1992) and Yilmaz et al. (1999) found that porcupines have short legs, while Demirsoy (1992) and Oktay (1988) found that there are five fingers on the extremities.

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Macro-anatomical Comparison of Celiac Artery in Hasak and Hasmer Sheep

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Abstract
This research was carried out to analyze the macro-anatomically of celiac artery and its branches, which is the common root of the vessels that provide nutrition to the stomach, liver, spleen and pancreas and the initial parts of the small intestine in hasak and hasmer sheep breeds. Six hasak and hasmer sheep were used in the study. Colored latex and monopolymethymethacrylate were given to the abdominal aorta. In both sheep breeds, it was determined that the first branch of the abdominal aorta in the cavum abdominis was celiac artery. Celiac artery first originated from lineal artery and then hepatic artery and gastric sinister artery as a common root. Branches named rami pancreatic rami, epiploic ramus, ruminal sinister artery and ruminal dexter artery originated from lineal artery. It was determined that hepatic artery gave cystic artery, gastric dexter artery, pancreatic rami and gastroduodenal artery. Gastric sinister artery was continuing its course as a continuation of celiac artery. During its course, the reticular artery was giving off gastroepiploic sinister artery and reticular accessory artery. As a result; It was determined that the veins originating from celiac artery in hasak and hasmer sheep breeds had some differences. It was concluded that these differences may be due to the genetic structure of the breeds.
Key Words: Anatomy, celiac artery, hasak, hasmer, sheep.

Hasak ve Hasmer Koyunlarında Arteria Celiaca'nın Makro-anatomik Olarak Karşılaştırılması

Özet
Bu araştırma, hasak ve hasmer koyun ırklarında mide, karaciğer, dalak, pankreasın ve ince bağırsağın ilk kısımlarının beslenmesini sağlayan damarların ortak kökü olan arteria celiaca'nın ve dallarının makro-anatomik olarak incelenmesi amacıyla yapılmıştır. Çalışmada altışar adet hasak ve hasmer koyun kullanıldı. Abdominal aortaya renkli lateks ve monopolimetilmetakrilat verildi. Her iki koyun ırkında da aorta abdominalisin cavum abdominis içindeki ilk dalının arteria celiaca olduğu belirlendi. Arteria celiaca, önce lineal arterden, daha sonra ortak bir kök olarak hepatik arter ve gastrik sinister arterden köken almıştır. Lineal arterden köken alan rami pankreatik rami, epiploik ramus, ruminal sinister arter ve ruminal dexter arter olarak adlandırılan dallar. Hepatik arterin kistik arter, gastrik dexter arter, pankreatik rami ve gastroduodenal arter verdiği belirlendi. Gastrik uğursuz arter, çölyak arterin devamı olarak seyrine devam ediyordu. Seyri sırasında retiküler arter, gastroepiploik uğursuz arter ve retiküler aksesuar arterden çıkıyordu. Sonuç olarak; Hasak ve hasmer koyun ırklarında çölyak arterden çıkan damarların bazı farklılıklar gösterdiği belirlendi. Bu farklılıkların ırkların genetik yapısından kaynaklanabileceği sonucuna varılmıştır.
Anahtar Kelimeler: *Anatomi, arteria celiaca, hasak, hasmer, koyun.*

Introduction

Since the past years, breeding studies have been carried out on various sheep breeds in our country. As a result of crossbreeding studies initiated at Bahri Dağdaş International Agricultural Research Institute in 1989; Hampshire Down (HD), German Black-Headed Meat sheep (ASB) and Hasak sheep breed with high meat yield carrying Akkaraman genotype has been developed. Males and females of the sheep breed with a long and thin tail do not have horns (Akmaz et al., 1999). As a result of crossing the German Black Head and Hampshire Down (HD) rams with the Merino sheep, the Hasmer sheep breed was developed in the same Institute. Hasmer sheep breed carries the characteristics of the sheep it is crossbred with and adapts well to environmental conditions. It has a large and robust body, a wide and deep chest structure (Sönmez et al., 2009).

The arteria celiaca supplies the liver, spleen, pancreas, stomach, and the initial part of the duodenum. Arteria celiaca gives off three main branches: arteria gastrika sinistra, arteria hepatica, and arteria lienalis; (Dursun, 2008; Dyce et al., 1987; McCarthy, 1984; Smuts and Bezuidenhout, 1987; Karmona and Kovachec, 1985). Although research has been done on some sheep breeds (Karmona and Kovachec, 1985; Karadağ, 1998; Türkmenoğlu, 1996; Langenfeld and Pastea, 1977; Mohamed et al., 2016), there is no evidence on arteria celiaca in Hasak and Hasmer sheep breeds obtained through breeding studies. It has been determined that no study has been carried out. In this study, arteria celiaca in both Hasak and Hasmer sheep breeds was examined comparatively and its differences with other breeds were investigated.

Materials and Methods

Six hasak and six hasmer sheep, supplied from Konya Bahri Dagdaş International Agricultural Research Institute, Experimental Animals Unit, were used. After washing with 10% saline, red fabric dye and latex were mixed and

injected into the aorta abdominalis. The materials were kept in 10% formaldehyde solution for 24 hours and dissected. The photographs of the materials whose dissections were completed were taken with the Nikon P900 83X Optical Zoom brand camera. The terminology was based on Nomina Anatomica Veterineria (N.A.V.) (Anonymous., 2012).

Results and Discussion

It was observed that aorta abdominalis passed from cavum thoracis to cavum abdominis via hiatus aorticus. It was determined that arteria celiaca was traveling ventrally at the level of the first lumbar vertebra. It was observed that the first vein branching from arteria celiaca was arteriae phrenicae caudales. Later, it was determined that arteria lienalis, arteria hepatica and arteria gastrica sinistra originated as a common root, respectively. Findings that indicate the origin of arteria celiaca and the first branch of the aorta abdominalis were also found in some sheep (Mohamed et al., 2016) and goat breeds (Mohamed et al., 2017; Youssef, 1991). Özudoğru et al. (2019) In Konya Merino; While Dursun (2008) and Türkmenoğlu (1996) reported that arteria celiaca originates from between the last thoracal and first lumbar vertebra in the ruminant, Alsafy (2009) and El Gendy (2007) reported that in goats, from the ventral of the aorta abdominalis at the level of the 1st and 2nd lumbar vertebrae. Some researchers (Karmona and Kovachec, 1985; Langenfeld and Pastea, 1977; Alsafy, 2009; Machado et al., 2002) stated in some of the materials that arteria celiaca had a common root with arteria mesenterica cranialis, aorta abdominalis. They reported that it was of origin.

Özüdoğru et al. (2019), Türkmenoğlu (1996) found that arteria hepatica and arteria gastrica sinistra emerged as a common root in three of the sheep they used as material, and Maala et al. (1988) reported that the arteria celiaca branching in goats was in six different ways, and in one of them, arteria gastrica sinistra and arteria hepatica emerged as a common root. In this study, it was determined that arteria gastrica sinistra and arteria hepatica originated from arteria celiaca as a common root. Some authors (Smuts and Bezuidenhout, 1987; Maala et al., 1988; McCarthy, 1984; Dyce et al., 1987) are from arteria celiaca; stated that arteria lienalis, arteria gastrica sinistra and arteria hepatica emerged as three separate branches. Some researchers (Alsafy, 2009; Perez et al., 2016) from arteria celiaca; They stated that they are divided into four branches as arteria lienalis, arteria hepatica, arteria gastrica sinistra and arteria ruminalis sinistra.

It was observed that the artery entering the hilus lienalis as arteria lienalis after giving ramus epiploicus and arteria ruminalis sinistra and arteria ruminalis dextra for the omentum majus after arteria lienalis gave rami pancreatici to the pancreas was divided into two branches. It was stated that similar findings were observed in goat (Alsafy, 2009) and buffalo (Machado et al., 2002).

It was observed that arteria ruminalis sinistra, originating from the left side of the arteria lienalis, followed a caudoventral course and reached the right side of the atrium ruminis. It was determined that this vein, which later passed through the sulcus cranialis of the rumen, gave branches that vascularized the parietal surface of saccus cecus craniodorsalis and saccus cecus cranioventralis in its course in the sulcus longitudinalis sinister. Boccaletti and Borelli (1981) and Mohamed et al. (2016), Mohamed et al. (2017) reported the same findings in goats.

It was determined that arteria ruminalis dextra originates from the right side of arteria lienalis and reaches the visceral surface of the rumen with a caudoventral course. It was determined that the arteria ruminalis dexter, which runs inside the sulcus longitudinalis dexter, extends to the sulcus caudalis and ends by passing through this groove to the parietal surface of the rumen. During its course, it was observed that the rumen gave coronary arteries that vascularized the saccus cecus on the parietal and visceral surface.

Originating from arteria celiaca as a common root with arteria gastrica sinistra, arteria hepatica runs from the visceral side of the liver towards porta hepatis and continues its course as arteria gastroduodenalis after giving vessels named arteria cystica, arteria gastrica dextra and rami pancreatici at the level of porta hepatis. detected. It was determined that this vessel, which was named arteria gastroepiploica dextra after the arteria gastroduodenalis gave the arteria pancreaticoduodenalis cranialis, anastomose with the arteria gastroepiploica sinistra in the curvatura minor of the abomasum. It has been reported in the literature (Dursun, 2008) that arteria hepatica is a thicker vessel than arteria gastrica sinistra. In this study, it was determined that arteria hepatica was thinner than arteria gastrica sinistra.

After separating from the arteria hepatica, it was determined that arteria cystica, which travels on the visceral surface of the liver, dispersed into the vesica fellea. The report of arteria cystica in goat (Alsafy, 2009), ruminant and sus (Getty, 1975) that it travels on the visceral surface of the liver and extends to vesica fellea after starting from arteria hepatica is similar to the research findings.

It was determined that arteria gastrica dextra running on the visceral side of the liver anastomosed with arteria gastrica sinistra after giving arteria lobe caudati for the caudal lobe of the liver. During the course of the abomasum on the curvatura minor, it was observed that it gave the omentum minus and branches feeding this edge.

It was observed that arteria gastroduodenalis, which is seen as a continuation of arteria hepatica, gave arteria pancreaticoduodenalis cranialis and was named arteria gastroepiploica dextra on the curvatura major of abomasum. It was determined that the arteria gastroepiploica dextra ended by anastomosis with the arteria gastroepiploica

sinistra and vascularized the curvatura major edge of the abomasum and the omentum majus during the course of the vessel.

It was observed that arteria pancreaticoduodenalis cranialis, originating from arteria gastroduodenalis, gave branches feeding the duodenum and pancreas in the pars cranialis part of the duodenum. Anastomosis was observed with arteria pancreaticoduodenalis caudalis, a branch of arteria mesenterica cranialis.

It was observed that arteria gastrica sinistra, which originates from arteria celiaca as a common root with arteria hepatica, is in the continuation of the vessel. It was noted for being the thickest of branches given by Arteria celiaca. It was determined that this vessel gave the arteria reticularis first during its course, and after giving the arteria gastroepiploica sinistra and arteria reticularis accessoria in the area between the omasum and the reticulum, it continued its course by giving right and left branches on the visceral surface of the omasum. It was determined that the abomasum was terminated by anastomosis with the arteria gastrica dextra on the curvatura minor side.

It was observed that arteria reticularis, originating from arteria gastrica sinistra, gave branches named ramus ruminalis and ramus reticularis in its course within the sulcus reticuloruminalis. It has been determined that the arteria reticularis, which feeds the atrium ruminis of the rumen and the caudal aspect of the reticulum, originates from the arteria gastrica sinistra. Nayar et al. (1983) goat, Türkmenoğlu (1996) sheep, Smuts and Bezuidenhout (1987) camel, Machado et al. (2002) in the buffalo arteria reticularis from arteria gastrica sinistra; Alsafy (2009) from arteria ruminalis sinistra in goat; Mohamed et al. (2016) reported that they originated from the arteria gastrica sinistra or arteria ruminalis sinistra in sheep.

The arteria gastroepiploica sinistra, which originates in the cranioventral direction from the arteria gastrica sinistra on the atrium ruminis, passes through the sulcus reticulo-omasi and anastomoses with the arteria gastroepiploica dextra on the curvatura major side of the abomasum and during its course and the omentum majus, reticulum and omentum majus, reticulum.

It was determined that arteria reticularis accessoria, originating from arteria gastrica sinistra immediately after arteria gastroepiploica sinistra, gave some branches on the visceral surface of the reticulum and the parietal surface of the omasum.

As a result; It has been determined that there are some differences between each other and according to other sheep breeds from the beginning of arteria celiaca in the aorta abdominalis to the branches that vascularize the organs in Hasmer and Hasak sheep used as research material. It was concluded that the detected differences may be due to racial characteristics.

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Macro-anatomical Studies on the Pancreas of Mammals

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Abstract
In mammals, the pancreas is a lobed, gray-pink gland. It has a total length of approximately 410 mm, a width of approximately 10-30 mm, and a maximum thickness of approximately 10 mm. The stomach is located between the liver and duodenum. A large portion of the anterior and upper abdominal cavity is located to the right of the midline, and a small portion is located to the left. It has a salivary gland structure and has internal and external secretions. It has three parts: corpus pancreatis, lobus pancreatis dexter, and lobus pancreatis sinister. Since the pancreas has two drafts, one upper and one lower, in embryonal development, there is also a draining duct belonging to these drafts. These drafts combine to form the pancreas. However, since the ducts of these drafts do not unite, the pancreas has two ducts. One of these channels is the ductus pancreaticus of the lower draft and the other is the ductus pancreaticus accessorius of the upper draft. Most of the pancreas is made up of exocrine tissue. Its external secretion contains a wide variety of digestive enzymes. This secretion is drained into the duodenum by a duct, the ductus pancreaticus, which varies according to the animal species. The part of the pancreas that makes internal secretion (pars endocrina pancreatis) consists of cell clusters called insulae pancreaticae, also called islets of langerhans. These cells are called insulocyti.

Key Words: Pancreas, macro-anatomy, microscopy, mammal.

Memelilerin Pankreası Üzerine Makro-anatomik incelemeler

Özet
Memeli hayvanlarda pancreas loplu, gri-pembe renkli bir bezdir. Toplam uzunluğu yaklaşık 410 mm, genişliği yaklaşık 10-30 mm ve maksimum kalınlığı yaklaşık 10 mm'dir. Mide, karaciğer ve duodenum arasında yer alır. Karın boşluğunun ön ve üstünde büyük kesimi orta çizginin sağında, küçük bir parçası da sol tarafta bulunur. Tükürük bezi yapısındadır, iç ve dış salgısı vardır. Corpus pancreatis, lobus pancreatis dexter ve lobus pancreatis sinister olmak üzere üç kısmı vardır. Pankreas embriyonal gelişiminde biri üst, diğeri alt iki taslağa sahip olduğundan bu taslaklara ait birer de akıtıcı kanalı mevcuttur. Bu taslaklar birleşerek pankreası oluşturur. Oysa bu taslaklara ait kanallar birleşmediklerinden pankreas iki kanala sahip olur. Bu kanallardan biri alt taslağa ait ductus pancreaticus diğeri üst taslağa ait ductus pancreaticus accessorius'tur. Pankreasın büyük bölümü, dış salgısını yapan dokudan oluşur. Dış salgısı çok çeşitli sindirim enzimlerini içerir. Bu salgı hayvan türlerine göre değişiklik gösteren bir kanal, ductus pancreaticus ile duodenum'a akıtılır. Pankreasın iç salgısını yapan kesimi yani (pars endocrina pancreatis), langerhans adacıkları da denilen insulae pancreaticae adındaki hücre kümelerinden oluşur. Bu hücreler insulocyti diye isimlendirilir.
Anahtar Kelimeler: Pancreas, makro-anatomy, microscopy, mammal.

Introduction

In mammals, the pancreas is a lobed, gray-pink gland. The pancreas is located between the stomach, liver and duodenum. A large part of the anterior and upper abdominal cavity is located on the right of the midline, and a small part is located on the left (Dursun, 2012). It has three parts: corpus pancreatis, lobus pancreatis dexter and lobus pancreatis sinister (Dursun, 2012; Sisson, 1975a; Konig and Liebich, 2007). The pancreas consists of an exocrine part, which is responsible for the production of some digestive enzymes, and an endocrine part, which produces the hormones insulin and glucagon, which play a role in the regulation of the body's carbohydrate metabolism (Banks, 1986). The exocrine part of the pancreas is a composite tubuloacinar gland that produces digestive enzymes (Frappier, 2007). The endocrine part produces hormones (Hafez et al., 2015).

For decades, the pancreas in experimental animals has been extensively studied in relation to its physiological component. Since the discovery of insulin in 1921 and its direct relationship to glucose metabolism, and research involving inflammatory, ischemic, and neoplastic morbidities, it has been clear that experimental models are needed to better understand local and systemic organic effects (Aghdassi et al., 2011; Cattley et al., 2013; Stan 2014; 2015; 2017). Detailed anatomical studies have been conducted in mice, rats, monkeys, dogs, and mini-pigs (Pandiri, 2014; Tsuchitani et al., 2016), with the exception of domestic animals, where the pancreas has been extensively studied both macroscopically and microscopically.

It is very important to know the anatomy of the pancreas in pancreas transplantation, operations to be performed and in the development of surgical techniques.

Materials and Methods

Pancreatic tissue samples of animals euthanized with high-dose ether anesthesia are taken for histochemical and electron microscopic examinations. Tissues are fixed in Bouin and Carnoy solutions for light microscopic examination. It is then passed through graded alcohols and xylol and blocked with a paraplast. In order to show the general structure of the tissue, sections of 5-6 microns obtained from the blocks, Mallory's triple staining modified by Crossman and aldehyde fuchsine light green orange G (AF) staining is performed to identify A and B cells (Bancroft and Cook, 1984). Tissue samples taken for electron microscopic examinations are kept for 24 hours in the pre-detection of glutaraldehyde–paraformaldehyde (pH 7.4) according to the Karnovsky (1965) method, then washed in cacodylate buffer and fixed in osmic acid for the second time. Araldite is blocked in M by passing through graded alcohols and propylene oxide. Semi-thin sections taken from these blocks are stained with toluidine blue. In semi-thin sections, the regions sought for electron microscopic examinations are marked and thin sections of 300–400 Angstroms are taken. After contrast staining with uranyl acetate and lead citrate, it is examined under a Carl Zeiss EM 9 S-2 model transmission electron microscope.

Results and Discussion

The pancreas was retroperitoneal, close to the second and third lumbar vertebrae, the head was attached to the duodenum, the body was extended transversely from the posterior abdominal wall, and its tail extended to the hilum of the spleen. According to Miyaki et al. (1964) stated that the rat pancreas consists of a body and two (right and left) lobes. The pancreatic body was located along the cranial part of the duodenum. The right lobe extended towards the duodenal ligament, and the left lobe towards the spleen, towards the duodenal ligament. In contrast, Takahashi et al. (1977) reported that the pancreas of the Syrian hamster consists of a head and three well-defined parts: duodenal, gastric, and spleen lobes. Ozdemir (2005) stated that the pancreas is located in the mesoduodenum and consists of three lobes in the hedgehog and badger.

The pancreas has two outlines in its embryonal development, one upper and the other lower. There is also a flow channel for these drafts. These drafts combine to form the pancreas. However, since the ducts of these drafts do not merge, the pancreas has two ducts. One of these channels is the lower ductus pancreaticus and the other is the upper ductus pancreaticus accessorius. Equide, carnivor, and human have both of these channels. Ductus pancreaticus is long and thick in the horse. It opens at the apex of the papilla duodeni major, side by side with the ductus choledochus. Ductus pancreaticus accessorius is slender. Opposite where the ductus pancreaticus opens, it opens into the papilla duodeni minor. The dog has both pancreatic ducts, but the ductus pancreaticus accessorius is larger. This channel is 2-3 cm from the papilla duodeni major. distance, the papilla opens into the duodenum minor. Large ruminant and sus have only ductus pancreaticus accessorius. Starting from the lobus pancreatis sinister, this duct opens into the upper wall of the duodenum, 30-40 cm from the opening of the bile duct in the large ruminant, and 12-25 cm in the pig. The small ruminant has a single draining duct, the ductus pancreaticus. This duct opens into the papilla duodeni major together with the ductus choledochus.

The pancreas does not contain a complete fibrous capsule at its outer border. However, it is covered with a thin layer of loose connective tissue from which septa extend to divide the gland into lobules. The edges of the largest lobules are visible even to the naked eye. Blood and lymph vessels, nerves and excretory ducts are located in the connective tissue septa. The lobules contain a variable number of acini, formed by pyramidal cells, each located in a single layer, covered with a basal lamina and forming a narrow lumen.

The pancreas is divided into some lobules by connective tissue. A series of islets of Langerhans are observed between the pancreatic acini. These islets consist of many endocrine cells. A single endocrine cell can also be distinguished in the exocrine pancreas. The pancreas consists of both exocrine and endocrine regions. A thin connective tissue capsule surrounds the pancreatic islet and separates it from other pancreatic cells. The pancreatic islet is vascularized by numerous blood vessels and capillaries. Each exocrine secretory acini consists of pyramidal-shaped clusters of cells arranged around a small lumen. The endocrine part of the pancreas, the pancreatic islet, is separated from the secretory acini of the exocrine pancreas by a thin connective tissue. The islet of the pancreas does not contain excretory ducts. Instead, it leaves the islet via numerous blood capillaries, which are highly vascularized and contain all secretory products. In contrast, the secretory elements of the exocrine pancreas deliver their secretory products directly to an excretory duct.

Basal parts of the cell are intensely basophilic. The nucleus is localized in the central-basal part of the cytoplasm. The apical cytoplasm is filled with secretory granules, often called zymogen granules, as they contain precursors of pancreatic juice enzymes (Fawcett, 1986; McCuskey and Chapman, 1969; Motta, 1990; Ozdemir, 2005). Junqueira et al. (1998), Tanyolac (1993), stated that pancreatic islets do not contain excretory ducts. Instead, it is highly vascularized and contains a large number of blood vessels. However, the secretory elements of the exocrine pancreas deliver their secretory products directly to an excretory duct.

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Evaluation of the effects of drying methods on post aflatoxin infection in maize

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Abstract
The cultivation and the usage of maize have been significantly increased across all provinces of Rwanda. Nevertheless, the problem of aflatoxin contamination remains a major factor that renders them to be unfit for animal and human consumption. In this research, the effects of drying methods (sun drying, kitchen drying, dry shelter) post aflatoxin infection in maize were evaluated in Northern Rwanda. A randomized complete block design with four replications was used with maize variety(H628) with drying methods as the main plot. Maize samples were tested for aflatoxin using aflatest. In both seasons (2021A and 2021B) the aflatoxin results show that the aflatoxin infection levels were lower in maize dried with kitchen drying (1.4 ppb) compared to the samples dried with sun drying (1.6ppb) and dry shelter (2.2). Also, it was seen that the three drying methods are good for reducing the aflatoxin infection levels lower than 10ppb as standards limit for East African countries. The aflatoxin infection levels were found to be significant (≤10 ppb) as results of kitchen drying than sun drying and dry shelter methods. This research resulted that proper drying such as drying maize on kitchen fire (kitchen drying) produce the lower level of aflatoxin infection in maize.
Key Words: Maize, aflatoxin, drying, methods.

Introduction

Maize is a vital staple crop in most Sub-Saharan African countries including Rwanda producing food that is consumed by the majority of the population in different nature, the small-scale farmers focus on cultivating a lot of quantity of food crops such as wheat, sorghum and potatoes on a large quantity of land, maize is a crop which is very important not only for consumption but also for commercial purpose because Rwanda farmers use to trade them with Tanzania and Uganda (Daly *et al*, 2016). Northern province of Rwanda produces a half of maize produced in Rwanda where many of them (60%) are processed into other crucial products like maize flour, most of people used to trade them informally where 80 % of maize are commercialized in that way with in the neighboring countries. Aflatoxin contamination has resulted in lower nutritional qualities in Rwandan maize output due to a variety of variables that happened throughout before and after harvesting stage (Nishimwe *et al.*, 2019). Aflatoxin can also be controlled by appropriate drying after harvesting with the appropriate time, insect control which may affect maize during storage after harvesting as well as protecting stores against pests by adopting biopesticides, all of these practices can help to limit mycotoxins upon post-harvest (Niyibituronsa *et al*, 2020). The aim of this study was to evaluate the best drying method which can be adopted to minimize the level of aflatoxin in maize**.**

Materials and Methods

Area for research

Experimental fields have been carried in the farm of the College of Agriculture, Animal Sciences and Veterinary Medicine, University of Rwanda situated in the Northern province, Musanze District, Busogo Sector at 72 km from Kigali as Capital city of Rwanda to the North-West. Latitude of 1° 33' 32" South & 29° 32' 57" of Longitude East with an elevation of 2,221 m above sea level. In January, the average temperature in Busogo is 20°C and in May it is 17°C. The soil is relatively productive based on the overall amount of annual rainfall obtained (Meteo Rwanda, 2020).

Experimental Design

During the research, the experiment was conducted for four treatment of fertilizer combination in four replications using a factorial arrangement in Randomized complete block design (RCBD) assigned at random in each replication. Treatments were arranged as **T1** stands for application of only NPK 17-17-17 and DAP, **T2** stands for Application of only Farm yard manure, **T3** stands for application of combined NPK 17-17-17, DAP and Farm yard manure and **T4** stands (control): No fertilizer. All experimental plots were planted with one maize variety (H628) purchased from RAB at a rate of 25 kg/ha. The 16 experimental plots were placed in the same location within two (2) agricultural seasons which are season 2021 A and 2021 B; plots size was set out at 5 m × 5 m (25 m^2) in size per treatment and sowing the seed was done with in one day in all plots directly after field preparation where in each hole 2 grains were placed. Spacing of 75 cm between rows and 40 cm with 40 cm between holes. After sowing, 30 tons of organic fertilizer (cow dung) and 100 kgs of DAP were used respectively while urea was applied during weeding (Minagri, 2017).

Drying of maize grains

During this study, issues of maize grain management as well as their storage were examined, in order to evaluate the good drying methods which can favorize small scale farmers, cooperatives or commercial farms to get high quality maize that are free from aflatoxin. During this study, we look out the natural and artificial drying method that are currently used. Finally, different structure of storage and drying methods fluctuating from modest family units to huge commercial units are examined as well as management suggestions for minimizing harm while storing. During this study, the impact of various drying processes on aflatoxin contamination levels after various treatments were evaluated and applied during the tests.

Sun Drying

While conducting this research, sun drying method has been adopted as well-known but old drying method which is putting maize on natural sun. The maize grains produced from the treatments T1, T2, T3, T4 for all replications (4) were put directly under sun on sheeting for the prevention of moisture content from the soil ground to reach the maize grains

Kitchen Drying:

In order for assessing the rate of aflatoxin, we used to adopt the kitchen drying as the other drying methods which is effective by putting maize grains above fire of the kitchen. Kimario (2021) reported that kitchen drying managed to reduce aflatoxin levels in maize at the rate of 78.5%.

Dry shelter:

In this study, dry shelter as one of the drying methods established by the government as post-harvest handling technology was used to evaluate its effect on aflatoxin contamination.

Testing of aflatoxin

With referring to VICAM. L P (1999), we used aflatest (Watertown, MA) of OAC fluorometer. The aflatest was chosen due to its rapidity where with in only 10 min per ton test you get the results, it is also very sensitive consequently providing reading as low as 2ppb to 10 ppb in a sample and continues to read the results until 50 ppb per sample; it is suitable for using it in the same extract instrumentation for other mycotoxins'test; it is easy to use thus it does not require special. Those testing tools are trusted due to less toxic materials they possess in comparison with conventional methods. This method possess in numerical data in ppb can be used to clean HPLC (High performance liquid chromatography).

The test was carried out by blending a crushed sample of the kernels weighing 25 g of blended maize grains mix with 5g of Na Cl and 125 ml of methanol (70%); 30% of distilled water (H_2O) in a blender jar at high speed for 2 minutes in covered blender jar, fluted filter paper was used to filter the extract and collect the filtrate in clean vessel (Neogen (2018).

Sampling

According to Hamed (2016), simple random sampling method was adopted by collecting and measuring the composite sample equal to the maximum of 1 kg of from each treatment in both seasons (2021A and 2021B) and dividing it into 12 sub samples of roughly 300 g each in each season. For the aflatoxin levels analysis, ground samples of roughly 25g were utilized for each sub sample and the average level was obtained, the sample collection was done with second -season maize which tend to dry out faster on the farm, the average moisture level in each treatment was 12.5%.

Within the 2 seasons of the study, total number of samples collected and tested were twenty-four (24) with combination produce of each treatment (T1, T2, T3, T4) of all replication. In accordance with the protocol used during sampling, samples were collected in polythene bags and transported them to the RSB Laboratory for aflatoxin testing.

Preparation of the sample

For avoiding the mold formation as well as aflatoxin production, maize grains were dried in order reach the moisture content of no more than 13% within 30 days, when maize are affected by aflatoxin there is a chance of getting pollution and the species causing aflatoxin causes those pollution.

According to Noreddine (2020), to address this problem, the entire 1 kg of the sample was grinded and segmented using only a Bunn and constantly fighting grinder (Mann: Bunn-o-Matic corporation Springfield, Illinois in the United States of America) in order to obtain a combined subsample for representing the overall sample characterized with codes associated with them to affiliate the items in the questionnaire.

Sample extraction

During sample extraction ground sample of 25 g weight was used, blended for 2 minutes at high speed with the blender covered with 125 ml of 70% ethanol and 5 g of Na Cl. after filtering the extract with fluted filter paper and then added 30 % of distilled water, in clean vessel the filtrate was collected (Neogen,2018).

Dilution of extract

15 ml of filtered was collected using a pipette and transferred to a clean jar where it has been watered by 30 ml of distilled H_2O then thoroughly mixed, a glass microfiber glass filter was used to filter the diluted extract into a glass syringe barrel labeled with 15ml marking.

Aflatoxin's extraction

During the extraction of aflatoxin,50 mg of crushed samples was mixed with 250 ml of 65% ethanol(v/v) in a laboratory mixer (IKA.Werker, Germany) and rapidly shaken for 3 minute material was filtering using Whatman No.1 filter paper once it had settled (Whatman international Ltd, Maidstone,Uk) (Neogen , 2018).

Quantification of aflatoxin

The samples were analyzed by using an enzyme-linked immunosorbent assay (ELISA) to quantify the total of aflatoxin as indicated by the company's procedures using a Reveal accuscan (Neogen,USA), the ELISA has a quantitative range of 2-150 g total aflatoxins/kg and a lower of detection(LOD) OF 2G/KG (Neogen ,2018).

Statistical analysis

The levels of aflatoxin of four treatments were analyzed in the years of research from 2020-2021. simple descriptive statistics and the SPSS statistical package from 1993 at p=0.05 was used to evaluate data such as mean, range, variance, coefficient of variation and least significant difference. The test statistic was the variance ratio test, the 'F' distribution was used to compare two growth seasons at the same time for significant variations, the selection of it had the advantages of comparing two environments in one period (Mohd ,2017),

Results and Discussion

Impact for methods of drying on aflatoxin infection for the Cropping season 2021A & 2021B.

The results of aflatoxin following the drying methods have shown the great impact on aflatoxin contamination as shown in the Table 1.

Table 1. Aflatoxin levels measured in every treatment resulting all methods of drying within cropping season 2021A & 2021B

	Results of in ppb of total aflatoxin in various drying techniques for all treatments					
	kitchen drying		**Dry shelter**		**Sun drying**	
Treatments/ Seasons	**2021A**	**2021 B**	**2021A**	**2021 B**	**2021A**	**2021 B**
T1	2.70^{ab}	1.60^{ab}	2.70^{ab}	3.20^{ab}	1.70^{ab}	2.90^{ab}
T2	3.70^{a}	4.90^{ab}	3.00^{ab}	5.0^{ab}	2.60^{ab}	1.80^{ab}
T3	1.40^{ab}	2.60^{ab}	$2.2.0^{ab}$	3.20^{ab}	1.60^{ab}	2.80^{ab}
T4	11.00^{ab}	13.00^{b}	10.5^{b}	11.7^{b}	25.50^{b}	26.70^{b}
LSD	**8.119**	**4.531**	**3.453**	**6.207**	**10.319**	**10.612**

T1 stands for inorganic fertilizer application, **T2** stands for organic fertilizer application, **T3** stands for mixture of inorganic and organic fertilizer application, **T4** stands for control (no fertilizer application and **LSD** stands for Least significant difference

The analysis of variance results shows the significant differences in aflatoxin contamination levels within in the drying procedures such as kitchen drying, sun drying and dry shelter drying in two seasons of the study because with a significant level of 0.05, F=17.22 is bigger than F tabulated which is 3.28 meaning that the alternative hypothesis is accepted and null hypothesis is rejected. The results from the same analysis of variance also shows no significant difference on the drying methods effects such as kitchen drying, sun drying and dry shelter between blocks across the two seasons of study which are 2021A and 2021B because with F calculated which is equal to 0.67 is less than F tabulated equal to 2.9 at 0.05 as significance level, so, the conjecture hypothesis was accepted and the research hypothesis was rejected. The difference in aflatoxin infection was examined in both season (2021A and 2021B) from all treatments following drying methods (dry shelter, sun drying, kitchen drying).

Nethertheless, the level of aflatoxin was found to have significant difference contamination in sun drying methods, kitchen drying and drying shelter methods as it is shown in Table 1.the lower aflatoxin infection levels were seen when using kitchen drying (1.6ppb) when the maize is grown with fertilization of mixture of organic and inorganic fertilizers compared to sun drying (1.6ppb) and dry shelter drying method (2.2ppb).

The inconsistency ratio test demonstrated a significant difference in the influence of methods of drying all treatments (T1, T2, T3, T4) on aflatoxin contamination in the seasons 2021A and 2021B. The result shows that treatment T4 the aflatoxin levels were 26.70 ppb when adopted the sun drying, whereas aflatoxin results for T3 was 1.4 when adopted the kitchen drying.

According to Magembe *et al* (2016) Right drying of harvested maize is very crucial, because the ineffective drying methods can increase the growth of fungus as well as reducing the quality of kernels for consumption and reduce the capacity of seeds to germinate for the next season, during harvesting, maize possess the higher moisture content with equivalent to 28-30% and have to be tried up to 12% to prevent fungal growth. According to Zuki (2018) the types of drying methods have great influence on the resistance of maize on fungal contamination which led to the aflatoxin contamination. this is coincided with the actual research assessing the impact of different drying methods currently used in Rwanda on aflatoxin attack on maize, this research has been carried out from the findings of these research mentioned above that both sun drying, kitchen drying, drying shelter drying were good for

minimizing the content of moisture of maize to the level which is recommended (≤12 %) to get the chances of reducing the intense aflatoxin attack on the kernels. however, kitchen drying method was found to be quick to reduce moisture content of the kernels compared to the sun drying and dry shelter drying methods. This finding was due to the direct exposure of the maize grains above the kitchen fire with short distance from the fire itself and the space where the kernels are put for drying.

Conclusion

The results shown that drying methods have the significant effect on aflatoxin infection, among three (3) drying methods used which are sun drying, kitchen drying and dry shelter, kitchen drying method is the best for reducing aflatoxin contamination in maize.

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Sustainable Development Goals of, Environmental Challenges & Global Water Resources Crisis

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Abstract

Water is a blessing and reason of survival on earth for human beings. Without water it is not difficult to live on earth, but it is impossible. Unfortunately, rapidly increasing in population, unplanned agriculture practices and industrial sector, has becomes a serious issue for environment and for future needs. Water is only resource which is unequally shared resources in the world. Water will be very important issue for next generations may face. Safe water access up to 50-100 liters per day for drinking and sanitation is a right of every human being, recognized by United Nations General Assembly in 2010. Approximately six billion people may suffer from scarcity of clean water by 2050. The agriculture sector is largest consumer of fresh water around 70% followed by industry and domestic 19% & 11% respectively. The Global demand of water is gradually increasing by 1% per year. Existing global water demand has been projected about 4,600 km^3 every year and estimated may increase up to 20%-30%, in range of 5,500-6,000 km^3 every year by 2050. Advancement of technology, excess use of fertilizers is main source of deterioration of water quality and has created serious concerns for environment, such as our drinking water contains various in many cases. About 10 billion tons of freshwater using by human and result severe polluted return to environment. It is estimated that about 80% of wastewater discharged from industries containing utmost hazardous contamination is of biological nature, which causes serious human health problems and may cause death. The nominal treatment is carried out in upper middle-income 38% and worst situation in lower middle-income countries up to 28%, only 8% in low-income countries, undergoes for treatment for reuse.

Keywords: *Agriculture, Environment, Wastewater treatment, Water mapping, Water Quality.*

ID:409

A Comparative Analysis between Food Affordability and Healthy Life among the Rural and Urban People of Bangladesh

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Abstract

Good health depends on moderate and proper nutritional food. There is a noticeable difference in eating patterns between individuals living in rural and urban regions. The main aspect of this study is to make a comparative analysis of the health of rural and urban people with their eating habits. In February 2022, data were collected from 1,400 people in Bangladesh's major cities through offline and online surveys and analyzed using IBM SPSS Statistics 25 and Microsoft Excel. Three types of correlation are brought out among the selected parameters such as local people will be able to protect themselves from heart disease by consuming vegetables. The paper highlights the staple food of people of all ages in Bangladesh as well as their daily food intake time and quantity through a wide survey. People will be able to adjust their health depending on the type and quantity of food they consume, and they will also be able to know whether urban people are ahead of rural people and vice versa. This research is able to bring good health to the people by reviewing the food habits of the people of the village and the city.

Keywords: *Healthy Life, Food Consumption, Food Habit, Village and Urban Life, Bangladeshi People, Health Diseases.*

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Vermicompost and its Biological Application in Plants

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Abstract
Imminent amount of wastes including field wastes organic in nature such as, food remain, municipal solid waste and manures can be transformed into a usable and safe product that can be utilized as a possible usable fertilizers. Vermicomposting is a microbiological procedure in which earthworms contact with various other microorganisms to alter biologically active chemicals into a humus-like nutrient-rich product. It has a sustainable peat-like material, organic matter is present in plant available form and has a high-water holding capacity and aeration. Moreover, it has high nutrients than the organic material from which it is made because of the biological activities of earthworms, and so serves as a rich source of nutrients for plant development and growth.
Key Words: *Vermicompost, Biological scavenger, Plant growth impact.*

ID:411

The Effect Of The Covıd-19 Process On Vegetable Agrıculture In Türkiye

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Abstract

The Corona virus, which first appeared in the city of Wuhan, China, has spread almost all over the world, especially in China, and has been declared a global pandemic. As a result of the measures taken, many sectors, including the agricultural sector, were adversely affected. Agricultural production, nutrition and food safety have taken the first place among the concerns of individuals in this process. With the emergence of the pandemic, it has emerged that the agricultural sector is important and a strategic sector all over the world and in our country. The measures taken have disrupted the supply of agri-food products to markets and consumers both within and beyond the borders of the country. There have been significant export restrictions in many countries. Türkiye is one of the rare countries in the world where fruits and vegetables can be grown in good conditions and with high quality thanks to the fertile and wide agricultural areas suitable for production and the ecological differences of different regions. Vegetables produced in our country meet the domestic need at a high rate and in excess, and our vegetable exports are increasing gradually. In terms of seasonal workers, who play a major role in agricultural production, problems have been experienced during the pandemic process. Since the transportation and accommodation of workers will increase the risk of epidemics, it has made it necessary to take measures to prevent them. Since the labor in vegetable production in open areas or greenhouses in large areas is high, vegetable production was affected and this was reflected in the prices. As in the rest of the world, the outdoor eating and drinking sector has almost come to a standstill in our country, and there has been a significant increase in domestic consumption. Vegetable consumption increased by about 15% in a study. On the other hand, the tourism sector is one of the most important components of the demand for agricultural and food products in Turkey. On the Aegean and Mediterranean coasts, there are producers who primarily market the vegetables they produce to hotels hosting foreign tourists. These producers were also directed to other markets that restricted production during the pandemic process. In this paper, agricultural production and vegetable farming in the pandemic process were evaluated with statistical data in general and the difficulties and changes in the process were explained.

Keywords: *Agricultural sector, pandemic, Covid-19, vegetable farming, economy.*

Covıd-19 Sürecinin Türkiye'de Sebze Tarımına Etkisi

Özet

Dünyada ilk olarak, Çin'in Wuhan şehrinde ortaya çıkan Koronavirüs, başta Çin olmak üzere dünyanın hemen her yerinde yayılma göstermiş olup, küresel bir pandemi ilan edilmiştir. Alınan tedbirler sonucunda aralarında tarım sektörünün de bulunduğu birçok sektör olumsuz etkilenmiştir. Tarımsal üretim, beslenme, gıda güvenliği bu süreçte bireylerin kaygıları arasında ilk sıraya yerleşmiştir. Pandeminin ortaya çıkmasıyla beraber tüm dünyada ve ülkemizde tarım sektörünün önemi ve stratejik bir sektör olduğu ortaya çıkmıştır. Alınan tedbirler hem ülke sınırları içinde hem de sınırlar ötesindeki pazarlara ve tüketicilere tarımsal gıda ürünlerinin arzını aksatmıştır. Birçok ülkede önemli ölçüde ihracatta kısıtlamalar olmuştur. Türkiye, üretime müsait verimli ve geniş tarım alanları, değişik bölgelerin ekolojik farklılıkları sayesinde meyve ve sebzelerinin iyi koşullarda ve kaliteli olarak yetişebildiği dünyadaki nadir ülkelerden birisidir. Ülkemizde üretilen sebzeler yurtiçi gereksinimi yüksek bir oranla ve fazlası ile karşılamaktadır ve sebze ihracatımız da giderek yükselmektedir. Tarımsal üretimde büyük rol oynayan mevsimlik işçiler açısından pandemi sürecinde sorunlar yaşanmıştır. İşçilerin taşınması, barınması salgın riskini artıracağı için bunların önüne geçmek adına önlemlerin alınmasını zorunlu kılmıştır. Geniş alanlarda açıkta ya da seralarda yapılan sebze üretiminde işçilik fazla olduğu için sebze üretimi etkilenmiş ve bu da fiyatlara yansımıştır.Bütün dünyada olduğu gibi ülkemizde de dışarıda yeme içme sektörü neredeyse durma noktasına gelirken ev içi tüketimde önemli artışlar oldu. Sebze tüketimi yapılan bir araştırmada yaklaşık % 15 artmıştır. Öte yandan, turizm sektörü Türkiye'de tarım ve gıda ürünlerine talebin en önemli bileşenlerindendir. Ege ve Akdeniz kıyısında, ürettikleri sebze öncelikle yabancı turist barındıran otellere pazarlayan üreticiler mevcuttur. Bu üreticilerimiz de üretimi kısıtlamış başka pazarlara pandemi sürecinde yönlenmişledir. Bu bildiride, pandemi sürecindeki tarımsal üretim ve sebze tarımı genel olarak istatistiksel verilerle değerlendirilmiş ve süreçteki zorluklar ile değişimler anlatılmıştır.

***Anahtar Kelimeler*:** *Tarım sektörü, pandemi, Covid-19, sebze tarımı,ekonomi.*

Giriş

2019 yılının aralık ayında Çin'in Wuhan kentinde ortaya çıkan ve hızla diğer ülkelere yayılan Coronaviridae familyasından olan Koronavirüs bir solunum yolu hastalığıdır. Sars Cov' e yakın benzerliğinden dolayı "Sars-Cov-2" (şiddetli akut solunum sendromu Koronavirüs 2 virüsü) olarak da isimlendirilmiştir (Rismanbaf A., 2020; Muscogiuri G. vd. 2020; Eskici, 2020, Lai vd, 2020; Sun vd. 2020; Akın, 2020). 25 Ocak 2022 tarihi itibariyle can kaybı 5.600.434'tür ve hala salgın tüm dünya ülkelerinde devam etmektedir (WHO,2022).

Sars-Cov-2 insandan insana bulaşabilen tek zincirli bir RNA virüsüdür (Ahn vd., 2020). Salgının hızlı yayılması ile ilgili artan endişelerden sonra DSÖ tarafından 11 Mart 2020 tarihinde küresel salgın ilan edilmiştir. Covid - 19'un birincil bulaşma yolu kişiden kişiye temas yoluyla (solunum damlacıkları, öksürme, hapşırma) ve fomitler (havlu, para, giysi, oyuncak gibi eşyalar) tarafından bulaştığı bildirilmektedir (Anonim 2019; Akın ve Akın, 2020). WHO'nun raporunda Korona virüslerin yiyeceklerde çoğalamadığı; çoğalmak için konakçı olarak bir hayvana veya insana ihtiyaç duyduğu belirtilmektedir Koronavirüs zarflı bir virüs olup yağlı bir zar ile çevrilidir, sabun veya bulaşık deterjanı yüzeylerdeki yağı çözmeye, su ise virüsü uzaklaştırmada oldukça etkilidir. Bütün enfeksiyonlarda olduğu gibi gıda da insanlar tarafından sorgulanmaktadır. Bu yüzden kullanılacak gıdalar özellikle meyve ve sebzeler bolca yıkanmalıdır gıdalarda bulaşmasa bile üretim ortamlarında enfekte olmuş kişilerin temas etmesi ile gıdalar üzerinde virüs canlı kalabilir ve gıdayı tüketecek olan kişi bu yüzeye temas ederek elini ağız, burun veya gözlerine dokundurması ile Cov-19 olabilir, ancak bunun virüsün ana yayılma yolu olmadığı düşünülmektedir (CDC,2020a; Doğan ve Doğan, 2020; Sağdıç vd., 2020).

Tarım yaşamın kaynağı olması nedeniyle insanlığın varoluşundan bugüne büyük önem taşımıştır ve yaşam devam ettiği sürece de önemini koruyacaktır). Son yıllarda ülkeler daha çok sanayi ve Dijital sektörlere ağırlık vererek tarım sektörünü geri plana atmışlardır. Covid-19 salgınıyla bu anlayış zayıflamış tarım ve hayvancılık faaliyetlerinin gıdaya ulaşmanın tek dayanak nokta olduğu görülmüştür. Ülke olarak gelişmişlik düzeyi ne olursa olsun tarımsal üretimin sürekliliğinin çok önemli olduğu gerçeği ortaya çıkmıştır. Gelişmiş olan ülkelerde arz yönlü riskler, az gelişmiş ülkelerde ise talep yönlü riskler ortaya çıkmıştır (Kayabaşı, 2020). Ülkeler Pandemi döneminde yayılımın azalması ve gıda krizinin önünü kesmek için ulusal ve uluslararası hareketlilikte kısıtlamalara gitmektedir. Koronavirüs salgını sebebiyle ülkeler hem insan hem ticari mal hareketlerini durdurmak zorunda kaldılar. Bu durum İnsanların yaşamlarını sürdürmek için temel ihtiyaç ürünlerine ulaşmayı zorlaştırdı, temel ihtiyaç maddelerinde dışa bağımlı, ithalata dayalı ekonomilerde gıdaya ulaşım daha da zorlaştı. Özellikle tarımda kendine yetebilen ve İthalat odaklı değil üretim odaklı olan ülkeler bu süreçten daha az zarar görmüşlerdir (Kayabaşı, 2020; Tutar vd.,2021). Küresel salgınlarda ülkeler içe kapanmakta, öncelikli olarak kendi halkının ihtiyaçlarını karşılama yoluna gitmektedir. Ülkelerin aldığı tedbirler kapsamında ithalat ve ihracatta yeni düzenlemelere gidilmiştir. Bu kapsamda birçok ülke ihracatçısı olduğu ürünlerin ihracatını durdurmak veya ithalata kota getirmek gibi önlemler almışlardır. Örneğin Rusya'nın buğday ihracatçısı olmasına rağmen ihracatının durdurulması, Kazakistan, Kırgızistan, Belarus ve Ermenistan'ın pirinç, ayçiçeği ve bazı sebzelerin (soğan) ihracatından kısıtlama kararı alması, büyük tahıl ihracatçılarından olan Ukrayna'nın karabuğday ihracatını belirli süre durdurması, dünyanın 3. büyük pirinç üreticisi olan Vietnam'ın ihracatını durdurması, hasat miktarının iyi olacağını hesapladıktan sonra yasağı kaldırıp ithalata kota getirmesi, Mısır'ın 3 ay boyunca bakliyat ihracatını durdurması ve ülkemizin bazı ürünlerde (soğan, patates, limon) ihracatını özel izne bağlaması, örnek verilebilir(Tutar vd.,2021).

Alınan tedbirlerin başında sokağa çıkma yasağı ile toplumlar izole bir hayata sürüklenmiş ve bu da birçok alanda olumsuzluklara sebep olmuştur. Karantina tedbirlerine bağlı olarak gıda tedarik zincirlerinde aksamalar, tarladan, gıdanın işlenmesine, gıda ticaretinden, ulusal ve uluslararası lojistik sistemlerine, ara ve nihai talebe kadar olan gıda zincirinin tüm halkalarını etkilemiştir. İş gücü arz ve talebinde önemli sorunlar çıkmış, yoğun üretim yapan üreticiler işgücü eksikliğine bağlı üretim ve gelir kaybı yaşarken, işgücü arz edenler ise gelir kayıpları yaşamışlardır (Doğan ve Doğan, 2020; Kayabaşı, 2020; Aydın ve Güner, 2020).

Çizelge 1. Dünya'da ve Seçilmiş Ülkelerde İşsizlik Oranları (+15 Yaş)

Dünya Geneli ve Seçilmiş Ülkeler	İşsizlik oranı (%)		Fark (%)
	2019	2020	
Dünya	5,37	6,47	1,10
Türkiye	13,7	13,2	-0,5
ABD	2,38	5,59	3,21
Kanada	4,41	7,48	3,07
AB-27 Ülke	6,7	7,1	0,4
Euro Bölgesi-19 Ülke	7,6	7,9	0,3
Belçika	5,4	5,6	0,2
Bulgaristan	4,2	5,1	0,9
Almanya	3,1	3,8	0,7
İspanya	14,1	15,5	1,4
İsviçre	4,4	4,8	0,4
İtalya	10,0	9,2	-0,8
Fransa	8,4	8,0	-0,4

Kaynak: https://ec.europa.eu/eurostat, https://databank.worldbank.org. Erişim: 10.02.2022

Avrupa Birliği ülkeleri birçok strateji uyguladıktan sonra son olarak sıkı tedbirler kapsamında mevsimlik tarım işçilerine yönelik düzenlemeler uygulamıştır (Yılmaz ve Yıldırım İşler, 2021). Avrupa Birliği ülkeleri için kritik öneme sahip olan bu mevsimlik işçiler salgın sürecinde "kritik işçi" olarak nitelendirilmeye başlamıştır. Bu nitelendirmenin en büyük nedeni tarım sektörünün faaliyetlerini (hasat, ekim ve bakım) salgın sürecinde de sağlıklı bir şekilde sürdürmeye devam etmektir (Çetin ve Yücesoy, 2020).

Çizelge 2. Farklı Ülkelerde GSYİH Büyüme Oranı (Yıllık)

Ülkeler	2018	2019	2020
Brezilya	1,78	1,41	-4,05
Kanada	2,42	1,86	-5,31
Belçika	1,78	1,78	-6,28
Fransa	1,86	1,84	-7,85
Almanya	1,08	1,05	-4,5
Yunanistan	1,55	1,85	-8,24
İtalya	0,94	0,28	-8,87
Japonya	0,55	0,27	-5,80
Portekiz	2,84	2,48	-7,57
İspanya	2,28	2,08	-10,82
İsviçre	2,91	1,21	-2,39
Türkiye	2,95	0,91	1,75
Amerika	2,99	2,16	-3,48
Polonya	5,35	4,54	-2,70

Çizelge 3. Küresel Gıda Güvenlik Skorları

Sıra	Ülke	Skor/100	Değişim
1	Singapur	87,4	0,0
2	İrlanda	84,0	+0,6
3	ABD	83,7	+0,6
4	İsviçre	83,1	0,0
5	Finlandiya	82,9	0,0
5	Norveç	82,9	+0,5
7	İsveç	82,7	+0,2
8	Kanada	82,4	+0,7
9	Hollanda	82,0	+0,5
10	Avusturya	81,7	+0,3
11	Almanya	81,5	+1,1
12	Avustralya	81,4	+0,9
13	Katar	81,2	+2,9
14	Danimarka	81,0	+0,6
15	Belçika	80,7	0,0
16	Fransa	80,4	0,0
17	Birleşik Krallık	79,1	-0,1
18	İsrail	79,0	+0,5
19	Yeni Zelanda	78,8	+0,1
20	Portekiz	77,8	+0,1
41	Türkiye	69,8	-0,6

Kaynak: The Economist Group, 2019; TİM, 2021

Ülkelerin salgın öncesi GSYİH büyüme oranı 2018/2019 pozitif bir büyüme seyrederken salgının etkileri 2020 yılında görülmeye başlamıştır. Büyüme rakamlarının çoğunlukla negatif bir oranda gerçekleştiği salgının ekonomik boyutunu ifade etmektedir. Alınan tedbirlerin meydana getirdiği olumsuzluklar ve halkın panik halinde olması arz talep dengesinde ani dalgalanmalara sebep olmuş, bu da gıda fiyatlarına yansımıştır. Dünya genelinde gıda fiyat endeksinde artışlar meydana gelmiştir (FAO,2022). Pandemi döneminde tüketim ihtiyaçlarında ki dönüşüm süreci, tedarikte yaşanan zorluklar ve karantina sebebiyle yaşanan panik dalgası pek çok ülkede market raflarının hızla boşalmasına sebep olmuş ve yerini dolduracak ürün teminin de zorluklarla karşılaşılmıştır (TİM, 2021).

Satın alınabilirlik, ulaşılabilirlik, kalite ve güvenlik başlıkları altında derlenen skorların ortalaması sonucunda Singapur 87,4'lük, İrlanda 84'lük ve ABD 83,7'lik skorlarla diğer ülkelerden pozitif olarak ayrışmaktadır. Türkiye ise 69,8 puanla 41. sırada bulunmaktadır.

Pandemi Döneminde Türkiye'de Tarım Sektörünün Durumu

Türkiye'de Covid-19 ilk olarak 2020 yılının mart ayında görülmeye başlamıştır (Tutar vd.,2021). Bu dönem Türkiye'de tarımsal üretimin dolayısıyla tarımsal faaliyetlerin ve mevsimlik işçi göçünün de başladığı bir süreçtir. Yaşamın devamı, sanayi sektörüne girdi sağlama, istihdam ve ihracat açısından öncelikli sektör olan tarım sektörüdür. Ana işgücünü mevsimlik tarım çalışanları ve aileleri oluşturmaktadır (Sarper,2009; Şimşek,2020). Salgın dönemi devam ederken tarımsal üretimin kesintiye uğramaması, yeterli ve sağlıklı gıdaya erişim sağlanması amacıyla çiftçilere özel izinler verilmiş ve tarlada faaliyetlere devam edilmesi bildirilmiştir. Bakanlıkların aldığı tedbir kararı kapsamında işgücü ihtiyacının öncelikli olarak il içinde karşılanması, karşılanmaması durumunda ise yakın çevre illerden mevsimlik tarım işçileri ile tarımsal sürekliliğin sağlanabileceği bölgeye mevsimlik tarım işçilerinin gelmesi durumunda ise ilgili bakanlıkların taşra teşkilatlarının alması gereken sorumluluklar belirtmektedir (Yılmaz ve Yıldırım İşler, 2021).Tarım işçilerinin çalışmak üzere geldikleri bölgelerde salgının yayılımının engellenmesi, gerekli tedbirlerin alınması için il ilçe Hıfzıssıhha kurulları görevlendirilmiştir.

Tarım işçilerinin ; konaklayacakları alana geldiklerinde il/ilçe emniyet müdürlüğüne haber verilmesi, konaklama alanlarında yatak aralarının en az 1,5 m olacak şekilde ayarlanması, çadırlar arası mesafenin artırılması, yeteri sayıda maskenin işveren tarafından sağlanması, mevsimlik tarım işçilerinin çevrede yaşayanlar ile sosyal iletişiminin kesilmesi, günlük ihtiyaçların sağlanması için temsilci seçilmesi, temsilcinin toplu halde yaşayan mevsimlik tarım işçilerinin tüm ihtiyaçlarını günlük olarak temin etmesi ve temsilci harici kimsenin dışarıdan alışveriş yapmaması, 7-14 günlük periyotlarda mevsimlik işçilerin ateş ölçümlerinin yapılması, konaklama alanlarının yerel yönetimler tarafından düzenli olarak dezenfekte edilmesi, tarım işçilerinin tarlaya gidişte ve dönüşte, işçilerin nakli sırasında araç kapasitesinin yarısı kadar kişi ile seyahat edilmesi kuralına uyulması gerekliliği ifade edilmektedir(Sağlık Bakanlığı, 2020; Yılmaz ve Yıldırım İşler, 2021) .

Salgından korunmada ve tedavide bağışıklık sisteminin rolü büyüktür. Covid-19 hastalarının bağışıklık sisteminin güçlendirilmesi ve akciğer hasarının önlenmesi amacıyla çeşitli besinsel tedavi yöntemleri İleri sürülmektedir Bunlardan bazıları çinko, magnezyum, selenyum, A vitamini, D vitamini, E vitamini ve yüksek doz C vitamini takviyesidir (Kartal vd., 2020).

Birleşmiş Milletler 2021 yılını "uluslararası meyve ve sebze yılı" ilan ederek dünya genelinde meyve ve sebzelerin önemi yıl boyunca vurgulanmıştır. Karşı karşıya olduğumuz sağlık krizinde bağışıklık sistemimizi güçlendirmek için sağlıklı beslenmenin gerekli olduğu belirtilmiştir. Her yetişkinin günlük olarak en az 400 gram meyve ve sebze tüketmesi önerilmektedir (Tarım ve Orman Bakanlığı, 2020, FAO). Bitkisel gıdalar bağışıklık sisteminin yüzde 85'ini oluşturan bağırsak mikrobiyota sağlığının geliştirilmesine ve artırmasına yardımcı olmaktadır (Restrepo 2020; Kartal vd., 2020). Bağışıklık sistemini güçlendirmede etkin rol oynayan besin içeriklerinde A, C, E vitaminleri ve betakaroten başta gelmektedir. Bu besin değerlerinden zengin olan sebzelere baktığımızda A vitamini; ıspanak, havuç, kırmızı biber. C vitamini; kırmızı biber, brokoli. E vitamini; ıspanak ve brokoli. Betakaroten; ıspanak, havuç, kırmızı biber 'de bolca bulunmaktadır (TÜRKOMP, 2022).

Koronavirüs bireylerin beslenme alışkanlıkları üzerinde de etkili olmuştur. Nitekim Pandemi sürecinde tüketimi en fazla artan ürün grupları arasında meyve ve sebze yer alıyor. Karaman ilinde yapılan bir anket çalışmasında (15 Mart-15 Nisan 2020) katılımcıların beslenmelerinde yemeği arttırdığı gıdalardan sebze ve sebze yemeklerinin oranı %15'tir (Dilber ve Dilber, 2020). Tarım sektörü küresel nüfustaki artış eğiliminden dolayı diğer şartlar sabit olsa dahi hacmini arttıran ve yükselen bir sektördür. Birleşmiş Milletler nüfus tahminlerine göre 2020 yılı için dünya nüfusunun 7 milyar 794 milyon 798 bin 729 kişi olduğu tahmin edildi. Bu tahminlere göre en fazla nüfusa sahip ülke 1 milyar 439 milyon 323 bin 774 kişi ile Çin olurken, bu ülkeyi 1 milyar 380 milyon 4 bin 385 kişi ile Hindistan, 331 milyon 2 bin 647 kişi ile Amerika Birleşik Devletleri (ABD) izledi. Bu üç ülke dünya toplam nüfusunun %40,4'ünü oluşturdu. Türkiye, 83 milyon 384 bin 680 kişi nüfusu ile nüfus büyüklüğüne göre 235 ülke arasında 19. sırada yer alırken, dünya toplam nüfusunun %1,1'ini oluşturdu (TÜİK,2021).

Pandemi Döneminde Ülkemizde Sebze Tarımı

Türkiye geniş ürün yelpazesine sahip, yetiştiriciliğe uygun iklim ve ekolojik özellikleri ile bitkisel üretim açısından avantajlı bir ülkedir. Birçok meyve ve sebzenin yetiştiriciliğinde dünya sıralamasında ilk sıralarda yer almaktadır. Örneğin; domateste 3, kuru soğanda 5, patateste 17. sıradadır (Anonim, 2021). TÜİK verilerine göre 2019 yılında toplam tarım alanı 37.716.000 (Ha), sebze bahçesi olarak kullanılan 790.000 (Ha) iken 2020 yılında toplam tarım alanı 37.762.000 (Ha), sebze bahçesi olarak kullanılan 779.000 (Ha)' dir. Sebze bahçesi alanlarında sırasıyla Akdeniz, Ege ve Orta Anadolu bölgeleri ilk sıralarda yer almaktadır. Son 3 yılda gerçekleşen bitkisel üretim değerlerine baktığımızda 2018- %41, 2019- %43, 2020- %45 olduğu görülmüştür. Her yıl artış gösteren bitkisel üretim değerlerinin %40 tarla bitkileri, %35'ini sebze üretimi, %25'i meyve üretimi oluşturmaktadır. Dünya sebze üretimi 2000 yılında 684 milyon 733 bin ton iken 2018'de 1 milyar 89 milyon ton olmuştur. Türkiye mevcut sebze üretimi ile dünya sebze üretimi içerisinde yaklaşık %3'lük bir paya sahiptir, Çin (%74), Hindistan (%17) ve ABD (%4)''den sonra dünya üretiminde 4. sırada yer almaktadır.

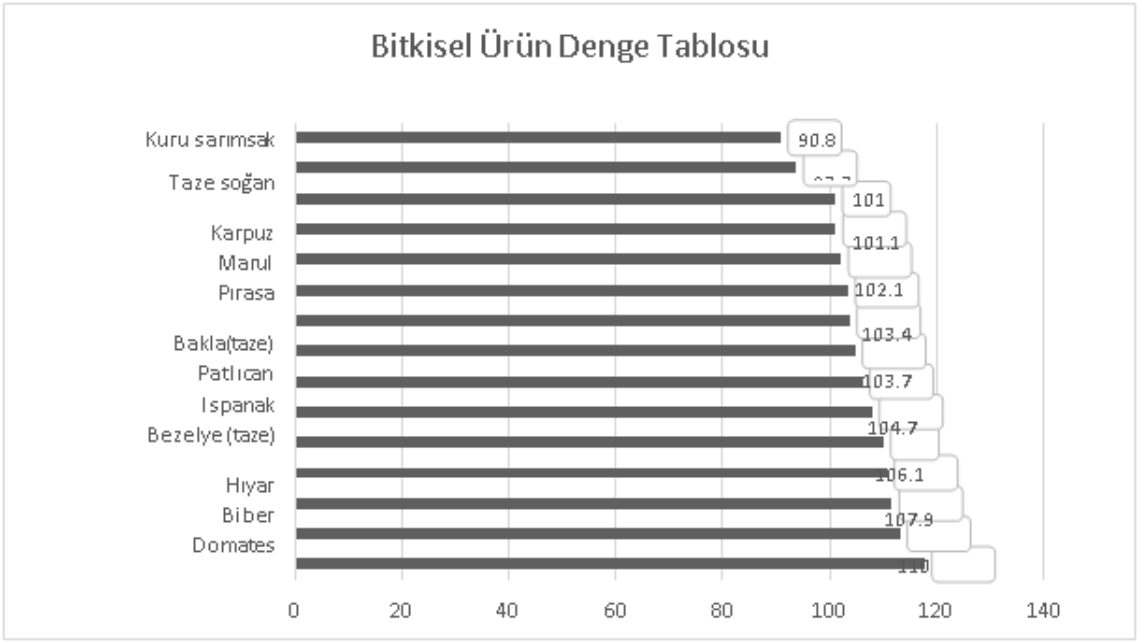
Bitkisel üretim istatistikleri incelendiğinde sebze üretim miktarı; 2019 yılında 31,1 milyon ton, 2020 yılında 31,2 milyon ton, 2021 yılında ise 31,8 milyon ton olmuştur. Sebze ürünleri üretim miktarı 2021 yılında 2020 yılına göre %1,8 artmıştır. Sebze ürünleri alt gruplarından yumru ve kök sebzeler %6,9 artış göstermiştir. Bu grupta yer alan

kuru soğan üretimi %9,6, kuru sarımsak üretimi ise %13,5 artış göstermiştir. Meyvesi için yetiştirilen sebzelerin üretimi yüzde 0,9 artış göstermiştir. Bu grupta yer alan biber (salçalık, kapya) üretimi %11,9, hıyar %2 artarken domates üretimi %0,8 azaldı. Ayrıca yaprağı yenen sebzelerden beyaz lahana üretimi %0,6 artarken, ıspanak üretimi %5,7 azaldı. Türkiye'de en fazla üretimi yapılan sebzeler; Domates (13,1 milyon), karpuz (3,5 milyon), biber (2,6 milyon), kuru soğan (2,5 milyon), hıyar (1,9 milyon), kavun (1,6 milyon) tondur (TÜİK,2022). Türkiye'de kişi başına yaklaşık 276 kg sebze tüketimi olmaktadır (Küden ve Daşgan, 2021).
Ülkemizde açıkta ve örtü altında sebze üretimi yapılmaktadır. Örtü altında sofralık taze tüketime yönelik mevsim dışı veya turfanda üretim söz konusu iken, açıkta sofralık ve sanayilik sebze üretimi yapılmaktadır. Örtü altı sebzeciliği bakımından Türkiye, Avrupa'da İspanya'dan sonra ikinci sırada yer alırken Dünya'da ise Çin, Güney Kore ve İspanya'dan sonra dördüncü sırada yer almaktadır. Ülkemizde toplam örtü altı alanı 805.159 da' dır. Bu alanın 401.795 da plastik sera, 218.326 da alçak tünel, 104.258 da yüksek tünel, 80.779 da ise cam seralar oluşturmaktadır. Örtü altı sebze üretimi 7.771.766 ton' dur. En fazla üretimi yapılan ürünler ise domates (4.1 ton), hıyar (1.1 ton), karpuz (850 bin)'dir (TÜİK,2022).

Çizelge 4.Türkiye'de örtü altında kullanılan yapılar

Yıllar	Toplam	Cam sera	Plastik sera	Yüksek tünel	Alçak tünel
2017	752 168	85 749	355 121	119 899	191 399
2018	772 091	78 110	368 527	114 232	211 222
2019	789 604	75 495	378 670	111 038	224 400
2020	805 159	80 779	401 795	104 258	218 326

Örtü altı tarımının yaygın bir şekilde iklimin avantajlı olduğu Akdeniz sahil şeridinde yer aldığı görülmektedir. Ancak son yıllarda sera ısıtılmasında jeotermal enerjinin kullanımı ile Ege bölgesi başta olmak üzere ülkenin farklı noktalarında jeotermal enerji ile ısıtılan topraksız üretim yapan büyük ve modern sera işletmelerinin kurulumunun arttığı görülmektedir (Küden ve Daşgan, 2021).
Sebze yetiştiriciliğinde açık tozlanan standart çeşitler ve F1 hibrit çeşitlerin tohumları kullanılmaktadır. Örtü altında yetiştirilen sebzelerin tamamı F1 hibrit çeşitlerden oluşurken açıkta yetiştiricilikte de %70-80'lere varan oranlarda hibrit tohum kullanılmaktadır. Türkiye F1 hibrit sebze tohumlarının geliştirilmesinde çok iyi yol almıştır ve yerli hibrit çeşitler pazarın %65-70'ini karşılamaktadır. Geri kalan oran ise çeşitlilik olması bakımından yabancı firmaların çeşitlerinden oluşmaktadır (Yanmaz ve ark., 2020).
Türkiye'de örtü altı ve açıkta sebze üreticileri gereksinim duydukları fideyi hazır satın alarak üretime başlamaktadır. Ülkemizde yılda 4 milyar adedi aşan hazır fide üretimi yapılmaktadır. 2021 yılı itibarıyla ülkede toplam 183 adet fide üretimi yapan tesis bulunmaktadır. Bu tesislerin çoğunluğu Antalya ilinde konuşlanmıştır. Sebze türleri bazında Antalya ilinde 2020 yılında üretilen hazır fidelerin sebze türlerine göre dağılımı şu şekilde olmuştur: domates: %51,4 biber: % 12.8, hıyar: %7.2, patlıcan: %3.7, karpuz: %5.2, kavun: 2,1, kabak: %3.4, lahana: %1.6, marul:7.6, diğer türler (karnabahar, lahana vb.): %5,0 (Fide birlik E-Bülten, Şubat 2021).
Tarımda kendine yeterlilik durumu her zaman önemlidir. Yeterlilik konusu tohum, gübre, sulama olanakları, tarımsal mekanizasyon ve diğer tarımsal girdiler açısından da önem arz etmektedir. Pandemi sonrası güvenilir gıda temini sağlamak ve iç piyasanın yeterli hale getirilmesi tüketici için yaşamsal değer taşımaktadır (Tutar vd.,2021). Türkiye'de toplam sebze ürünlerinde, 2019-2020 piyasa döneminde yurt içi üretimin, yurt içi talebi karşılama derecesi %107,2 oldu. Sebzelerde en yüksek yeterlilik derecesi havuçta %117,7 olurken, kuru soğanda %113,1, sakız kabakta ise %111,6 olarak gerçekleşmiştir. Kendi kendine yeterli olmak oldukça önemlidir. İç piyasada yeterlilik seviyesine ulaşmak gelecekteki risklere karşı hazırlıklı olmayı sağlamaktadır. Dünyadaki tüm ülkeler için tarım ve gıdada ithalat bir çözüm yolu değildir (TÜİK, 2022).
Ürün denge tabloları, tarımsal ürünlerin arz kaynaklarını ve kullanım şekillerini belirli bir referans dönemi boyunca karşılaştırarak ayrıntılarıyla ortaya koyan tablolardır.
Yeterlilik derecesi; bir bölgenin kullanılabilir üretiminin (iç üretim) o bölgenin talebini ya da yurt içi kullanımını (insan, hayvan ve endüstrinin bütün ihtiyaçlarını) ne ölçüde karşılayacak durumda olduğunu gösterir. Değerin, 100'den küçük olması, üretimin yurt içi talebi tam olarak karşılayamadığı durumu temsil eder. 100'den büyük olan bir değer, normal iç ihtiyaçları geçen, ihraç edilebilir ve/veya stoklanabilir miktarların varlığını gösterir. (TÜİK,2022).
Tüm dünya' da olduğu gibi Türkiye'de gıda fiyat endekslerinde artış görüldü. Covid-19 'un etkisi ÜFE ve TÜFE' de etkisini gösterdi. ÜFE değerlerinde meydana gelen artış, TÜFE değerleri ile doğrudan ilişkili olduğu görülmektedir. Ülkemiz tarım sektöründe kendine yetebilecek potansiyelde olsa da sorun sadece üretim ile sınırlı kalmamakta (Özdemir, 2020). Türkiye'de çiftçilerin girdi maliyetlerinden (Mazot, elektrik, gübre, tohum, ilaç vb.) dolayı üretim yapmakta zorlandığı görülmektedir. (Yıldırım, 2020; Çetin ve Yücesoy, 2020).



Şekil 1. Bitkisel Ürün Denge Tablosu, Kaynak: TÜİK, 2022

Çizelge 5. Tarım Ürünleri Üretici Fiyat Endeksleri (2019 – 2021)

	Ocak	Şubat	Mart	Nisan	Mayıs	Haziran	Temmuz	Ağustos	Eylül	Ekim	Kasım	Aralık
2019	153,64	157,84	160,60	162,35	160,80	156,02	154,38	153,30	155,73	158,38	161,16	164,67
2020	169,63	173,98	177,27	176,29	177,84	178,64	179,52	179,91	184,52	188,00	194,62	199,64
2021	205,69	211,06	216,38	214,67	213,76	217,52	220,44	224,33	227,60	231,43	242,00	272,29

Kaynak: TÜİK, 2022

Çizelge 6. Tüketici Fiyat Endeksleri (2019-2021)

	Ocak	Şubat	Mart	Nisan	Mayıs	Haziran	Temmuz	Ağustos	Eylül	Ekim	Kasım	Aralık
2019	398,07	398,71	402,81	409,63	413,52	413,63	419,24	422,84	427,04	435,59	437,25	440,50
2020	446,45	448,02	450,58	454,43	460,62	465,84	468,56	472,61	477,21	487,38	498,58	504,81
2021	513,30	517,96	523,53	532,32	537,05	547,48	557,36	563,60	570,66	584,32	604,84	686,95

Kaynak: TÜİK, 2022

Çizelge 7. Türkiye Geneli Yaş Sebze İhracat Kayıt Rakamları

Tarih	Miktar (Kg)	Değer ($)
Ocak-Aralık (2018)	1,306,301,845	592,858,796
Ocak-Aralık (2019)	1,282,485,178	643,962,690
Ocak-Aralık (2020)	1,313,475,985	699,219,688
Ocak- Aralık (2021)	1,771,148,925	875,713,825

Kaynak: AKİB,2021

Tarım ve gıda ürünleri dış ticareti iyi yapıldığı takdirde gıda fiyatlarındaki dalgalanmaların olumsuz etkilerini azaltabilmektedir. İhracat, ülke çiftçisine farklı pazarlar bulması, satın alım gücü, ürününü yüksek fiyattan satabilme imkânı sağlaması vb. durumlardan fayda sağlamaktadır. İthalat ise, ülke içinde aşırı fiyat artışlarından halkı korumak, iç piyasada ürün çeşitlendirmek vb. fiyat düşüren uygulamalar düşünülerek yapıldığında oldukça önemli yere sahiptir (Artık, 2020).

2018-2021 yılları arasında en fazla yaş sebze ihracatı yapılan ilk sıralarda yer alan ülkeler; Suriye, Rusya, Irak, Romanya, Ukrayna, Bulgaristan ve Gürcistan 'dır. (AKİB;2018- 2021).

Yaş sebze ihracatı yapan illere bakıldığında; 2020 yılında 1.Antalya, 2.Hatay, 3.Mersin, 4.Şırnak, 5.İzmir illere yer almaktadır. 2021 yılında 1.Antalya, 2.Şırnak, 3.Mersin, 4.Hatay, 5.Artvin illerinin olduğu belirlenmiştir. Covid-19 kapsamında alınan önlemler ile ihracatta kısıtlamalar getirilmiştir. Salgının yayılımının önünü kesmek için komşu ülkeler ile sınır kapıları kapatılmış veya sınırlamalar getirilmiştir. Şırnak ilinde bulunan sınır kapısında ise 17 Mart 2020 yılında hayata geçirilen kısıtlamalar 21 Nisan 2020 yılında gevşetilmiş, yaş sebze ve meyve ihracatına devam edilmiştir. 2021 yılında ihracat yapan iller arasında 2. Sıraya çıkmasının sebebi bu durum olabilir. 2020 -2021 yılları arasında en fazla ihracatı yapılan sebzeler ise; domates, soğan, patates, biber, kabak, havuç ilk sıralarda yer alıyor (AKİB, 2021).

Sonuç

Sonuç olarak, pandemi döneminde taze meyve ve sebze tüketme alışkanlığının bağışıklık sistemini güçlendirmek için ne kadar önemli olduğu bir kez daha ortaya konmuştur. Tarım üreticileri ve işçileri için izin pandemi süresince devam etmiş ve üretimde ülkemiz geriye düşmemiştir. Fiyatlar ise dünya genelinde ekonomi olumsuz etkilendiği için artış olmuştur. Ancak insanların alım gücünü aşan fiyatlar görülmemiştir. Ülkemizde tüketilen tüm sebzeleri tüketiciler piyasada bulmakta zorlanmamışlardır. Pandemi dönemi tüm sektörlerde yavaşlama ya da durma yaşanmış ama tarımsal üretim devamlılığını sürdürmüştür. Dünyada bu tür olasılıklara karşı ülkemizde üretim stratejileri geliştirmeli, birinci sınıf tarım arazileri sanayi ya da turizm sektörü için kullanılmamalıdır.

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The Effects Of Some Rhızobacterıa Specıes On Plant Developement And Fruıt Qualıty In Melons Grown Under Irrıgated And Non-Irrıgated Condıtıons

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Abstract

It has been determined in many research results that plant growth promoting rhizobacteria (PGPR) affect yield, plant growth and fruit quality and play an important role. However, the use of biostimulants in agricultural production in Malatya is negligible. In order to contribute to the region's producers, a research was planned directly in the producer's garden in the Malatya/Arguvan region, which is an important melon production center. A trial was established with Arguvan (Narmikan) melon type and Kırkağaç 637 melon cultivars, which are the most grown local cultivars in the summer period of plant growth-promoting rhizobacteria in ırrıgated and non-ırrıgated melon cultivation in Malatya-Arguvan conditions, and the trial was repeated for two consecutive years. In the research, Bacillus subtilis, *Bacillus megatorium, Enterococcus spp*. and cocktail bacteria solutions, which are a mixture of these three bacteria were used. Inoculation of bacteria into seeds was done by soaking the seeds in bacterial solution for 24 hours. The effects of the use of bacteria on the fruit quality of melon in cultivation with the method of seed sowing in the field were determined. In the study, the presented of which are resulted in fruit only pomological porperties ; fruit height, fruit weight, fruit flesh thickness, fruit shell thickness, fruit diameter, seed cavity diameter, pH and WTSS contents were examined, and two-year results were presented. The effects of different bacteria on the fruit pomological properties were not found statistically significant except for the TSS values of Kırkağaç 637 cultivars grown under non-irrigated conditions. The effects of different bacteria on the fruit pomological characteristics of Kırkağaç 637 melons grown under non-irrigated conditions were found statistically significant, although there were differences in other parameters, it was not statistically significant. Bacillus subtilis bacteria application has been the prominent bacterial application in terms of fruit characteristics.
Key wosrds: *Beneficial microorganisms, PGPR, melon, fruit pomological properties*

Bitki Büyümesini Arttırıcı Bazı Rhizobakteri Türlerinin Kısıtlı Sulama Koşullarında Yetiştirilen Kavunlarda Meyve Kalitesi Üzerine Etkileri

Özet

Bitki gelişimini teşvik edici rizobakterilerin (PGPR) verim, bitki gelişimi ve meyve kalitesine etki ettiği ve önemli rol oynadığı birçok araştırma sonuçlarında tespit edilmiştir. Ancak biyostimulantların Malatya'da tarımsal üretimde kullanımı yok denecek kadar azdır. Bölge üreticisine katkı sağlaması amacıyla önemli kavun üretim merkezi olan Malatya/Arguvan bölgesinde direkt üretici bahçesinde araştırma planlanmıştır. Malatya-Arguvan koşullarında sulu ve kuru kavun yetiştiriciliğinde Bitki gelişimini teşvik edici rizobakterilerin yaz döneminde yörede en çok yetiştirilen bir lokal çeşit olan Arguvan (Narmikan) kavun tipi ve Kırkağaç 637 kavun çeşidiyle deneme kurulmuş ve iki yıl üst üste deneme tekrarlanmıştır. Araştırmada, *Bacillus subtilis, Bacillus megatorium, Enterococcus spp*. ve bu üç bakterinin karışımı olan kokteyl bakteri solüsyonları kullanılmıştır. Bakterilerin tohumlara inokulasyonu, tohumların bakteri solusyonunda 24 saat bekletilmesi suretiyle yapılmıştır. Araziye tohum ekimi yöntemi ile yapılan yetiştiricilikte kavunda bakteri kullanımının meyve kalitesine etkileri belirlenmiştir. Burada sadece meyvedeki sonuçları sunulan araştırmada; meyve yüksekliği, meyve ağırlığı, meyve eti kalınlığı, meyve kabuk kalınlığı, meyve çapı, çekirdek evi çapı, pH ve SÇKM içeriklerine bakılmış, iki yıllık sonuçlar sunulmuştur. Farklı bakterilerin meyve pomolojik özelliklerine etkileri susuz koşullarda yetiştirilen Kırkağaç 637 kavunlarının SÇKM değerleri istatistiksel olarak önemli bulunmuş, diğer parametrelerde farklılık olmasına rağmen istatistiksel önemde bulunmamıştır. *Bacillus subtilis* bakteri uygulaması meyve özellikleri bakımından öne çıkan bakteri uygulaması olmuştur.

Anahtar Kelimeler: *Yararlı Mikroorganizmalar, PGPR, Kavun, Meyve Pomolojik Özellikler*

ID:415

Comparative Analysis of Organoleptic and Nutritive Properties of Fresh and Powdered Milk Yoghurt

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Abstract
Yoghurt is a dairy product produced by bacteria fermentation of milk sugar into lactic acid. It is often sold with a fruit vanilla or chocolate flavour but can be unflavoured. This study compared the consumers' acceptability and nutritive values of fresh milk yoghurt and powdered milk yoghurt. The pH value of both fresh and powdered milk yoghurts (4.28 and 4.89 respectively) indicates that the pH range for successful yoghurt production was met. Sensory evaluation was conducted on the processed yoghurts to determine the level of acceptability of the product. The sensory quality showed that mouth taste and general acceptability of fresh milk yoghurt were significantly (P<0.05) higher than that of powdered milk yoghurt while there was no significant difference P>0.05 in the colour and aroma of the yoghurt samples. There was a significant (P<0.05) decrease in the titrable acidity of fresh milk yoghurt to that of powdered milk yoghurt. The total solid, temperature and pH of both samples showed no significant difference (P>0.05). The minerals and vitamins content of powdered milk yoghurt were significantly higher compared to that of fresh milk yoghurt probably due to the fortification of powdered milk.
***Keywords**: Fresh, Nutrient, Organoleptic, Powder, Yoghurt*

Introduction
Yoghurt is a fermented milk product. The word 'yoghurt' is derived from the Turkish word "yoğurt" which means thickened. Yoghurt is defined as the product being manufactured from milk with or without the addition of some natural derivative of milk, such as skim milk powder, whey concentrates that results from the coagulation of the milk proteins, due to the lactic acid secreted by defined species of bacterial culture (Sfakianakis and Tzia, 2014). When enough lactic acid is produced the milk coagulates and this coagulated milk is called Yoghurt.
Yoghurt is mainly produced from bovine milk, although milk from other mammals may be used for yoghurt production as well. Yoghurt varies in appearance, flavor and ingredients. Yoghurt derived from the milk of species other than bovine tends to vary in several sensory and physicochemical characteristics, due to differences per milk composition. For instance, Yoghurt derived from milk with high fat content as seen in sheep, goat and buffalo has a creamier texture compared to that derived from milk with lower fat content (bovine, mare). Therefore, the species of the milk-producing mammal significantly influence the characteristics of the produced Yoghurt (Tamime and Robisons, 2007). Thus, this study aim to produce and compare the organoleptic and nutritive values of fresh milk yoghurt and powdered milk yoghurt.

Materials and Method
Sample Source
Fresh milk was collected at Aliyu Farm Limited Sokoto and Miksi powdered milk was obtained at old market Sokoto, Sokoto State Nigeria.

Production of Fresh Milk Yoghurt (El-Zubeir et al., 2012)
Two (2) liters of fresh whole cow's milk was pasteurized by placing the milk in a water bath, the milk was stirred continuously, till the milk attained the temperature of 85°C. The milk is held at this temperature for 30 min. At the end of the pasteurization period, the pasteurized milk was cooled to 45°C before inoculating it with 50 ml commercially produced LAB starter culture. The inoculated milk samples were stirred thoroughly and incubation at 45°C for 8 hours. After the fermentation, the yoghurt was cooled down and 0.5 g% of colorant was added and mixed thoroughly.

Production of Powdered Milk Yoghurt (Adam and Moss, 1992)
Eight hundred gram (800 g) of Milksi powered milk was weighed and transferred into a beaker containing 2 L of sterilized distilled water, the mixture was stirred continuously with a sterile wooden spoon till a homogenous solution was formed. The container was covered with aluminium foil and pasteurized at 85°C for 30 minutes. The pasteurized milk was then cooled to 45°C, 50 ml commercially produced LAB starter culture was added and incubated at 45°C for 10 hours. After the fermentation, the yoghurt was cooled to refrigerator temperature (4-6°C) and 0.5 g% of colorant was added and mixed well.

Sensory Evaluation of the Yoghurt Drink (Ihekoronye and Ngoddy, 1985)

The product samples were evaluated using 5-point hedonic method for sensory characteristics. The overall acceptability was done using 10 pre-trained panels selected randomly. The panels were given a hedonic questionnaire, both samples of fresh milk yoghurt and powdered milk yoghurts. They were asked to compare the sample by testing for taste, aroma, color, and general acceptability. All tests were performed and rated on a 5-point hedonic scale as: Very good = 5; Good = 4; Neither like nor dislike = 3; Dislike = 2; Extremely dislike = 1.

Determination of Titrable Acidity

This was determined using the alkaline titrimetric method of Sadler and Murphy (2003). Following the method, 10 ml of each of the sample was dispensed into a separate conical flask and 1 ml of phenolphthalein indicator was added. The mixture was titrated against standard alkaline solution (0.01N NaOH solution). Titration was done till a persistent faint pink coloration was obtained.

The total titrable acidity was calculated using the formula:

% Titrable acidity (TA) = (T x N/W) X 100

Where,

T = Titre value

N = Normality of titrant

W= Weight of sample used

Determination of Total Solid (AOAC, 2002)

Five (5) gram of both fresh milk yoghurt and powdered milk yoghurt were weighed into separate crucible (w_1) and dried in an oven at 105°C to a constant weight. The dried samples were cooled in a desiccator for 30 minutes and weighed (w_2). The total solid content of each sample was calculated as follows:

Total solid (g/kg) = final weight of dried sample + crucible – weight of crucible/weight of fresh sample in kilogram.

Determination of Mineral Elements (Na, K, Ca, Mg and P)

Sodium (Na^+) and Potassium (K^+) were analyzed by flame photometer (AOAC, 2002). Calcium (Ca^{2+}) and Magnesium (Mg^{2+}) are analyzed using EDTA titrimetric method (AOAC, 2002) while Phosphorus (P) was determined using spectrophotometry method (AOAC, 2002).

Determination of pH and Temperature

The pH of the two yoghurt samples were measured using a pH meter with a glass electrode and thermometer according to the method of AOAC (2002)

Determination of Vitamins

Vitamins A, C, and E were determined following the standard method of Association of Official Analytical Chemists (AOAC, 2002).

Statistical Analysis

All the data obtained were analyzed using student T-test. The significance difference was calculated at 95% level of significance using GraphPad Instat version 3.0.

Results

Table 1 shows the physicochemical properties of fresh and powdered milk yoghurt. There was a significant difference (P<0.05) between the titrable acidity (TA) of the samples. The total solid, temperature and pH of both samples showed no significant difference (P>0.05). The sensory quality showed the taste of fresh milk yoghurt and powdered milk yoghurt as rated by the panelist were significantly difference (P<0.05) while there was no significant difference in the color of the yoghurt samples.

Table 1. Physicochemical Properties of Fresh and Powder Milk Yoghurt

Parameters	Fresh Milk Yoghurt	Powdered Milk Yoghurt
Temperature	5.2±0.05^a	5.3±0.05^a
pH	4.28±0.01^b	4.89±0.03^a
Titratable Acidity	0.70±0.01^b	0.92±0.01^a
Total Solid (g/kg)	110.67±1.45^a	109.00±2.08^a

Values are mean ± SD of three (3) replicates. The mean with the same superscript on the same row are not significantly difference (P<0.05).

Table 2: Sensory Quality of Fresh Milk and Powdered Milk Yoghurt

Organoleptic Properties	Fresh Milk Yoghurt	Powdered Milk Yoghurt
Aroma	4.80±0.20^a	4.60±0.25^a
Taste	4.80±0.20^a	2.80±0.74^b
Color	4.40±0.25^a	4.38±0.20^a
General Acceptability	4.80±0.20^a	3.00±0.55^b

Values are mean ± SD of three (3) replicates. The mean with the same superscript on the same row are not significantly difference (P<0.05).

Table 3: Mineral Analysis of Fresh Milk and Powdered Milk Yoghurt

Minerals	Fresh Milk Yoghurt	Powdered Milk Yoghurt
Sodium(mg/kg)	27.67±5.77[b]	35.00±0.58[a]
Potassium(mg/kg)	250.00±5.77[b]	310.00±5.77[a]
Calcium(mg/kg)	0.84±0.01[a]	0.83±0.01[a]
Magnesium(mg/kg)	0.28±0.02[a]	0.38±0.02[a]
Phosphorus(mg/kg)	1.53±0.02[a]	1.55±0.01[a]

Values are mean ± SD of three (3) replicates. Mean with different superscript on the same row are significantly different at $P < 0.05$.

Table 4: Vitamins content of fresh milk and powdered milk yoghurt

Vitamins	Fresh Milk Yoghurt	Powdered Milk Yoghurt
Vitamin A (mg/dl)	141.98±1.168[b]	185.50±1.17[a]
Vitamin C (mg/dl)	5027.40±2.95[b]	6857.2±5.89[a]
Vitamin E (mg/dl)	6.10±2.44[a]	12.19±0.7[b]

Values are mean ± SD of three (3) replicates. Mean with different superscript on the same row are significantly different at $P < 0.05$.

The mineral content of the fresh milk and powdered milk yoghurts was presented in Table 3. Powdered milk yoghurt was found to have a significantly high mineral content compared to the fresh milk yoghurt. The powdered milk yoghurt contained Sodium (35 mg/kg), Potassium (310 mg/kg), Magnesium (0.38 mg/kg) and Phosphorus (1.55 mg/kg). The vitamins content of fresh and powdered milk yoghurt was presented in Table 4. It was observed that the vitamin content of the powdered milk yoghurt significantly ($P < 0.05$) higher than that of the fresh milk yoghurt.

Discussion

Yoghurt is a fermented milk product with numerous health and nutritional benefits. Yoghurt helps reduce body weight, blood pressure, LDL-cholesterol and lipid peroxidation (Georgakouli *et al.*, 2016). Yoghurt is also a rich source of protein. This study compared the consumers' acceptability and nutritive values of fresh milk yoghurt and powdered milk yoghurt. The pH of the yoghurt produced ranged from 4.28 to 4.89 thereby confirming the acidity of the yoghurt samples. The acidic pH is important in inhibiting the growth of pathogenic microorganisms in yoghurt thereby preventing the yoghurt spoilage and poisoning. The titrable acidity which measures the actual acid value present in the sample was found to be higher in the powdered milk yoghurt and might be due to its high content of vitamin C. Many of the panelists accepted and had preference for the fresh milk yoghurt than the powdered milk, this might be due to it unusual taste and aroma as the use of fresh (cow) milk in yoghurt was not very common. Mineral analysis of powdered milk yoghurt and fresh milk yoghurt revealed the content Sodium, potassium, calcium, magnesium and phosphorus. It was observed in this study that the mineral composition of the powdered milk was higher compared to the fresh milk yoghurt. This could be due to the fortification of the powdered milk to enhance the mineral contents. According to Jesen (1998) fresh cow milk is not considered a rich source of mineral elements except for calcium and phosphorus hence the need to fortify the cow milk. Yoghurt is a very good source of essential minerals needed for human metabolism but the concentration of its major elements depends on the species, the individual animal, the method of feeding, lactation stage, and health condition of the udders (Cashman, 2006). The concentrations of antioxidant vitamins were found to be higher in the powdered milk yoghurt compared to the fresh milk yoghurt. This might be due to addition of vitamins A, C and E during the fortification process of powdered milk.

Conclusion

This study shows that the fresh milk yoghurt is more acceptable based on the sensory qualities. However, the powdered milk yoghurt is richer in minerals compared to fresh milk yoghurt.

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Production and Bacteriological Quality of Soy Yoghurt

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Abstract
Soybean is a valuable plant-based protein with several functional food applications such as production of soy yoghurt. This study was aimed at determining the bacteriological quality of soy yoghurt. Soy yoghurt was prepared by standard procedure and was divided into four groups of six samples each excluding day 0 with only one sample. The yoghurt samples were subjected to treatments with 0.5 g% sodium benzoate, 0.5 g% potassium metabisulphate and a combination of both preservatives at 0.25 g% each. Microbial qualities were determined at an interval of a day for 7 days period. The total bacterial count for soy yoghurt treated with potassium metabisulphate (SPM) ranges from 5.00±0.342 to 7.75±0.342 log10cfu/ml and that of sodium benzoate treated soy yoghurt (SSB) ranges from 5.0±0.392 to 7.70±0.392 log10cfu/ml and for the combination of both sodium benzoate and potassium metabisulphate (BOTH) value ranges from 5.00±0.402 to 7.53±0.402 log10cfu/ml. Soy yoghurt untreated (SU) has a range of 5.00±0.367 to 8.00±0.367 log10cfu/ml. For coliform count FSU has 14.0 as most probable number, while SPM and SSB has a value ranging from 14.0±1.078 to 21.0±1.078 while a combination of both has a range of 14±1.00 to 20±1.00. SU has a range of 14±1.078 to 24±1.078. The organisms isolated from the samples were *Bacillus spp*. 30.77%, *Shigella spp*. 23.08%, *Salmonella spp.* and *E. coli* with 15% each and *Staphilococcus* and *Streptococcus spp*. with 7.69% each. Only *Bacillus spp.* was isolated in both FSU and BOTH. The results suggest that the use of combined sodium benzoate and potassium metabisulphate preservatives at 0.25 g% each was more effective at eliminating most of the bacteria implicated in soy yoghurt spoilage.
Keywords: *Bacterial count, bacteriological quality, protein rich, soy yoghurt, treated.*

Introduction
Soybean (*Glycine max*) is an inexpensive and sustainable plant-based protein containing 37 to 40% protein, 5.4% crude fiber, 18.2 to 20% oil and 10% mineral (Iombor *et al*., 2009; Jayasena *et al*., 2010). It is generally considered as a highly versatile grain which has many functional food applications such as production of soy yoghurt (Omotayo *et al*., 2007). Yoghurt is a fermented functional dairy food product rich in nutrients, it is often produced by fermenting fresh milk with lactic acid bacteria (Ye *et al*., 2013). Yoghurt provides remarkable health benefits such as reduction of serum cholesterol, stabilize gut microflora and stimulate immune system (Shori, 2013).
Soy yoghurt is produced from soymilk an aqueous extract of soybean. It is commonly characterized as having a beany, grassy or soy flavor, it can be improved by lactic acid fermentation as in yoghurt-like products (Jimoh & Kolapo, 2007). Soymilk yoghurt, however, has remained its relatively short shelf life, due to the growth and proliferation of spoilage microorganisms such as bacteria, yeasts and molds. The processing and storage conditions of soymilk extract, however, influence the presence or absence of these spoilage organisms in the extract. For example, yeasts and molds are problematic in foods in that they discolour food surfaces, cause off odours and off flavours as well as produce toxins. Evaluation of the bacterial quality of soy yoghurt become apparent due to the high risk associated with consuming substandard or unhygienic soy yoghurt containing pathogenic organisms.

Materials and Methods
Preparation of Soymilk Extract
Soybean seeds were obtained from Sokoto Central Market, Sokoto State, Nigeria. Soy milk was extracted by method of Onuorah *et al.* (2007). One (1kg) kilograms of healthy and unbroken soybean seeds were soaked in warm water for 12 h and then decanted and rinsed with tap water. The soybean seeds were wet milled with 5 L of water and the slurry was filtered using double layer muslin cloth to obtain the filtrate.

Preparation of Soy Yoghurt
About 5 L of soymilk extract was warm in water bath at 35-38ºC for 20 minutes, then 0.5% of gelatin was added under constant rapid stirring. Then the extract was pasteurized at 80ºC for 30 minutes in water bath. The pasteurized soymilk extract was then homogenized and cooled to 45ºC, then 2% of yoghurt culture was added and the mixture was incubated at 45ºC until a pH of 4.0-4.3 was reached. The incubated yoghurt was then refrigerated at 6ºC for 12 h, 12 g% (w/v) of sugar and 0.5 g% (w/v) of vanilla flavour were added.

Experimental Design

The soy yoghurt was divided into four groups of six samples each except for day zero (group 1) which has one sample. All the samples were filled into a sterile cork bottles. The groups are as follows:

Group 1: Fresh Soy Yoghurt Untreated (FSU)
Group 2: Soy Yoghurt Untreated (SU)
Group 3: Soy Yoghurt Treated with 0.5 g% Sodium Benzoate (SSB)
Group 4: Soy Yoghurt Treated with 0.5 g% Potassium Metabisulphate (SPM)
Group5: Soy Yoghurt Treated with equal amount of 0.25 g% Sodium Benzoate and Potassium Metabisulphate (BOTH)

Bacteriological Analysis

Determination of Total Bacterial Counts

Nutrient agar (NA) and MacConkey agar (MAC) were used to culture bacteria and coliform present in the soy yoghurt, respectively. The agars were prepared in accordance with the manufacturer's (Titan Biotech Ltd) instruction. The samples were serially diluted 4 times aseptically using 1 mL of soy yoghurt samples with 9 mL of sterile distilled water to reduce the microbial load. After dilution, 0.1 mL of 10^{-4} dilution factor was inoculated on the surface of solidified agars and bent glass rod was used to spread the sample onto the agars. The inoculated plates were incubated at 37°C for 24 h. Colonies that were formed on the agars were count using colony counter and the results were recorded as $\log_{10}$ colony forming unit per millimeter ($\log_{10}$cfu/ml) of soy yoghurt.

Purification of Microbial Isolates

Isolated colonies were sub-cultured on NA and MAC and incubated at 37°C for 24 h. After incubation, pure bacterial isolates were stored on NA. The stock cultures were then preserved in a refrigerator at 4°C until used for further microbiological analyses.

Presumptive Test

The primary isolate was carried out using MacConkey broth, sterile syringe was used to inoculate 10 mL, 1 mL and 0.1 mL of the sample into three tubes containing MacConkey broth. The tubes were closed tightly, vortex and then incubated at 37°C for 24 h. Gas and acid formation were observed by colour change from purple to amber yellow and the most probable number (MPN) of coliform was determined on the probability table (Manga *et al.*, 2008).

Confirmed Test

The prepared Eosin methylene blue was poured into sterilized petri dishes. Inoculums were picked with a wire loop from tubes showing positive presumptive test and was streaked into the media. The inoculated petri dishes were placed in the incubator at 27°C for 24 h. After the incubation, colonies were observed.

Completed Test

From plates showing positive confirmatory test, an inoculums were picked and inoculated into tubes of MacConkey broth and Nutrient agar, both tubes were incubated at 27°C for 24 h. Positive complete test was indicated by gas formation in MacConkey broth, inoculation into nutrient ager was used to determine colonies count.

Characterization and Identification of Bacterial Isolates

Bacterial isolates were characterized and identified by observation of colonial and morphological characteristics, gram reaction and biochemical tests. The biochemical tests used for identification were motility, indole, catalase, citrate utilization, Methyl Red (MR), Voges- Proskauer (VP), Triple-Sugar Iron agar (TSI), starch hydrolysis, urease and hydrogen sulfide production were carried out in accordance with standard methods described by Elmahmood & Doughari (2007). The isolates were finally identified using Bergey's Manual of Determinative Bacteriology following the method of Holt *et al*. (2000).

Data Analysis

The analyses were conducted in triplicate and results were expressed as Mean ± Standard deviation. One-way analysis of variance was used to determine the difference between the mean at 95% confidence limit using GraphPad Instant version 2.0 San Diego, USA.

Results

Figure 1.0 presents the effect of storage time on the total bacterial count of soy yoghurt. There is a significant increase in the bacterial load from day 2 to day 7, most particularly for the untreated sample. The different preservatives have no significant difference on the bacterial load. The bacterial count for SPM ranges from 5.0±0.34 to 7.75±0.34 log_{10}cfu/mL and 5.0±0.39 to 7.7±0.39 log_{10}cfu/mL for SSB, while that of combined preservatives range from 5.0±0.40 to 7.53±0.41 log_{10}cfu/mL. But, for the untreated sample (SU) there is a significant increase in the bacterial count from 5.0±0.37 to 8.00±0.37 log_{10}cfu/mL as the storage day increase.

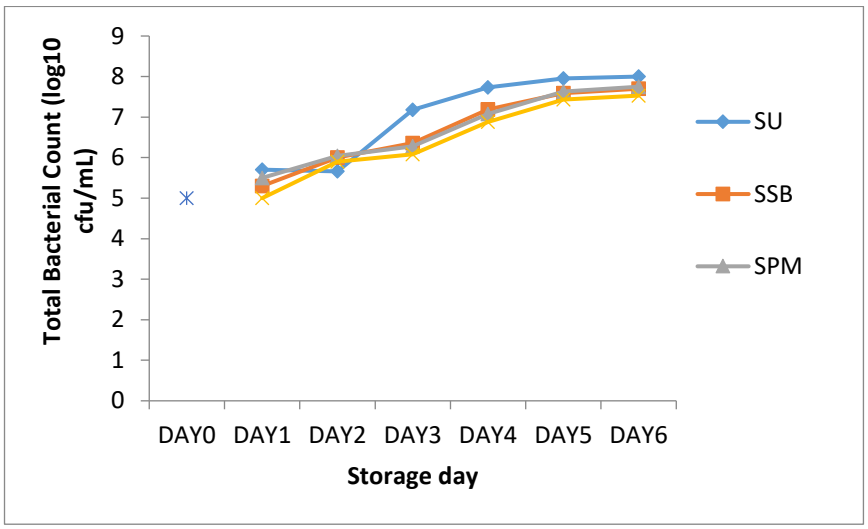

Figure 1.0: Effect of Storage Time on Total Bacterial Count of Treated and Untreated Soy Yoghurt

FSU: fresh soy yoghurt untreated, SU: soy yoghurt untreated, SSB: soy yoghurt treated with 0.5 g% sodium benzoate, SPM: soy yoghurt treated with 0.5 g% potassium metabisulphate, BOTH: soy yoghurt treated with equal amount of 0.25 g% potassium metabisulphate and sodium benzoate.

Most Probable Number of Coliform

Figure 2.0 presents the most probably number (MPN) of coliforms. All the treated samples at day 1 have the same MPN of 14±1.00 like that of FSU. However, the MPN of SU significantly increased from 14±1.08 at day 0 to 17±1.08 and 20±1.078 at day 1 and 2, respectively. Both SSB and SPM have a significant increased to 17±1.078 after 2 days of storage. But, the sample with the equal amount of 0.25 g% potassium metabisulphate and sodium benzoate has no significant increase in the MPN after 2 days of storage. At day 3, the only changes found was on the SU where the value for number of coliforms increased from 20±1.078 in day 2 to 21±1.078. At day 4, SSB and SPM increased to 20±1.078 from 17±1.078 while BOTH increased to 17±1.00. At day 5, SU significantly increased to 24±1.078 from 21±1.078, while SSB and SPM and BOTH did not change. At day 6, SSB and SPM increased to 21±1.078 from 20±1.078 while BOTH increased to 20±1.00 from 17±1.00 while SU remained constant at 24±1.078.

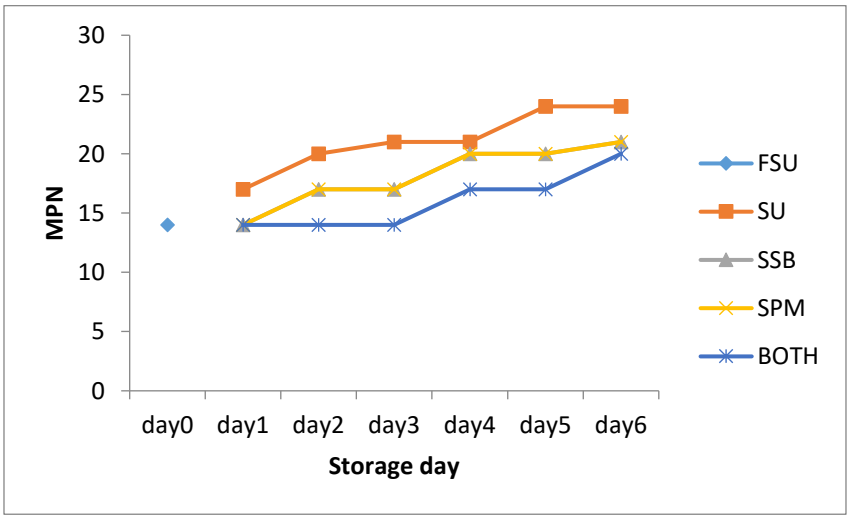

Figure 2.0: Most Probable Number (MPN) of Coliform in Treated and Untreated Soy Yoghurt

FSU: fresh soy yoghurt untreated, SU: soy yoghurt untreated, SSB: soy yoghurt treated with 0.5 g% sodium benzoate, SPM: soy yoghurt treated with 0.5 g% potassium metabisulphate, BOTH: soy yoghurt treated with equal amount of 0.25 g% potassium metabisulphate and sodium benzoate.

Table 1. Morphological and Biochemical Characteristics of Isolated Organisms from Treated and Untreated Soy Yoghurt

Morphological Characterization			Biochemical Characterization											Organism
GR	Shape	Spore	Cat	Id	Cit	MR	VP	U	G	S	L	H_2S	Mot	Gas	
-	Coc	-	+	-	+	+	-	-	+	-	-	-	-	-	*Shigella spp*
+	rod	-	+	-	-	+	-	-	+	-	+	-	-	+	*Bacillus spp.*
+	rod	-	+	+	+	-	+	-	+	+	+	+	+	-	*Staphylococcus*
-	rod	-	+	+	-	+	-	-	+	+	+	-	+	+	*aureus*
+	rod	-	-	+	-	+	-	-	+	-	-	+	+	-	*Escherichia coli*
-	rod	-	-	+	-	+	-	-	+	-	-	+	+	-	*Salmonella typhi*
															Salmonella spp.

Key: GR = gram reaction; Coc = cocci; Cat = catalase; Id = indole; Cit =citrate; MR = methyl red; VP = Voges Proskauer; U = urease; G = glucose; S = sucrose; L = lactose; Mot = motility; + = positive; - = negative

Table 2. Bacterial Isolated From Treated and Untreated Soy Yoghurt

Bacteria sample	FSU	SU	SSU	SPM	BOTH
Bacillus spp.	+	+	+	+	+
Escherichia coli	-	+	+	-	-
Shigella spp.	-	+	+	+	-
Streptococcus spp.		+	-	-	-
Staphylococcus aureus	-	+	-	-	-
Salmonella typhi	-	+	-	+	-

FSU: fresh soy yoghurt untreated, SU: soy yoghurt untreated, SSB: soy yoghurt treated with 0.5 g% sodium benzoate, SPM: soy yoghurt treated with 0.5 g% potassium metabisulphate, BOTH: soy yoghurt treated with equal amount of 0.25 g% potassium metabisulphate and sodium benzoate.

The percentage frequency of occurrence of isolated organism from treated and untreated soy yoghurt is presented in Figure 3.0. A total of six bacteria were isolated from the samples. *Bacillus spp.* has the highest frequency of occurrence with 30.77%, followed by *Shigella spp.* with 23.08% and the organisms with the least frequency of occurrence are *Streptococcus and Staphylococcus* with frequency of 7.69%.

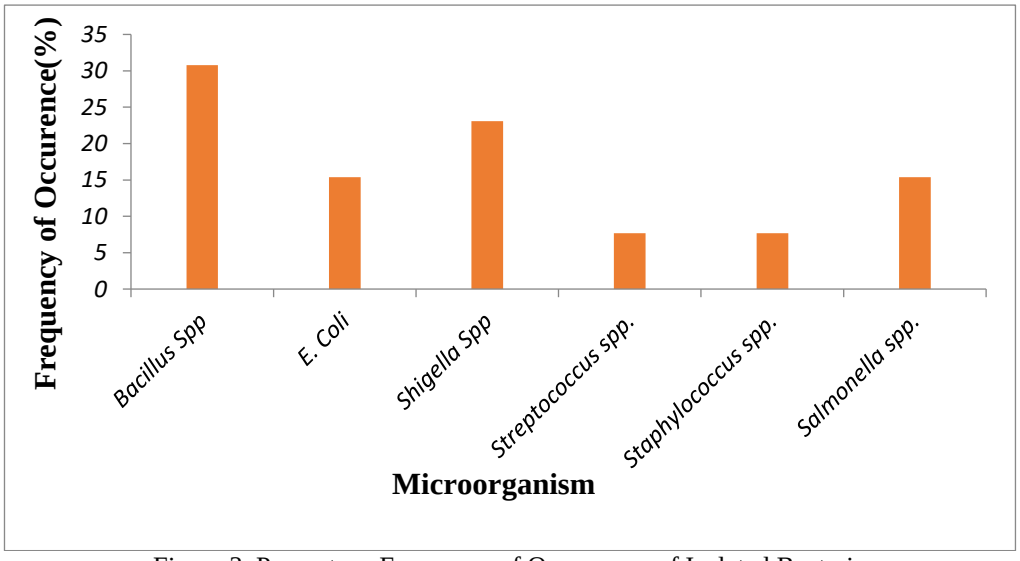

Figure 3. Percentage Frequency of Occurrence of Isolated Bacteria

Discussion

Soymilk yoghurt is a creamy, nutritious probiotic drink which contains protein, fat, carbohydrates, vitamins, minerals and live organisms. The nutritious nature of soymilk yoghurt makes it a good medium for microbial growth if not accurately process and preserve. Many microorganisms such as mesophilic aerobic bacteria, coliforms and yeasts are known to be responsible for the spoilage of soymilk yoghurt (Osuntogun and Aboaba, 2004). Soymilk has a great potential to supplement the dairy milk. Chemical preservatives are included in food to prevent microbial spoilage and to minimize the risk of consumer exposure to infection (Sean and Eileen, 2004). These chemical agents affect microorganisms by disrupting critical cell factors e.g they may damage the plasma

membrane or denature various cell proteins while others interfere with the functioning of nucleic acids thus inhibiting cell reproduction (Lansing *et al*., 2002).

The results obtained from MPN test which is a presumptive test for coliform helps to know the estimated amount of coliform present in a giving sample. It can be used as a test to know how safe a food sample is for consumption. Increase MPN result shows that the soy yoghurt is not safe for human consumption as earlier reported by Paulsen *et al*. (2006); Kunicka (2007). This kind of result was obtained from day 4 to day 6 and it was higher in SU sample which has no preservative, and the low number of coliform in sample BOTH is an indication that the use of the combination of sodium benzoate and potassium metabisulphate is better form of preserving soy yoghurt.

Effects of Preservation on Total Bacteria Count of Soy Yoghurt

Soy yoghurt served as an important source of protein in human diet (Jimoh & Kolapo, 2007). Its nutrient value has made it so irresistible that it is recommended by nutritionists. The greatest problem encountered is that the spoilage organisms survive in preservatives. The decrease in total bacterial count in the sample containing combination of sodium benzoate and potassium metabisulphate could probably be because of the bactericidal effect produced by the preservatives used. This tends to decrease to a higher extent the growth of most bacteria. The total bacterial load of day 0, 1 satisfy the FAO (1979) microbial limit of (4.0 to 5.60$\log_{10}$cfu/mL) for yoghurt. At day 2 and 3, all the samples fall within the fairly good limit of FAO (1979) standard limit of 6.30$\log_{10}$cfu/mL. At day 4, 5 and 6, all the samples fall within the range that is bad for consumption from 7.30$\log_{10}$cfu/mL and above.

Microorganism Isolated from Soy Yoghurt

The bacteria isolated include: *Staphylococcus spp, Streptococcus spp, Shigella spp, Bacillus spp*. *E. coli, Salmonella spp.* The occurrence of *Streptococci* is in line with the works of Chambers (2005) who reported that organisms that contaminate the surface teat and udders of the cow include *Staphylococci*, *Streptococci*, spore formers, coliforms and gram negative bacteria which can survive pasteurization temperature. The isolated organisms present in the soy yoghurt could be from the cow milk yoghurt used as starter culture during the production process. In most foods, the total bacterial count is often an indication for the sanitary quality, safety and utility of foods. It may reflect the conditions under which the product is produced such as contamination of raw materials, the effectiveness of processing and the sanitary conditions of equipment and utensils. *Bacillus spp.* was the dominant bacteria isolated in the yoghurt, they are inhabitant of soil (Van Eeden & Korsten, 2004) and food borne pathogens associated with health hazard (FAO, 1979; Odu and Adeniji, 2013). *Streptococcus* and *Staphylococcal* recorded the least bacterial load. Although, *Staphylococcal* load does not exceed the hazardous level but the presence should be discouraged because it level could increase if poorly stored. The possible source of this organism may be from the nasal passage, skin and other mammals. The presence of *Staphylococcus aureus* in yoghurt may cause *Staphylococcal* food poisoning which is a major type of food toxicity caused by ingestion of improperly stored or cooked food in which *S. aureus* has grown.

Conclusion

It can be concluded therefore that absence of preservative leads to increase in the viable bacterial load and hence quick spoilage of soy yoghurt. Several pathogenic bacteria were found to be responsible for the spoilage of soy yoghurt. The use of the combination of 0.25 g% of sodium benzoate and 0.25 g% of potassium metabisulphate is the most effective way of prolonging the shelf life of soy yoghurt.

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Impact Of Climate Change On Global Water Resources, Quality And Challenges For Sustainable Development Goals

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Abstract

Water is a blessing and reason of survival on earth for human beings. Without water it is not difficult to live on earth, but it is impossible. Unfortunately, rapidly increasing in population, unplanned agriculture practices and industrial sector, has becomes a serious issue for environment and for future needs. Approximately six billion people may suffer from scarcity of clean water by 2050. The agriculture sector is largest consumer of fresh water around 70% followed by industry and domestic 19% & 11% respectively. The Global demand of water is gradually increasing by 1% per year. Existing global water demand has been projected about 4,600 km^3 every year and estimated may increase up to 20%-30%, in range of 5,500-6,000 km^3 every year by 2050. Advancement of technology, excess use of fertilizers is main source of deterioration of water quality and has created serious concerns for environment, such as our drinking water contains various in many cases. About 10 billion tons of freshwater using by human and result severe polluted return to environment. It is estimated that about 80% of wastewater discharged from industries containing utmost hazardous contamination is of biological nature, which causes serious human health problems and may cause death. The nominal treatment is carried out in upper middle-income 38% and worst situation in lower middle-income countries up to 28%, only 8% in low-income countries, undergoes for treatment for reuse.

Keywords: *Agriculture, Climate change, Environmental Challenges, Wastewater treatment, Water Quality*

Introduction

Water is blessing by nature, it a scarce and necessary resource that is crucial to human welfare. It is only renewable when treated correctly. Groundwater has potential to fight against hunger, creates jobs and provides food security and can play vital role in socio-economic development of the world. The share of groundwater in availability of all liquid freshwater on earth is around 99% *[WWDR, 2022]*. It is fact that more than 1.7 billion people now live in river basins where human demand exceeds natural recharge; two-thirds of the world's population will live in water-stressed countries by 2025. Even while water can pose a significant barrier to sustainable development, water management can play a significant role in strengthening the resilience of social, economic, and environmental systems in the face of rapid and unpredictable change. Water is crucial for sustainable development; because it sustains ecological health, economic growth, and human existence, It is crucial for raising population health, productivity, and wellbeing as well as for reducing the burden of disease worldwide. More than 1.7 billion people currently reside in river basins where water usage exceeds recharge, causing rivers to dry up, groundwater to run dry, and ecosystems and the services they provide to deteriorate *[UN sustainable development]*. Climate change is altering weather patterns, which causes extreme weather events, variable water supply, a worsening of water scarcity, and contaminated water supplies. These effects can have a big impact on the quantity and quality of water that kids need to survive. By 2050, it is anticipated that the global water demand (measured in withdrawals) would have increased by 55% *[OECD 2012]*. Over 80% of wastewater is reportedly released without treatment, according to some estimates.

The most economically and socially damaging natural disasters are those that include water. Floods, droughts, and storms have affected 4.2 billion people since the 1992 Rio Earth Summit, accounting for 95% of all catastrophe victims, and have cost USD 1.3 trillion in damage (63% of all damage) *[WWDR-2022]***.** As human populations increase, industrial and agricultural activity increases, and climate change threatens to significantly disrupt the hydrological cycle, declining water quality has emerged as a global problem. Eutrophication, which is caused by high nutrient loads (mostly phosphorus and nitrogen), is the most common issue with water quality on a global scale and significantly reduces the beneficial uses of water. Agricultural runoff, residential sewage (which can also be a source of microbiological pollution), industrial effluents, and air inputs from burning fossil fuels and bushfires are among the main sources of nutrients. Due to their complicated dynamics, relatively longer water residence durations, and function as an integrating sink for pollutants from their drainage basins, lakes and reservoirs are particularly vulnerable to the harmful effects of eutrophication. Nitrogen levels above 5 mg/l of water are frequently signs of contamination from animal and human waste or fertilizer runoff from agricultural areas.

A necessity for water resources are one of the natural resources that can be discovered in sufficient quantities is water. It is a vital source for the continuation of life on Earth. It is frequently utilised for many different things, including drinking, washing, cleaning, cooking, irrigation, and other residential and commercial functions. By 2030, cut the amount of untreated wastewater upto 50 percent, less dumping, restrict the release of hazardous chemicals and materials, enhance recycling and safe reuse and reduce pollution by 2030 *[UN sustainable*

development]. Every continent already experiences a water shortage. 500 million people, or almost one-fifth of the world's population, are on the edge of experiencing physical scarcity, which will impact about 1.2 billion people. Economic water deficit affects an extra 1.6 billion people, or close to a quarter of the world's population (where countries lack the necessary infrastructure to take water from rivers and aquifers) *[UNDP, 2006]*. One of the major issues that many cultures and the world will face in the twenty-first century is a lack of clean water. Since this century, water demand has increased at a rate that is more than twice that of population growth. Both a natural and man-made issue, water scarcity; for the seven billion people on the earth, there is enough freshwater available, but it is dispersed unevenly and too much of it is polluted, and handled in an unsustainable manner.

Impact of global climate change on water resources

Water is essential for some important sectors including consumption of human, agriculture crops, production of energy as well as manufacturing of industrial items, all these are water consuming activities. The demand of water for use of different sectors by 2050 will increase upto 70% *[WWDR, 2017]* .The irrigation land doubled, tripled in livestock and 20 times increase observed in aquaculture *[WWDR, 2015]*. The population of the world may increase upto 8.6 billion in 2030 and 9.8 billion in 2050. The emphasis should be given on increasing water use efficiency and conservation of water resources to meet the food and nutritional requirements of the population by 2050. To develop global water resources, should be implementation of climate-smart agriculture practices [*Sheikh and Karim, 2020]*. The variation or increase of temperature will change the pattern of precipitation and humidity by 2050 *[Wang, et al. 2013]*. The green house gases are largest reason for change pattern of weather *[Milly et al, 2011]*. Around 0.88 C has been increased between 1880-2012, and by 2100 may accelerate further 0.3-4.8C *[Carter et al, 2015]*. The climate change effects were observed in different regions such as Hotan River in China *[Climate Change 2013; Luo et al, 2017]* There is a potential impact of climate change in North Korea *[Climate Change 2014]*. The climate change impacts were observed as increased in temperature in Europe. The pattern has been changed in precipitation and snow cover and increased in flood and drought condition. The river discharge has affected in Germany and other European countries due to climate change *[Lee et al, 2017]*. The central and Eastern Europe is experiencing in precipitation, decreasing during last century *[IPCC, 2007]*. Austria, Poland, Hungry, Germany and Czech Republic are affected by extreme flood during last decade *[Klein et al, 2002]*. Switzerland and Finland are facing ice cover shorter duration. Due to this situation the Europe may suffer in different sectors such as agriculture, energy production, as well as drinking water *[Klein et al, 2002]*. The study shows impact of climate change in 22 basins in Australia, and change of precipitation and potential evapotranspiration around 1% may cause a change of runoff by 2.1–2.5% and 0.5–1.0%, respectively *[Vose et al, 2016]*.

World water position and demand

Water availability, Quality and Asia region

Water is the center of the three pillars of sustainable development-economy, society and the environment. Water pollution is a biggest threat to the planet including our ecosystem. Only little amount of industrial and municipal wastewater is treated 8 and 28% in low-income countries and lower-middle-income countries. As it plays a vital role in achieving poverty reduction, in production/ growth, public health, food security. The freshwater is becoming very rare as well as biggest challenge for Asia continent and increasing uncertainty for future needs. Around 16% people are struggling for safe water. UN has projected around 2025 50% countries of the world may face water shortages and around 2050 ¾ people of the world will be affected by water shortage. Asia continent is comprises of 50% of population of the world (please add table of figure to compare population) and around 2/3 population is increasing in the world, it is expected that around 500 million population may increase in 10 years, other side there is a less freshwater resources for Asian people 3920 m^3/person/year. Around USD 8 billion are required for the requirement of safe drinking water to meet the millennium development goals. According to the *[WHO,2017]*783 million people, or roughly one out of every ten people on the earth, do not have access to safe d rinking water, and 2.5 billion people, or more than a third of mankind; do not have access to appropriate sanitatio n. In Asia, where more than half of the 2.5 billion people donot have access to proper sanitation, the problem is p articularly urgent. Farmers will require additional 19 percent more water by 2050, according to the UN Food and Agricultural Organization *[FAO, 2009*] much of it in countries already facing water scarcity. According to the *[FAO, 2009]*,food output will need to increase by 70% by 2050 to feed a world population that is predicted to increase f rom 7.3 billion to 9.3 billion people. The average amount of fresh water per person in Asia is 47% of the global a verage of freshwater/person. However, it is home to 65 percent of the world's population.

Despite having the fourth largest fresh water reserves in the world, China has the world's second lowest per-capita water supply. In 2015, the World Health Organization *[WHO ,2017]* claimed that 884 million people lacked access to even basic drinking water, with 159 million relying on surface water *[WHO,2017]* around 02 billion people used contaminated drinking water containing faecal. By 2025 around 1.8 billion people will live in water scarcity countries (less than 1000m3/person.365 days) and water stressed population will be fifty percent of the world *[Mitra 2014; Bain, et al, 2014]*. Domestic and industrial sectors demand will increase upto 55% by 2050 [*WWAP*

2015]. Combination of anthropogenic and nutrient factors is responsible for degradation of water throughout the world. Improper treatment of municipal and industrial effluent and traditional agriculture practices are key responsible for river's pollution. Yangtze River is discharging 0,333 million tons plastic waste into East China Sea. Ganga River is receiving around 0.115 million tons plastic waste per year *[D'Mello 2017];* while Yemna River contributes sewage water 3.9 billion liters per day by 21 outlets *[Yadav, 2013]*. Over exploitation of freshwater resources are damaging upto 1.75 trillion USD to agriculture, biodiversity and ecosystem sectors *[Niko, 2013]*. In Asia 5.2 billion populations is projected by 2050.

Around 80% of Asian rivers are in poor health, 1.7 billion populations are using lack basic sanitation in 2015. Around 3.4 billion people population will live in water stress areas in Asia continent *[ADB 2016]*. 2 billion populations can suffer for food security disaster by 2050 and affect more than 1.8 billion population in water stress by 2080 *[UN-ESCAP 2015]*. 700 million died and 1.7 billion people are affected by different calamities during ten years 2006-2016 *[ADB 2016]*. Groundwater is a major water supply upto 1/3 in some Asian countries such as Pakistan, India, china and Bangladesh; tube well are76% & 60% source of water for people of Bangladesh and Cambodia *[UNESCO 2015]*. It is projected that groundwater irrigation adds upto USD 30 billion per year in Asian countries economy *[WWAP 2015]*. Hardly 22% of effluent is treated for safe discharge in surface water bodies in Asia *[UN WATER 2017]*. South Korea and japan are not 100% treating wastewater; while pacific island countries 17%central and western Asian countries 34% southeast Asian countries 38% and east Asian countries 57%, are treating their generated effluent in the countries *[UN WATER 2017]*.

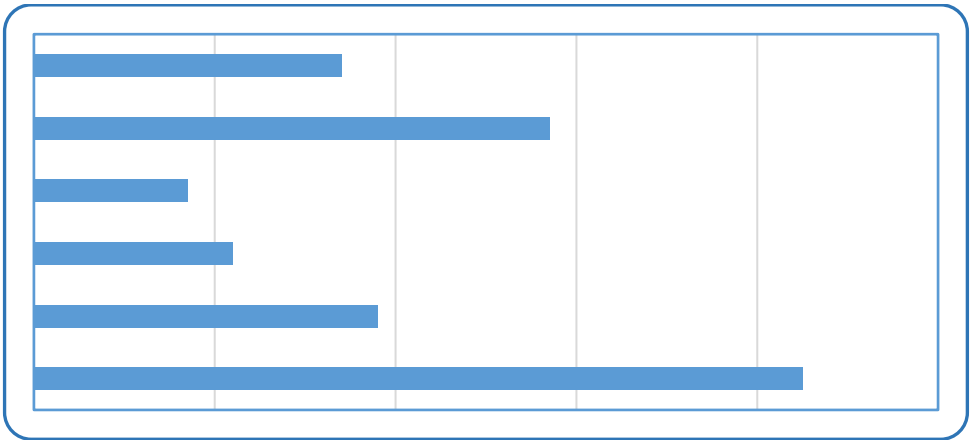

Figure 1- Wastewater Treatment by sub-regions in Asia *[UN WATER 2017]*

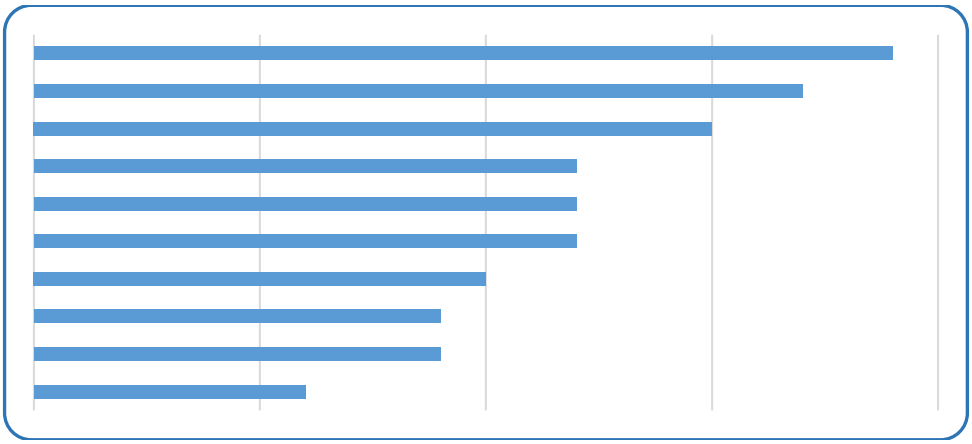

Figure 2- Wastewater Treatment by countries in Asia

The water is considered is a precious gift for the world. Due to the excess human demand scarcity of water, the safe water access is a rising a serious issue for environmental protection and sustainability. The irresponsible role of human for consuming of freshwater resources is responsible for deterioration the quality of water resources on this planet.

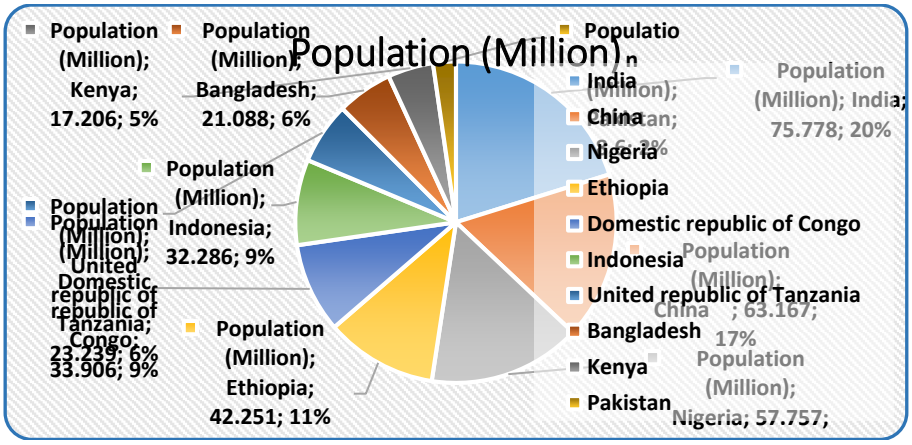

Figure 3- Top 10 countries without access to safe water *[UNDP 2016]*

South Asia and Availability of Water

South Asia region is a very populated region as compared to other regions with around 1.6 billion population in 2010, and by 2050 over 2.2 billion, almost more than 33% increase *[WB 2013b]*. It comprises of regular members Pakistan, India, Bangladesh, Bhutan, Nepal, Sri Lanka, and Maldives. The agriculture sector is major source of livelihood of this region. Nearly 50% of the population is directly or indirectly involved in agriculture sector; it contains 18% in the GDP of south Asia *[WB 2013a]*. Agriculture crops production depends on the availability of freshwater resources and it's judiciously utilization. The population in 20th century has increased three times; while six times increase in use of the water *[FAO 2009]*. Due to drought situation the agriculture sector is facing USD 8 billion per year due to crops production, which has affected more population as compared to other natural disasters *[Zhang, et al, 2015; Keyantash and Dracup, 2002]*. China faces loss of 27 million tons of grains since 20 years *[Chen et al, 2014]*. Since 1960 the per capita of freshwater resources has declined upto 55% (FAO) Demand for freshwater may further increase upto by 2030r 50% *[WWAP 2012]*. Global population's 40% is affecting by water scarcity. Pakistan is an agriculture dependent country, 20% of GDP, have one the largest irrigation network but with 60% losses and counted very poor system and using almost 73% of water resources which is one the highest consuming country *[Hukka et al, 2010]*. In Pakistan the people are suffering from water shortages around among 207 million have no access to safe water *[Zulfiqar, 2018]*.

Once pakistan was abundant water country, but at the moment water resources in pakistan is gradually decreasing from 5260m3/capita to 1000m3/capita (1951-2016), which shows the water pressure due to increasing of population and injudiciously use of this resource. It may further decrease upto 869m3/capita by 2025 and ultimately may face water crisis to food security *[Nabi et al 2019; Mikosch et al 2020; Ullah et al 2018]*. If this situation continuous and reaches to 500m3/capita by 2025 it will become land without water. 24 cities are holding burden of population, with lack of access to clean water i.e. Karachi, Lahore, Faisalabad and Rawalpindi *[Kummu, et al 2016]*. The global economy may face cost of 500 billion USD, due to insecurity of water *[WWAP 2016]*. The mangroves ecosystems are severely affected to coastal areas of America and Asia. In 2013 world is witnessed loss of 50 billion USD, in 2013 due to flood management *[Guha-Sapir, 20014]*. 45 million people are using arsenic contaminated water in Bangladesh *[Flanagan et al 2012]*. Leakage is one of the biggest issue and nearly 30% loss in abstracted water globally [Kingdom et al 2006]. Also loss 45 million m3 due to poor infrastructure or leakages; this losted water is sufficient for nearly 20 million people *[Kingdom et al 2006]*. The huge investment is required to improve or maintain, USA need to allocate USD 195 billion by 2040 *[ASCE 2011]*.

Water resources are facing disposal of 2million tons/day human waste *[WWAP 2017a]*, fossil fuel/nonrenewable resources are affecting freshwater resources upto 18 billion m3/year *[WWAP 2017b]*. While 40% wastewater pollution due to food sector from developed or high income countries as well as 54% from less developed or low income countries *[UNEP 2007]*. The globally loss may increase upto 19.2 billion USD, from 2020-2050 due to rise of 20C in temperature *[WB 2010]*. 1/5 of the global population may suffer due to excess BOD and 1/3 from excessive phosphorus and nitrogen by 2050 *[Veolia and IFPRI 2015]*.

Central Asia and Use of Water

Central Asia has been identified as one of the regions with the utmost possibility for conflicts over water *[Zhupankhan, et al 2018]*. The temperature has increased twice in central Asia since 1970 it is fast as compared to other countries globally *[WBGU 2007]* further increase of temperature 2-4 ^{0}C by 2025 and 3-5 by 2080, projected y IPCC *[Lioubimtseva et al 2009; Lutz et al 2013]*. Nearly 70% disputes in central Asia are due to scarcity of freshwater resources *[Severskiy, 2004]*. The central Asia is rich in other natural resources i.e minerals and fossil fuels, however not rich in water, it keeps major role in economic development of Turkmenistan, Kyrgyzstan, Uzbekistan, and Tajikistan *[FAO 2015; EEA 2018]*. The major water consumer is irrigation sector,

which used nearly 60-90% in central Asian states [*FAO 2015; EEA 2018]*. The use of water varies as per region and development activities, as per 2006 data, the agriculture sector was biggest consumer of water in world followed by industries and municipal. It is further distributed that in Asia, the agriculture sector is largest consumer, Europe for industrial while equally proportion in North America *[FAO 2015]*.

The two cities Edinburgh and Glasgow of Scotland are facing water quality problems, despite that many rivers flow (Clyde, Forth) in the surroundings of both cities but issues are stagnant *[SEPA 2007]*. In north eastern part river basin area may create environmental issues due to agricultural activities. Nearly 40% of Scottish water does not meet the environmental standards for good ecology *[SEPA 2007]*. The main reason for this situation is agricultural pollution, sewer over flow and contaminates water run off by roads *[SEPA 2007]*. In 2008 and 2009 (summer season) monitoring of streams and rivers were identified by EPA in USA. The water quality was almost found unsatisfactory due to high percentage 40% of phosphorus and 27% for nitrogen; due to excess use of fertilizers and wastewater. The biological communities were also at high risk due to higher percentage of phosphorus and nitrogen *[EPA 2014a]*. Globally, it has been estimated that between5 and 20 million hectares of land are irrigated with untreated wastewater *[Drechsel, et al 2010]*.

Conclusion

Economic development cannot declare wholly responsible for the deterioration of water quality as well as not solution of all problems. Some other steps are also very essential such as watershed management, which is very important for the water quality, water availability increase, and recharge of groundwater and helpful for reduction of other impacts. It is recommended to manage irrigation water to use and implementation of climate-smart agriculture practices and protects the water resources and quality. Allocation of water for agriculture is very hard/core issue and accurate data can play very important role for water conservation/saving due to this many lives can save, cost reduction, and minimize other impacts on water resources/reservoirs. It is recommended to be a creative mind for the water management system such as municipal, industrial and irrigation. The policy should be formulated on every country's basis. The focus should be on the latest techniques of irrigation system/techniques such as Deficit irrigation, micro irrigation, Drip and Sprinkler irrigation system should be introduced/ implemented to replace the traditional irrigation system. Crops with high yield on lowest water use should introduce to feed the population of around 9 billion by 2050; because due to increase of population by 2050 will severely affect water resources and may reduce availability of water. For policy making it is necessary for data availability of wastewater generation, its discharge without treatment or treated, without complete or proper information it is very difficult to make action plan, protection of environment resources from wastewater pollution. Given the importance of water we need to save water and change our lifestyle to minimize use of water.

It is difficult to imagine life on the earth without water. We should adopt agriculture mechanization, high yielding seeds and crops will have to be cultivated on less water, replacing new irrigation techniques including drip irrigation and sprinkle irrigation. Because with water savings to cope with the growing population by 2050. With improving irrigation efficiency, the usage of freshwater can reduce. It is recommended to monitor the entire water management system including agriculture to prevent from a severe crisis of water management and for that we should be more creative than we ever were. For efficient usage of water there is a need for the development of Global Monitoring Information System for water which can provide necessary information on water management and progress monitoring of desirable targets. Development of this system will provide us the wide spectrum of information from different levels, like form local to national and ultimately the global level. Hurdles to research, technology and innovation applications is due to the lack of financial resources for improvement of existing technologies in developing countries but also the lack of awareness for promoting the research and innovation in the countries which are already developed to shift to the new and efficient technologies for large-scale applications. The high costs of high-end technologies hamper their widespread application, especially in developing countries. It is because of the quick depletion of the available resources of water and its impact on climate change, conventional irrigation systems must be revised because of it cannot sustain in many areas around the globe. The incomplete data is a hurdle to make policies for water resources in Asia. We should change technologies for rice, and sugarcane crops to save water. Considering the dire circumstances of scarcity and quality deterioration of freshwater quality in world, it is recommended that necessary steps should be taken on urgent basis and vehemently to address the issues at hand to adopt policy-based solutions to address the challenges in supply and demand side management of water resources to approach for reduction in water use; reuse and recycle apply at supply side for wastewater reclamation.

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Response of NPK split application for Irish potatoes derived from the nutrients' uptake pattern

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Abstract

For all food crops, including Irish potatoes, harvestable biomass is largely carbon, from the atmosphere, accumulated through the photosynthesis. Thus, the nutrient-deficiency stress-induced yellowing of leaves may result in substantial yield losses. We know that the premature aging of actively photosynthesing leaves may be caused by early and mid-season soil nutrients depletion, a very probable problem in most open field conditions, particularly heavy-rainfall-and mountainous regions, which is the case for major Irish potatoes growing areas of Rwanda. With the split application of the inorganic fertilizers, we may, however, be able to prevent the condition and achieve good yields. The practice ensures that sufficient levels of soil nutrients, especially nitrogen, phosphorus, and potassium, are available to the crops during the nutrient-deficiency senstive development and growth stages. International Plant nutrition Institute recommends applying a right rate of a right fertilizer type at a right growth stage in a right place. In this study, basing on the nutrients uptake pattern of the potato plant, we derived and tested three NPK.17.17.17 splits (T1: 23%-77%, T2:41%-59%, and T3:59%-41%) following a three-replication single-factor Completely Randomized Block Design under relatively young volcanic loam soil of the northern province of Rwanda, Busogo sector. Except for the control, T0, to which a whole rate (100%) of 28 grams per plant were applied at planting, for the other experimental conditions, the first fraction was applied 30 days after planting and then the remaining 30 days afterwards. Results, from data on vegetative growth, chlorophyll index 60 and 90 days after planting, the number of tubers, and total tuber yields, show that applying 59% of a right rate of NPK.17.17.17 first and then the remaining, 41%, afterwards may be recommended under the study area and other spots with similar soil-climatic conditions.

Keywords:*NPK-split-application,nutrient-uptake-pattern,premature-aging-of-photosynthetically-active-leaves, nutrient-deficiency-sensitive-growth-and-development-stages.*

Introduction

As the knowledge on Irish potatoes (*Solanum tuberosum* L.) improves, it is increasingly becoming clear that Irish potatoes are an important food source. They have a high-biological-value (BV) protein (Kowalczwski et al.,2019). Their protein has a biological value of 90. More importantly, the potatoes, per unit area, produce more food than any known major crop; and they are more water-efficient than cereals (Sun et al., 2015). Not surprisingly, they are the third most important food in the world (International Potato Center, n.d). And, fortunately, thanks to their outstanding agronomic plasticity (Celis-Gamboa, 2002), over 100 countries are able to grow Irish potatoes (International Potato Center, n.d). Undoubtedly, the potatoes have potential to take the human race to a higher level of the food security ladder. As an important food source, Irish potatoes have captured great attention of the scientific community. Even so, yields are still far lower than the attainable.

Our inorganic fertilizers application methods need to be revised. For Irish potatoes, tuber yield substantially depends on the source capacity. In order words, growing tubers chiefly rely on photosynthesis to accumulate storage material in order to reach their potential maturity sizes. The source capacity is a function of the number and lifespan of photo-synthetically active leaves. Under leachy-and mountainous environments, which is the case for Rwanda's potato growing regions, the early and or mid-season soil nutrients depletion is almost always possible. And it is known that the early and mid-season nutrients-deficiency conditions cause premature aging of foliage and, as a consequence, negatively affect tuber growth. Jenkins & Mahmoods (2003) show that soil deficiency stresses of nitrogen, phosphorus, and potassium can cause 26-63% of the fresh tuber yield loss. Under most open field conditions, without the proper split application of the leachable and volatile inorganic NPK fertilizers, high Irish potatoes yields may be impossible. International Plant Nutrition Institute advocates the 4Rs principle: that a right rate of a right fertilizer type should be applied at a right growth stage in a right place (with compatible soil-climatic conditions).

This research, therefore, sought to develop a split application technique of the fertilizer for Irish potatoes. The objective was to answer the question, "Given a right rate of NPK.17.17.17, basing on the nutrients uptake pattern of the crop, how can the rate be split into two fractions, one of which is to be applied at a certain time and then the remaining afterwards?"

To arrive at such a technique, the nutrients' uptake pattern of potato plant was used to derive, quantitatively, three NPK.17.17.17 splits: 23%-77%, 41%-59%, and 59%-41%.

The fertilizer rate per plant used was 28 grams. The first fraction was applied 30 days after planting and then the remaining 30 days afterwards. The experimental conditions were tested under relatively young volcanic loam soil of Busogo sector, Musanze district, of the Northern province of Rwanda during both the short rainy season (27th March 2019 – 27th July 2019) and long rainy reason (25th October 2019 – 25th February 2020). The timing of the fertilizer application was not a part of the work, however.
The experiment revealed that, with an appropriate inorganic fertilizers split application practice, high yields, 50-100 tons/ha, of Irish potatoes are not remote possibilities even under ordinary rain-fed field conditions.

Materials and Methods

The study was conducted in the northern province of Rwanda, Musanze district, Busogo sector. The location is characterized by young volcanic loam soil. The average annual temperature is 16.2^0 C. The site receives 1,420 mm, as annual precipitation. The previous crop was peas for the year 1 experiment (27th March 2019-27th July 2019, season B). For the year 2 experiment (25th October 2020-25th February 2020, season A), the field had been under fallowing.
The test subject was the local popular variety, Kinigi. The 70cm x 30cm spacing was used during planting. Potato seeds were planted to a depth of 10 cm. Ample cow manure per plant was applied as a basic fertilizer for all the experimental conditions. Following the single-factor Completely Randomized Block Design, the treatments were applied as follow: T0-100 % of 28 grams per plant at planting; T1-23 % of the 28 grams 30 days after planting and then 77 % of the 28 grams 60 days after planting; T2-41% of the 28 grams 30 days after planting and then 59 % of the 28 grams 60 days after planting; T3-59 % of the 28 grams and then 41 % of the 28 grams of the 28 grams 60 days after planting. During the administration of the experimental conditions, a complete circular shallow depression around each plant was created, approximately 10 cm from the main stem. The fertilizer was then hand-applied and reasonably uniformly distributed around each plant. A “light ridging”, done as weeding, and earthing-up were done 30 days and 60 days after planting, respectively. The ridging and earthing-up were coupled with the administration of the experimental conditions so that we could cover the fertilizer with ample soil, to reduce volatilization of the fertilizer. For disease management, on emergence, the fungicides, Ridomil and dithane (following the recommendations) were applied and then dithane on a weekly basis until two weeks before harvesting.
Chlorophyll index 60 and 90 days after planting was measured using SPAD. Data on yield, number of tubers and total tuber weight per plant, were also collected. Ten plants per treatment were randomly selected. The total tuber yields were calculated as follows: total tuber weight per the 10-plants sample multiplying by 10,000 square metres divided by the area occupied by the ten plants at the 70cm x 30cm spacing. All the data were arranged and summarized using Microsoft Excel 2019, and analyzed using SPSSv16. ANOVA (Analysis of Variance), and the post-hoc test, were used to compare the experimental conditions.

Results

Chlorophyll index 60 days after planting (CI60).

For the first-year experiment (see Figure 1 and Table 1), T2 resulted in the highest chlorophyll index (T2, 43.67; T0, 43.12; T3, 43.09; T1, 41.29). The treatment differed statistically significantly only from T1, however. For the second-year experiment (see Figure1 and Table 2), T3 produced the highest chlorophyll index, and it was significantly different from T0 and T2 (T3,46.7; T2, 46.0; T0, 46.0; T1, 45.3).

Table 1. Chlorophyll index at 60 DAP for the 2019 experiment: Multiple comparison of the NPK.17.17.17 split levels

(I)NPK split level	*(J)NPK split level*	*MD(I-J)*	*Sig.*
0	1	1.83333*	.004
	2	-.55333	.365
	3	.03000	.961
1	0	-1.83333*	.004
	2	-2.38667*	.000
	3	-1.80333*	.005
2	0	.55333	.365
	1	2.38667*	.000
	3	.58333	.340
3	0	-.03000	.961
	1	1.80333*	.005
	2	-.58333	.340

I:the first split level; J: the second split level; MD: mean difference between the first and the second split level; Sig: significance level; 1:T_1; 2:T_2; 3:T_3; 0:T_0. (T_1, T_2, T_3, and T_0 are the split levels of NPK.17.17.17). A significance level less than .050 indicates a statistical significance difference between the first and the second split level being compared.

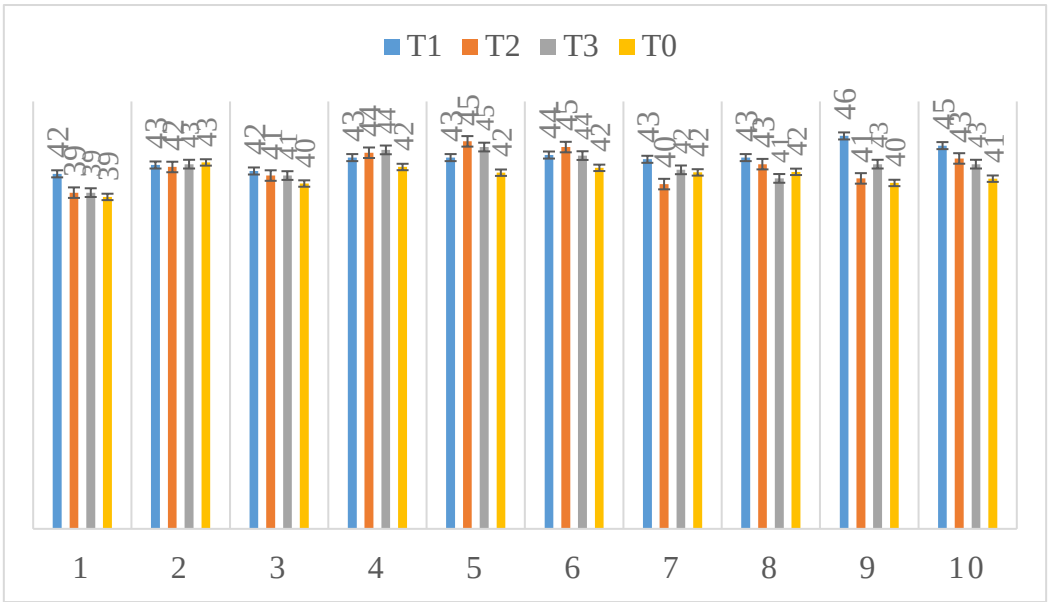

Figure 1.Effect of NPK.17.17.17 split levels on Chlorophyll index 60 days after planting-the season B experiment

Table 2. Chlorophyll index at 60 DAP for the 2020 experiment: Multiple comparison of the NPK.17.17.17 split levels

(I) NPK split level	*(J) NPK split level*	*MD (I-J)*	*Sig.*
0	1	.69750	.067
	2	.01250	.973
	3	-.74750	.050
1	0	-.69750	.067
	2	-.68500	.071
	3	-1.44500*	.000
2	0	-.01250	.973
	1	.68500	.071
	3	-.76000*	.047
3	0	.74750	.050
	1	1.44500*	.000
	2	.76000*	.047

I:the first split level; J: the second split level; MD: mean difference between the first and the second split level; Sig: significance level; 1: T_1; 2:T_2; 3:T_3; 0:T_0. (T_1, T_2, T_3, and T_0 are the split levels of NPK.17.17.17). A significance level less than .050 indicates a statistical significance difference between the first and the second split level being compared.

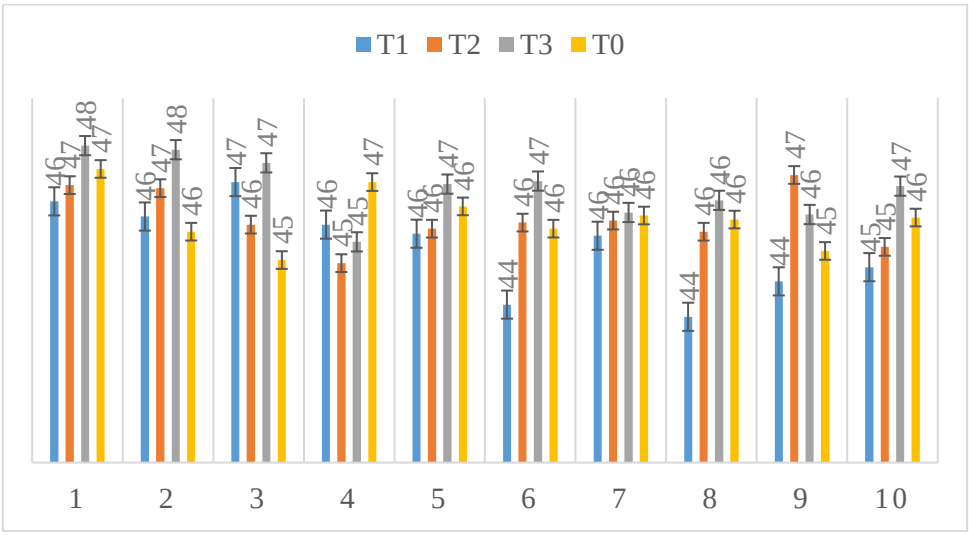

Figure 2.Effect of NPK.17.17.17 split levels on Chlorophyll index 60 days after planting--the season A experiment

Chlorophyll index 90 days after planting (CI90)

For the first-year experiment (see Fig. 3), chlorophyll index 90 days after planting did not differ significantly for the experimental conditions. For the second-year experiment (see Fig. 3 and Table 3), however, T3 significantly differed from only T0. T3 was insignificantly different from T1and T2. T1 and T2 were also insignificantly different from T0.

Table 3. Chlorophyll index at 90 days after planting for the 2020 experiment: Multiple comparison of the NPK.17.17.17 split levels

(I)Split level	*(J) Split level*	*MD(I-J)*	*Sig.*
	1	-.45500	.399
0	2	-1.00500	.067
	3	-1.29250*	.020
	0	.45500	.399
1	2	-.55000	.309
	3	-.83750	.125
	0	1.00500	.067
2	1	.55000	.309
	3	-.28750	.593
	0	1.29250*	.020
3	1	.83750	.125
	2	.28750	.593

I: the first split level; J: the second split level; MD: mean difference between the first and the second split level; Sig: significance level; 1: T_1; 2:T_2; 3:T_3; 0:T_0. (T_1, T_2, T_3, and T_0 are the split levels of NPK.17.17.17). A significance level less than .050 indicates a statistical significance difference between the first and the second split level being compared.

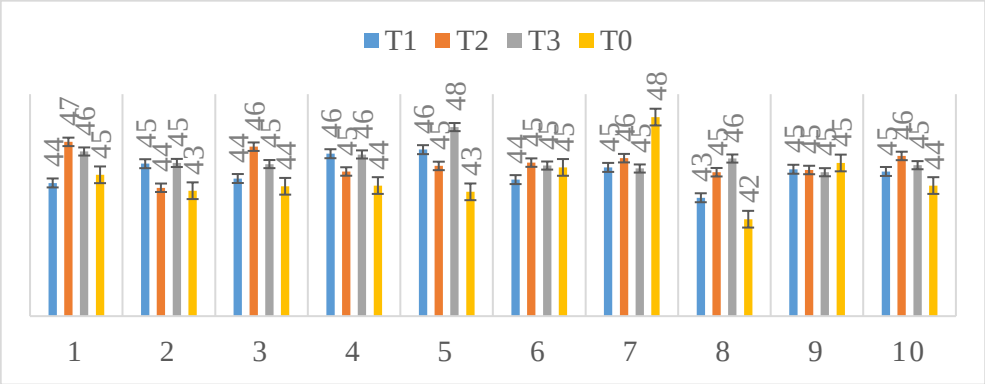

Figure 3. Effect of NPK.17.17.17 split levels on chlorophyll index 90 days after planting--the season B experiment

Total tuber number per plant

For the first-year experiment, statistically significant differences were observed (see Table 4 and figure). The second-year experimental data revealed that T3 resulted in a significantly greatest number of tubers. The number of tubers for T3 was greater than that of T1 and T0(T0, 15 tubers; T1, 17 tubers; T2, 19 tubers; T3, 20 tubers) (See Table5 and figure 5).

Table 4. Total tuber number per plant for the 2019 experiment: Multiple comparison of the NPK.17.17.17 split levels

(I)NPK split level	*(J)NPK split level*	*MD(I-J)*	*Sig.*
	1	-1.984000	.091
0	2	2.150000	.071
	3	-6.117000*	.000
	0	1.984000	.091
1	2	4.134000*	.004
	3	-4.133000*	.004
	0	-2.150000	.071
2	1	-4.134000*	.004
	3	-8.267000*	.000
	0	6.117000*	.000
3	1	4.133000*	.004
	2	8.267000*	.000

I: the first split level; J: the second split level; MD: mean difference between the first and the second split level; Sig: significance level; 1: T_1; 2:T_2; 3:T_3; 0:T_0. (T_1, T_2, T_3, and T_0 are the split levels of NPK.17.17.17). A significance level less than .050 indicates a statistical significance difference between the first and the second split level being compared.

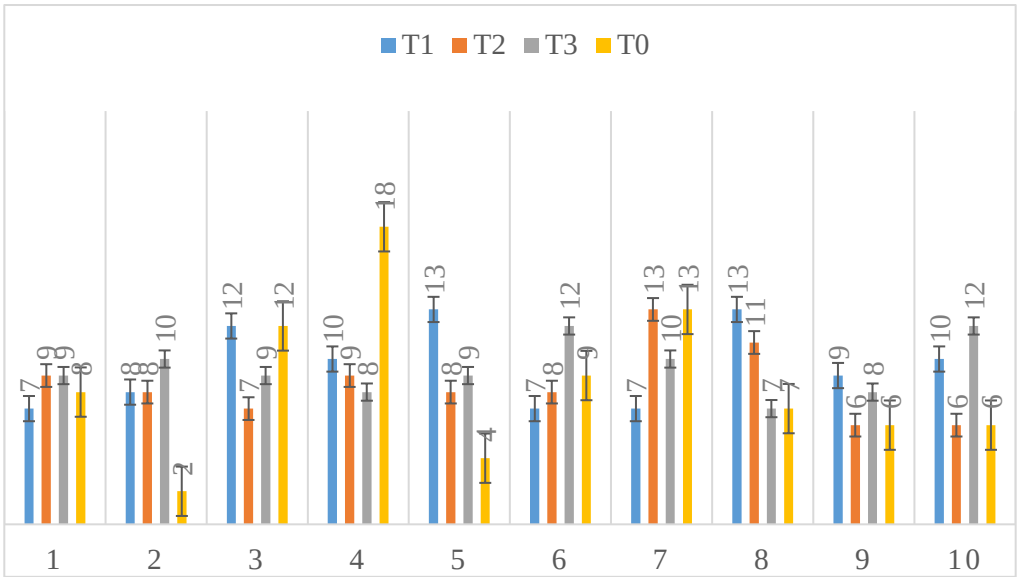

Figure 4. Effect of NPK.17.17.17 split levels on the number of tubers--the season B experiment

Table 5. Total tuber number per plant for the 2020 experiment: Multiple comparison of the NPK.17.17.17 split levels

(I) NPK.17.17.17 split level	*(J) NPK.17.17.17 split level*	*MD (I-J)*	*Sig.*
0	1	-1.90000	.116
	2	-4.35000*	.001
	3	-5.00000*	.000
1	0	1.90000	.116
	2	-2.45000*	.045
	3	-3.10000*	.012
2	0	4.35000*	.001
	1	2.45000*	.045
	3	-.65000	.585
3	0	5.00000*	.000
	1	3.10000*	.012
	2	.65000	.585

I: the first split level; J: the second split level; MD: mean difference between the first and the second split level; Sig: significance level; 1: T_1; 2:T_2; 3:T_3; 0:T_0. (T_1, T_2, T_3, and T_0 are the split levels of NPK.17.17.17). A significance level less than .050 indicates a statistical significance difference between the first and the second split level being compared.

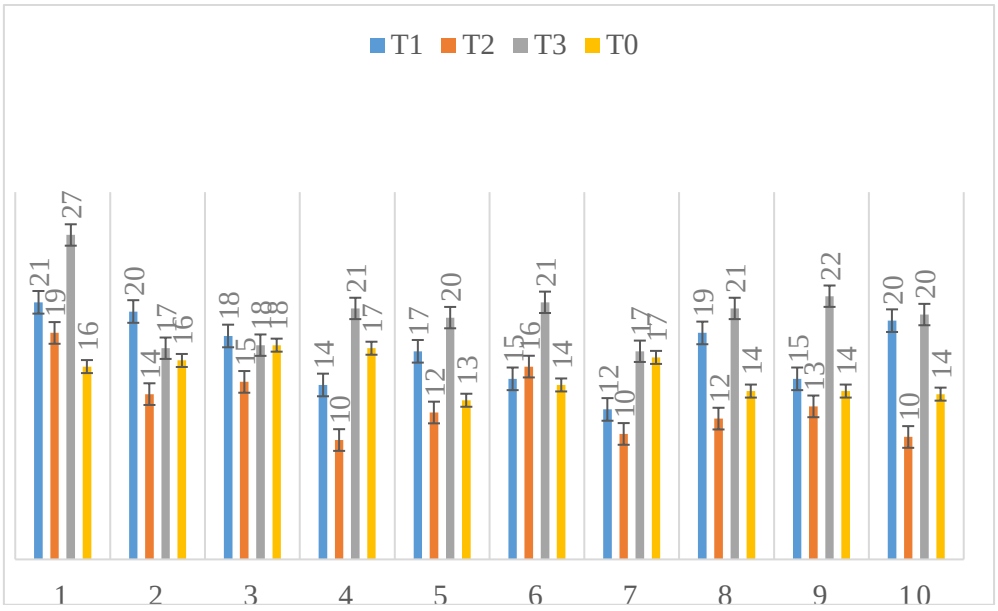

Figure 5.Effect of NPK.17.17.17 split levels on the number of tubers --season A experiment

Total tuber weight per plant

For the first-year and second-year experiment (see Table 6 and Table 7 and Fig. 4), statistically significant differences were observed. T3 resulted in the highest total tuber weight per plant. Total tuber weight per plant were T3y1=59t/ha and T3y2=124 t/ha, T1y1=51t/ha and T1y2=114t/ha, T0y1=52t/ha and T0y2=110t/ha, T2y1=46t/ha and T2y2=105t/ha). (The indices, y1 and y2 stand for year-one experiment and year-two experiment, respectively).

Table 6. Total tuber weight per plant for the 2019 experiment: Multiple comparison of the NPK.17.17.17 split levels

(I) NPK Split	*(J) NPK MD Split*	*(I-J)*	*Sig.*
0	1	.32000	.866
	2	5.31333*	.020
	3	-6.76000*	.006
1	0	-.32000	.866
	2	4.99333*	.027
	3	-7.08000*	.005
2	0	-5.31333*	.020
	1	-4.99333*	.027
	3	-12.07333*	.000
3	0	6.76000*	.006
	1	7.08000*	.005
	2	12.07333*	.000

I: the first split level; J: the second split level; MD: mean difference between the first and the second split level; Sig.: significance level; 1: T_1; 2:T_2; 3:T_3; 0:T_0. (T_1, T_2, T_3, and T_0 are the split levels of NPK.17.17.17). A significance level less than 0.05 indicates a statistical significance difference between the first and the second split level being compared.

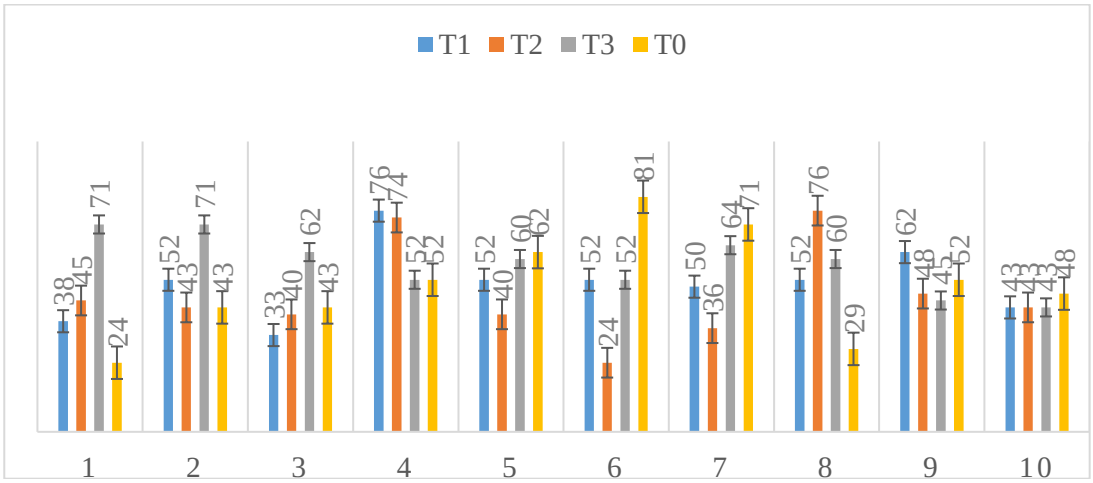

Figure 6. Effect of NPK.17.17.17 split levels on total tuber yield--the season B experiment

Table 7. Total tuber weight per plant for the 2020 experiment: Multiple comparison of the NPK.17.17.17 split levels.

(I) NPK.17.17.17 split level	*(J) NPK.17.17.17 split level*	*MD(I-J)*	*Sig.*
0	1	-.10625	.476
	2	.02375	.873
	3	-.36125*	.019
1	0	.10625	.476
	2	.13000	.384
	3	-.25500	.093
2	0	-.02375	.873
	1	-.13000	.384
	3	-.38500*	.013
3	0	.36125*	.019
	1	.25500	.093
	2	.38500*	.013

I: the first split level; J: the second split level; MD: mean difference between the first and the second split level; Sig.: significance level; 1: T_1; 2:T_2; 3:T_3; 0:T_0. (T_1, T_2, T_3, and T_0 are the split levels of NPK.17.17.17). A significance level less than .050 indicates a statistical significance difference between the first and the second split level being compared.

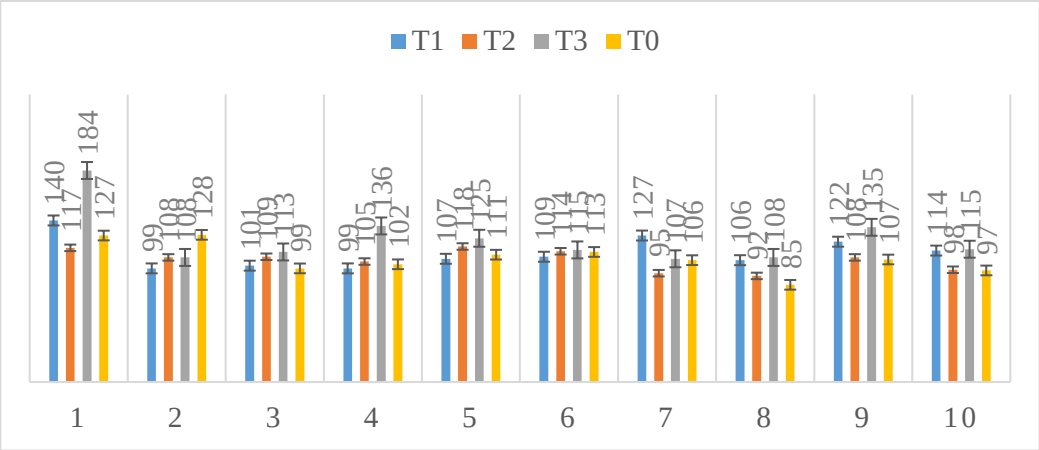

Figure 7. Effect of NPK.17.17.17 split levels on total tuber weight--the season A experiment

Discussion

Overall, split application significantly increased total tuber number (TTN) per plant and total tuber weight (TTW) per plant. Specifically, T_3, to which 59% of NPK.17.17.17 at the rate of 28 grams per plant 30 days after planting was applied and then the remaining, 41%, of the fertilizer, 30 days afterwards satisfactorily consistently resulted in the greatest total tuber number and total tuber weight per plant compared to the other treatments and the experimental condition, T_0, to which 100% of the fertilizer (28grams per plant) at planting was applied: total tuber numbers for the second-year experiment were T3=20 tubers, T2=19 tubers, T1=17 tubers, T0=15 tubers; total tuber weight per plant were T3y1=59t/ha and T3y2=124 t/ha, T1y1=51t/ha and T1y2=114t/ha, T0y1=52t/ha and T0y2=110t/ha, T2 y1=46t/ha and T2 y2=105t/ha). (The indices, y1 and y2, stand for year-one experiment and year-two experiment, respectively.) The findings are in harmony with other investigators (Vos, 1999; Al-Moshileh et al., 2005; Turamyenyirijuru, 2013; Mutubuki et al.,2015; Purnendu et al., 2019). The observation that delaying applying the first portion of the fertilizer did not compromise vegetative growth of the crop for most of the splits suggests that the "at-planting-time" application of the fertilizer may not be an economically effective and efficient option to achieve vigorous vegetative growth and higher yields under the study area field conditions and similar environments.

When the fertilizer is applied at planting time, the loss may be unbearably high. At planting time, and dozens of days afterwards, there is very low canopy cover and zero-or small root volume and density. For most crops, the period would therefore be characterized by low rates of nutrients uptake. Thus, applying the leachable fertilizer at planting would significantly increase in-season cumulative nutrients loss. And the higher in-season cumulative loss of the fertilizer, the more it would be likely that a plant is starved during nutrients-deficiency sensitive late development and growth stages. For Irish potatoes, the amounts of mid-season available nutrients, particularly potassium, phosphorus, and nitrogen, significantly affect tuber yield. Potassium is known to be essential for translocation of sugars for starch synthesis. Besides, the element activates a number of enzymes that are important for tuber growth processes such as starch and protein assembling (Lindhaeur & De Fekete, 1990), whereas phosphorus is necessary for the phosphorylation of the sugars, one of the essential steps for starch production (Fernandes et al., 2015). Nitrogen is also an irreplaceably important element for the tuber growth process, as it is the building blocks of proteins.

Jenkins & Mahmoods (2003) reveal that the nutrients deficiency conditions of the elements can cause substantial fresh weight tuber yield losses:26-47 %, 30 %, and 34-63 % for nitrogen, phosphorus, and potassium, respectively. Nutrients deficiency stress can also reduce tuber number. Celis-Gamboa (2002) explored the "Temporal relationships between plant development and tuber formation processes". For the potato, according to the research, a maximum number of tubers will have been determined by 75-89 days after planting. Considering this, T0 would have produced the highest total number of tubers per plant, however, the opposite was observed: there is a phenomenon called tuber reabsorption, by which small growing tubers undergo reversed growth (Celis-Gamboa, 2002). Some tubers may have undergone reabsorption due to the competition for nutrients among growing tubers and, thus, early depletion of the soil nutrients. In fact, while T0 subjects may have enjoyed sufficient amounts of the nutrients during early tuber development and growth stages (stolon formation, stolon elongation, stolon branching, tuber induction, and tuber initiation), which would have resulted in the highest tuber number, only few formed tubers must have been able to mature due to the mid-season nutrient-deficiency. In this study, the one part of the fertilizer Applied 30 days after planting and then the remaining part applied at 30 days afterwards must have significantly reduced nutrients loss, maximized nutrients uptake, availed ample nutrients during the mid-season nutrient-deficiency sensitive tuber growth period, and as a result, contributed to the high tuber yields.

It was observed, however, that the split applications, T1 and T2, did not significantly out-yielded T_0: during the growth process of a crop there must be "a point of no return", the point beyond which application of nutrients to a

nutrients-starved crop cannot satisfactorily restore vegetative growth to a level that will meet nutrients demands of sinks (growing tubers), particularly for crops, such as Irish potatoes, whose yield is limited by source capacity. For T1, only 23 % of 28 grams of NPK.17.17.17 was applied. Considering that a significant part of the fertilizer was lost due to leaching, immobilization, fixation, runoff, and volatilization, there is a possibility that during the early active vegetative stages rhizosphere nutrients levels became so low that vegetative growth was so compromised—and reached the "point of no return". In fact, chlorophyll indices were consistently lower for the experimental condition, T1. This can also account for lower tuber yield observed for T2 (to which 41 % of the fertilizer was applied 30 days after planting) compared to T3 (to which 59 % of the fertilizer was applied during the early active vegetative growth stage).

Calculations, based on the nutrients (nitrogen, phosphorus, and potassium) uptake pattern of the crop show that at least 53 %, 61 %, and 57 % of nitrogen, phosphorus and potassium, respectively, are required to sustain the early active vegetative growth stages and a part of the tuber growth stage. Obviously, T1 and T2 could not meet the demands under the leachy field conditions of these experiments.

From the results, we can conclude that applying 59 % of a right rate of the fertilizer at 30 days after planting and then the remaining fraction (41%) at 60 days after planting is a recommendable practice under the study area and other spots with similar soil-climatic conditions. Author acknowledges, however, that since this research followed the single-factor experimental design and thus largely focused on only one question "If we were to divide an NPK fertilizer rate into two fractions, one of which is to be applied at a certain date after planting and then the remaining afterwards, what would be the two fractions?" thirty days and 60 days after planting may not be the best dates for the fertilizer application. Nevertheless, this study does satisfactorily show that any potato nutrition practice involving the leachable inoraganic fertilizer application at planting time may not be effective and efficient under the experiments conditions. It was found that, instead, it is possible to have our crops, even heavy feeders, such as potato, "wait" for the "fast food" (the leachable and volatile inorganic fertilizer) until dozens of days without compromising their vegetative growth and yield.

For future studies, there is still growing list of agronomical and food safety questions this investigation could not answer:

- If, for the inorganic leachable fertilizer, splitting a rate into, say, two fractions one of which is to be applied at a certain time after planting and then the remaining afterwards is better. Exactly, at what dates?
- How does the split application affect nutritional quality of tubers (protein, starch, reducing sugars, vitamins, minerals, nitrate and nitrite, harmful heavy metals, free amino acids content)?
- Under compatible field conditions, given a right rate and a right fertilizer type, are all the parameters (agronomical, agro-physiological, and economic efficiency) achievable with split application?
- How do different varieties respond to inorganic fertilizers split application techniques?

Acknowledgment

We thank Dr. Obedi Nyamangyoku Ishibwela, Dr. Sylvestre Habimana, and Dr. Saidi Rumanzi Mbrak. Without the three men, in particular Dr. Sylvestre, this research would not have won a spot at this conference. They were helpful in the research journey. Author, however, takes full responsibility for any scientific or linguistic shortcomings of this work.

We also thank the organizers of the sixth International Anatolian Agriculture, Food, Environment and biology Congress for affording us a chance to expose the research to the other spots of the world.

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ID:424

The Monitoring of the Resistance Genes Associated with BCMV and BCMNV in Promising Common Bean Lines

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Abstract

Bean common mosaic virus (BCMV) and Bean common mosaic necrosis virus (BCMNV) are important virus diseases that are common in bean plants around the world and cause critical yield losses. The use of resistant varieties is one of the most effective and economical methods of combating these pathogens. Gene and molecular markers associated with resistance to BCMV and BCMNV factors have been identified in the world and they have been widely used by researchers in breeding studies. In this study, resistance sources of 43 promising common bean lines selected in previous projects (TUBITAK: 115R042 and 109O163) to BCMV and BCMNV were investigated by using different molecular markers (SW-13, SBD-5, ROC11) in our country. Findings revealed that 21 common bean lines contained different resistance gene combinations (*I* and *bc-1²* genes), while 8 common bean lines had *bc-1²* and *bc-3* genes. In addition, 13 common bean lines were found to contain a single resistance gene. It is thought that the resistance genes determined in common bean lines can be used as an important source of resistance in the development of resistant breeding materials against the BCMV and BCMNV diseases.
Key Words: *BCMV, BCMNV, Marker, Gene, Resistance*

This study was supported by the BAIBU BAP unit (Project number: 2022.10.06.1550).

Ümitvar Fasulye Hatlarında BCMV ve BCMNV ile İlişkili Direnç Genlerinin İzlenmesi

Özet

Fasulye yaygın mozaik virüsü (BCMV) ve fasulye yaygın mozaik nekroz virüsü (BCMNV), dünya genelinde fasulye bitkilerinde yaygın olarak görülen ve kritik verim kayıplarına neden olan önemli virüs hastalıklarıdır. Bu patojenlerle mücadelede en etkili ve ekonomik yöntemlerden birisi dirençli çeşitlerin kullanılmasıdır. BCMV ve BCMNV etmenlerine karşı dayanıklılıkla ilişkili gen ve moleküler belirteçler dünyada tanımlanmış ve araştırmacılar tarafından ıslah çalışmalarında yaygın olarak kullanılmaktadır. Bu çalışmada, ülkemizde daha önceki projelerde (TÜBİTAK: 115R042 ve 109O163) ümitvar olarak seçilen 43 fasulye hattının farklı moleküler markörler (SW-13, SBD-5, ROC11) kullanılarak BCMV ve BCMNV'ye karşı direnç kaynakları araştırılmıştır. Elde edilen sonuçlar, 21 fasulye hattının farklı direnç gen kombinasyonlarını (*I* ve *bc-1²* genleri) içerdiği, 8 fasulye hattının ise *bc-1²* ve *bc-3* genlerine sahip olduğu belirlenmiştir. Ayrıca, test edilen fasulye hatlarının 13'ünün tek bir direnç genini içerdiği tespit edilmiştir. Fasulye hatlarında belirlenen dayanıklılık genlerinin BCMV ve BCMNV hastalıklarına karşı dirençli ıslah materyallerinin geliştirilmesinde önemli bir dayanıklılık kaynağı olarak kullanılabileceği düşünülmektedir.
Anahtar Kelimeler: *BCMV, BCMNV, Markör, Gen, Dayanıklılık*

Bu çalışma BAİBÜ BAP koordinasyon birimi tarafından desteklenmiştir (Proje no: 2022.10.06.1550).

ID:426

Cytotoxic and Genotoxic effects of Bisphenol S on different Model Organisms

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Abstract

Bisphenol S (BPS) is an alternative for Bisphenol A(BPA) which has been introduced to the industry. Bisphenol S is an organic compound and is used in the production of many products used in daily life. Long-term exposure to these compounds causes different types of health problems and cytotoxic and genotoxic effects on both animal and human beings. But the research on its toxic effects is limited. BPS also has estrogen, antiandrogen, and anti-thyroid hormone properties, which might unfavorably affect the reproductive system, endocrine system, and nervous system of C. elegans and humans, and may cause oxidative stress. It has been demonstrated that BPS can interrupt the balance of sex steroid hormones and damage the normal reproduction of adult zebrafish. Studies in mammals show that BPS unpleasantly disturbs 5a-R3 mRNA levels in the brain of female rats, prevents steroid gene transcripts, and shows antiandrogenic action in H295R cells of the human and rodent fetal testis. Bisphenol S is a genotoxic substance that damages DNA in BEAS-2B cells (bronchial epithelial cells). Bisphenol S has toxic effects on hepatic cells and the endocrine system and causes genotoxicity by causing DNA double-strand breaks. Cytotoxicity of Bisphenol S was tested on hepatocyte and renal cells of the mouse. BPS increases the amount of ROS (reactive oxygen species) in the cell and causes cytotoxicity. Bisphenol S causes abnormalities in the fetus or embryo during pregnancy because it can cross the placental barrier when the mother came into contact with contaminated food. So, this review shows that Bisphenol S is used in daily life products, food packaging, etc. It has genotoxic, cytotoxic, and estrogenic activity and has adverse effects on living organisms at the cellular as well as organ level. It can cause different types of disorders. Such as obesity, hormonal imbalance, DNA damage, developmental disorders in the embryo, and reduce egg and sperm quality. Different studies show different toxic effects of BPS on different organisms.

Key Words:

ID:427

Application of Rhizobium and its Exopolysaccharides in drought and disease control

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Abstract
Biologically synthesized Exopolysaccharides (EPS) from Rhizobia and Arbuscular Mycorrhizal Fungi (AMF) can serve as biocontrol agents which tolerate biotic and abiotic stresses. However, there is limited information on their application to non-leguminous plants. The biocontrol potentials of Rhizobia, Rhizobial-exopolysaccharides (*Bradyrhizobium japonicum* USDA 110) and AMF (*Glomus clarum*), singly and in combination on *Bipolaris maydis* (BM) infection and drought tolerance in two maize varieties (TZmI1466 and TZmI1297) were evaluated in screen house experiments using a complete randomized design with three replicates. The growth, root and shoot biomass and disease incidence data were collected and analysed by descriptive statistics and one-way ANOVA at $\alpha_{0.05}$.Seed treatments with EPS had the highest significant effect on BM (1.67) and drought in maize.The effect of Rhizobia, exopolysaccharide and AMF treatments against BM showed that Rhizobia alone significantly suppressed the BM effect on the growth character. The exopolysaccharide improved all the growth parameters during water stress, while AMF-treated plants improved the plant height (43.41±2.30), leaf area (114.08±7.89) and stem diameter (2.58±0.10). Maize variety TZm11297 performed best for the number of leaves (8.48±0.12) and leaf area (116.97±2.94) but not significantly different from the rest TZm14466 growth characters. Microbial inoculants had significant effect on drought stress in maize thus ensuring enhanced crop productivity. The EPS produced and AMF had preventive ability against drought.

Keywords: *Rhizobial exopolysaccharides, Arbuscular mycorrhizal fungi, Bipolaris maydis control, Maize drought tolerance*

ID:428

Nutritional composition and shelf-life extension of formulated nano-food blends fortified with selenium enriched *Lactobacillus pentosus* (LP-SeNPs) nanoparticles

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Abstract

Selenium Enriched *Lactobacillus pentosus* ADET MW861694 (LP-SeNPs) nanoparticles were intracellularly biosynthesized, characterized, used to fortify formulated blends, and the nutritional and shelf-life of the blends stored at room temperature for 30 days were evaluated. The LP-SeNPs, Lactobacillus pentosus (LP) plus Sodium Selenite and Non-selenium LP was used to ferment formulated blend comprising of Acha, Soybean, Tigernut, and Date palm fruit powder in the ration 70:20:5:5 respectively. Blends fermented with LP-SeNPs, LP plus sodium selenite, Non-selenium LP was labelled Nanofood 1, Nano-food 11 and Blend 1 while the Unfortified Blend labelled Blend 1 serves as control. SEM and SEM showed intracellularly deposited selenium around the outer membrane of *Lactobacillus pentosus* and a spherical SeNPs with 11.7 nm in diameter. The EDX, XRD and DLS analysis ascertain the presence of elemental selenium atom, the crystalline nature and an average particle size of 106.1 nm and polydispersity index (PDI) of 0.295 of the nanoparticles. The pH and lactic acid content of the formulated blends ranged from 3.27-5.52 and 0.09 - 0.25 mg/L. Nanofood I had the highest crude protein, crude fibre, and carbohydrate content (3.38±0.010%, 0.79±0.03%, and 16.54±0.30%). Nanofood 1 and 11 had the highest potassium content and Blend I had the highest phosphorus, iron, calcium, and selenium content. Biofortification improve the nutritional composition and bio-preserved the formulated blends during storage.

Key words: *Selenium Enriched Lactobacillus pentosus, Nanoparticles, Formulated Blends, Tiger Nut, Shelf-Life Extension, Fortification.*

ID:429

Phytofabrication and biological evaluation of silver nanoparticles of *Bridelia ferruginea* extracts

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ABSTRACT

Globally, medicinal plants are gaining attentions as alternative sources of phytochemicals and metabolites that have enormous therapeutically benefits to mankind. Nanoparticles have progressively become an important area of research with unique properties that have been employed in different fields of science and medicine in the treatment of various infections. Phytochemical, phytofabrication of silver nanoparticles (SNPs) using methanol extracts of *Bridelia ferruginea* (MBF) bark and leaves (MBF_B and MBF_L), and their biological evaluation were investigated. The phytofabricated bark and leaves extracts silver nanoparticles (MBF_BSNPs and MBF_LSNPs) were characterized using standard methods. Antibacterial, anti-tubercular, antioxidant and cytotoxicity effects of the extracts and their SNPs were investigated. Alkaloids, flavonoids, tannins, phenols, saponins, cardiac glycoside, terpenoids were present in the extracts. MBF_B, MBF_BSNPs and MBF_L, MBF_LSNPs had the highest antagonistic activities (14.0mm, 20.0mm, 12.0mm and 21.0mm) against *K. pneumoniae* 8309, *K. pneumoniae* 8309, *P. aeruginosa* 15422 and *S. typhi* 13311 respectively. MBF_B and MBF_L had 87.6% and 84.6% DPPH scavenging activity and TAC, TPC and FRAP activities in a dose dependent manner. MBF_B and MBF_L exhibited 100% ant-tubercular activities against rifampicin resistant *M. tuberculosis* (RR-TB) H37RU, 2390 and 916 and *M. tuberculosis* (RR-TB) 2570 and 916 respectively. MBF_B and MBF_L exhibited 100% ant-tubercular activities against Multi-drug resistant *M. tuberculosis* (MDR-TB) 1934, 237, 866 and 885 and *M. tuberculosis* (MDR-TB) 866 and 885 at 20mg/mL respectively. MBF_B and MBF_BSNPS had 100% cytotoxicity effects against A549, 75% activities on Hela and MCF7 cancer cell lines. In conclusion, the plants extracts and their had phytochemicals with high biotechnological values and their silver nanoparticles.

Key words:

ID:435

An Impact Assessment of Covid-19 Lockdown Period on the Sediment Quality of Meriç - Ergene River Basin in Türkiye

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Abstract

The aim of this research was to evaluate the impact of the Covid-19 lockdown period on sediment quality of Meriç – Ergene River Basin by determining the potentially toxic elements (PTEs) in sediment samples collected from 25 stations in the basin. Some significant ecological indicators including Potential Ecological Risk Index (PERI), Contamination Factor (CF), Pollution Load Index (PLI), Biological Risk Index (BRI) and Geo – Accumulation Index (I_{geo}) and some significant statistical indicators including Pearson Correlation Index (PCI), Factor Analysis (FA) and Cluster Analysis (CA) were applied to detected data. As a results of this research, all the investigated PTEs in sediments of the basin show quite significant differences between the pre-lockdown and lockdown periods. PTE contents have considerably decreased between the rates of 12.8 – 45.4% during the lockdown period. Similarly, the values of sediment quality risk assessment indices have decreased between the rates of 22.4 – 35.8%. In the lockdown period, reduction of industry of many industrial facilities located in the basin reduced the amount of effluents, leading to significant improvement in sediment quality of the basin.

Keywords: *Meriç – Ergene River Basin, Sediment quality, Covid-19 lockdown period*

ID:436

Which Organism is More Suitable as a Toxic Metal Accumulation Bioindicator – Fishes or Diatoms: A Case Study of an A Class Wetland in Türkiye?

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Abstract

The aim of this research was to compare the diatoms as the first step and the fishes as the last step of the food chain as toxic metal accumulation bioindicator in Gala Lake an A Class wetland in Meriç Delta in Türkiye. For this purpose, bioaccumulations of potentially toxic elements (PTEs) were determined in liver, gill and muscle tissues of two commercially consumed fish species *Carassius gibelio* and *Cyprinus carpio* and in frustules of epiphytic diatom communities living on submerged macrophytes. Biotic samples were collected seasonally from the Gala Lake considering the paddy harvest period that is a major stress factor for the ecosystem. Also, potential human health risks associated with the consumption of fishes and consumption – dermal contact of diatoms were evaluated both for summer – before paddy harvest (BPH) and autumn – after paddy harvest (APH) periods. As a result of this research, the investigated toxic metal concentrations were increased significantly in diatoms in the APH period, while less significant exchanges were recorded in fishes. The data showed that although the fishes bioaccumulate the PTEs in their tissues much higher than the diatoms, diatoms are much more sensitive to changes in the environmental conditions than fishes.

Keywords: *Bioindication, Gala Lake, Toxic metals*

ID:437

The Carotenoids in Aquatic Animals

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Abstract

World aquacultural production will be consist of 46 of global fishery productions and projected 196 million tons in 2025. Global fishery consumption will be increased from 20 kg to 22 kg per capita, as well. Carotenoids are an important component to increase growth rate, immune system activities, and reproduction behavior in fish. Carotenoids are called also tetraterpenoids, which are organic pigments (yellow, orange, and red) and produced by plants, algae, bacteria and fungi in ecosystem. Many marine and freshwater animals, including fish and crustaceans are taken them from diets (feed) and stored in the fatty tissues. But, carnivours are used only from animal oil to hold in themselves. They can not be formed by fish and they should be added to fish meal. Theses components have different forms. Fish and other aquatic animals have two forms of them, which are called astaxantin and cantaxantin. They have a very important function to protect the poly-unsaturated fatty acids-PUFA in aquatic animals. Since UV (ultra-violet) has a negative effect on PUFA in order to oxidate. There are important reasons to take for human wellness. In this study, it is going to be given a more detail information about the definition, mechanism, functions of carotenoids, and indication about the previous studies being done on the carotenoids for aquatic animals.

Key Words: *Aquatic organisms, Carotenoids, Aquaculture*

Akuatik Hayvanlarda Karotenoidler

Özet

Dünya akuakültür üretmi 2035 yılında 46 global balıkçılık ürünlerinden ve 196 milyon tonluk üretimden oluşacaktır. Global su ürünleri tüketimi de kişi başı 20 kg'dan 22 kg'a yükselecektir. Karotenoidler büyümeyi, bağışıklık sistemin güçlenmesini ve üreme davranışlarının artması için önemli komponentlerdir. Karotenoidler organik pigmentler (sarı, oranj ve kırmızı) olarak isimlendirilen tetraterpenoidlerdir ve bitkiler, algler, bakteriler ve fungiler tarafından üretilirler. Balık ve kabukluların içinde bulunduğu birçok deniz ve Tatlısu hayvanlaronları diyetlerinden (yem) alırlar ve yağ dokularında tutarlar. Fakat, karnivorlar bunların hepsini tutmak için yalnızca hayvansal yağları kullanırlar. Bunlar balıklar tarafından oluşturulamaz ve balık yemlerine ilave edilmelilerdir. Bu komponentler farklı formlara sahiplerdir. Balık ve diğer akuatik hayvanlar onlardan astaxantin ve cantaxantin olan iki formuna sahiptir. Onlar, aquatik hayvanlarda bulunan çoklu doymamış yağ asitlerini (PUFA) korumak için çok önemli bir fonksiyona sahiplerdir. Çünkü UV'nin (Ultra-Viyolet) okside olması için PUFA üzerine negatif bir etkiye sahiptir. İnsan sıhhati için alınmasının önemli sebepleri vardır. Bu çalışmada, karotenoidlerin tanımı, mekanizması ve fonksiyonları ve akuatik hayvanlar için karotenoidler hakkında şimdiye kadar yapılmış çalışmalar üzerine detaylı bilgiler verilecektir.

Anahtar Kelimeler: *Akuatik organizmalar, Karotenoidler, Akuakültür*

ID:440

Impact of Cumin on Physiological function of Body, Review

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Abstract

Herbal plants have been used for numerous purposes in daily routine like in food additives due to their availability, benefits, and use for pharmaceutical purposes and preparation of drugs without side effects on the human body. Among herbal plants, one of the best herbals is Cumin due to its unique properties and positive impact on the function of the body. Cuminum cyminum L. (cumin) from the Apiaceae family is located in the Mediterranean region and is used in the structure of traditional medicine. Cumin contains many dietary minerals and vitamins like B and E and iron which plays a role in the physiological function of the body. Cumin shows antioxidant properties that make it unique and useful in the treatments of many diseases which is related to GIT, brain, blood, and respiratory-related issues like indigestion and jaundice, epilepsy, and whooping cough, also works as a coagulant in the body. Currently, many herbal drugs are used to treat obesity, which has many adverse effects and are more expensive, But Cumin seeds are nutritionally rich with a high amount of monounsaturated fats, proteins, and dietary fibers. Previous experiment revealed that taking 300 mg of Cumin for eight weeks results in a significant decrease in weight, body mass index (BMI), and insulin level in the body. Cumin also has wide usage in the beverage, food, liquor, medicine, perfume, and toiletry industries. The objective of this work is to highlight the latest and most precise review of the benefits of using cumin and its impact on the physiological function of the body without side effects.

Keywords: Cuminum cyminum, Cumin, antioxidant, weight loss, physiological

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Caviar Technology

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Abstract
Fish roe (caviar), which has a high nutritional value among aquatic products, has an important place in the balanced diet of people. Caviar is a delicious and economically valuable food product made from different fish species in different geographies in the world and named in different ways. Fish eggs contain high concentrations of lipid and protein. Fish roe are processed with various technologies, giving a difference to the palate. Even small mistakes during the preparation of caviar greatly affect the quality. In order to obtain good quality caviar, it is necessary to be careful and meticulous at every stage of the processes such as taking the eggs and washing them. This is related to the experience of the person who prepares the caviar. Although it is a less common product obtained from sturgeon species, it is one of the snack foods on the tables. Black caviar from sturgeon roe occupies an important position in the food market with high nutritional and commercial value, and in other research areas, including cosmetics, due to its high-quality content. In this review, caviar species, nutritional value and production technology will be discussed.
Key Words: *Caviar, Fisheries, Roe, Nutritional value, Production technology*

Havyar Teknolojisi

Özet
Su ürünleri arasında besin değeri yüksek olan balık yumurtası (havyar), insanların dengeli beslenmesinde önemli bir yere sahiptir. Havyar, dünyanın farklı coğrafyalarında bulunan farklı balık türlerinden yapılan ve farklı şekillerde isimlendirilen lezzetli ve ekonomik değeri olan bir gıda ürünüdür. Balık yumurtaları yüksek konsantrasyonlarda lipid ve protein içerirler. Balık yumurtası çeşitli teknolojilerle işlenerek damak tadına farklılıklar katmaktadır. Havyarın hazırlanması sırasında yapılan küçük hatalar bile kaliteyi büyük ölçüde etkiler. Kaliteli havyar elde etmek için yumurtaların alınması, yıkanması gibi işlemlerin her aşamasında dikkatli ve titiz olmak gerekir. Bu durum havyarı hazırlayan kişinin tecrübesiyle alakalıdır. Mersin balığı türlerinden elde edilen daha az yaygın bir ürün olmasına rağmen sofraların aperatif yiyeceklerinden biridir. Mersin balığından elde edilen siyah havyar, besin ve ticari değeri yüksek ve yüksek kaliteli içeriği nedeniyle kozmetik dahil diğer araştırma alanlarında önemli bir konuma sahiptir. Bu derlemede havyar türleri, besin değeri ve üretim teknolojisi ele alınacaktır.
Anahtar Kelimeler: *Havyar, Su ürünleri, Besdin değeri, Üretim teknolojisi*

Introduction
Fish and other aquatic products are among the foods recommended for the prevention and treatment of diseases with their high nutritional properties. Due to the increase in fish consumption and its high nutritional and commercial value, the demand for fish caviar has increased in recent years. Caviar, which is a name given to fish eggs in general, is a delicious and economically valuable food product made from different fish species in different geographies in the world and named in different ways. “Caviar” is defined in the dictionary meaning as “fish (mostly sturgeon) roe in the case of paste prepared with salt” (Özden et al., 2018).

Although the word caviar is accepted as the general name of fish eggs, the first thing that comes to mind when caviar is mentioned is the egg of sturgeon. Sturgeon eggs are used to make genuine caviar. Eggs of fish other than sturgeon, prepared in the same way as real caviar, are called fish roe, not caviar. According to many sources, the word caviar is of Turkish origin. Known as "Caviar" in English and "Ikra" in Russian, caviar is of Persian origin. It is derived from the compound word "Haye", which consists of the Persian word "Haye" meaning egg, and "Var" meaning "like" (Şengör et al., 2002; Özpolat, 2006; Kaba et al., 2013).

It has been known that caviar has been made since the 13th century, and it has been recorded that Russia has produced caviar since the 16th century. With the development and industrialization of fisheries towards the end of the 19th century, the caviar technique also developed. As in the past, today, Russia and Iran, which border the Caspian Sea, produce the most caviar. In addition, it started to be produced in significant quantities in the Amur River in China. In addition, in recent years, Japan, the United States and Canada have advanced significantly in caviar production. In our country, caviar production has not reached an economic level yet. While Turkey's caviar production was 6-10 tons in the 1930s, today Turkey has become an exporter in fish roe production while it is an importing country. 200 million out of 600 million caviar produced in a year are exported (Özpolat, 2006; Anonymous, 2022a).

Due to the fact that caviar is an expensive product, it has not gained much space in Turkish cuisine. American consumers, on the other hand, do not consume fish eggs much because they are very salty and contain high cholesterol. The fact that the product is expensive is also one of the reasons why it is not preferred. However, fish roe maintains its feature of being the main presentation of rich and distinguished tables, especially in Europe. In Japan, where fish roe is a popular product, the eggs of almost all sea creatures are eaten. Especially herring eggs on moss are very popular. Collecting herring eggs on seaweed has been an important industry in Alaska (Turan, 2006).

Caviar Technolgy

Although salted sturgeon roe are generally accepted as caviar, caviar is also produced from the eggs of different fish species. For this purpose, the eggs of the trout family, mullet and carp are mostly used. According to some researchers, seafood processing technology starts from the egg of the fish. Fish roe are also processed with various technologies, adding a difference to the palate. For this purpose, apart from salting, technologies such as freezing, smoking, canning and sausage production are used. Even small mistakes during the preparation of caviar greatly affect the quality. In order to obtain good quality caviar, it is necessary to be careful and meticulous at every stage of the processes such as taking the eggs and washing them. This is related to the experience of the person preparing the caviar (Özpolat, 2006).

Turkish standard caviar; Eggs obtained mostly from sturgeon, mullet, trout, pearl mullet and carp by milking while they are still alive or by splitting their bellies are washed and cleaned, then boiled for half an hour in 2-3% (m/m) salt water or salted with dry or wet salting. prepared by separating the eggs from the ovaries by smoking and adding additives if necessary; It is defined as a product that is made durable by heat treatment and consumed as raw, fried or grilled [7-8]. The main types of fish roe available in the market are as follows, and all of them are described as "caviar" by TSE (Turan, 2006).

Fish eggs are basically passed through some processing steps. The two important reasons for the implementation of these steps are to reduce the water activity (aw) by removing the water from the egg, which causes rapid spoilage and negatively affects the shelf life, and to prevent rancidity (bitterness) in the oil by reducing the contact with oxygen. As a result, it is tried to preserve the taste and quality of the product by waxing, pressing or vacuuming. Salting method is used at almost every stage of caviar production. Salting is basically divided into two as dry salting and brine salting. When preparing fish roe, these two methods are generally used and it is called "mixed salting". Although salting methods vary from country to country, the aim is to reduce water activity and thus prevent bacterial growth. Besides the salting method, the quality and composition of the salt to be used is also very important. Color change, hardening of the product surface and crystalline structures can be seen in eggs treated with salt containing iron and copper (Turan, 2006; Duyar et al., 2008; Mol and Turan, 2008).

Nutritional Value of Caviar

Not all fish eggs have the same chemical composition. The type of fish, egg condition and maturity, harvest time and location are the most important factors affecting the chemical composition of fish eggs. Caviar is also a source of high-quality protein, as it contains high levels of essential amino acids. fish roe; It contains 22-29% protein, 28-36% fat, 14-30% water, 6-13% ash and 3-10% carbohydrates, and depending on the fish species, they can have a black, yellow, orange or transparent appearance. Their diameters vary between 0.3 mm and 0.5 cm, depending on the species. Since it is difficult to keep fish eggs fresh, they must be processed. Salting amount and application time in fish eggs are one of the most important factors affecting the quality of caviar (Turan, 2006; Özden et al., 2018).

Caviar is a one-of-a-kind food product that contains a significant number of vitamins and minerals such as Omega-3, which ensures a healthy and stable immune system for the human body. 30% of caviar is easily digestible protein; One serving (25 grams) can meet half of the body's daily protein needs. This unique product contains vitamins B12, B6, D and more. Caviar is also rich in amino acids, micro and macronutrients. A 100-gram serving contains plenty of B12, iron, calcium and vitamin A. Caviar can be useful in the treatment of some health conditions; it also helps to strengthen bone tissue and improve the immune system (Anonymous, 2022b).

Caviar is also a source of high-quality protein, as it contains high levels of essential amino acids. With the consumption of approximately one teaspoon of caviar in one serving, 2-3 g of protein is obtained. It also contains a significant amount of polyunsaturated fatty acids. The dominant fatty acid in caviar is oleic acid and its amount varies between 32.9 and 42.6%. It was determined that n-3 polyunsaturated fatty acids in sturgeon caviar were 3 times higher than n-6 polyunsaturated fatty acids. Trout caviar 6-8% total lipid, 24-27% protein, 21% saturated fatty acids, 34% monounsaturated fatty acids, 15% omega-6 polyunsaturated fatty acids, 22% It consists of omega-3 polyunsaturated fatty acids and contains an energy value of approximately 180 kilocalories. The most important fatty acids are eicosapentaenoic acid and docosahexaenoic acid, which are present in roe at levels of 6% and 12%, respectively (Özden et al., 2018).

Types of Caviar

"Black caviar" obtained from sturgeon eggs takes the first place in world caviar production. This is followed by caviar obtained from the eggs of other fish (capelin, lumpfish, trout, salmon, mullet, carp, etc.) (Şengör, 2002).

Almas: It is a very rare type of caviar known as Golden (Golden) caviar. It is produced from albino sturgeon or an Osetra sturgeon that is at least 60 years old. Its taste is described as soft delicacy, creamy and very light in color.

Beluga: Caviar produced from Acipencer huso type sturgeon eggs. It is the highest quality type of caviar. This coarse-grained caviar is black or dark gray in color. It has a melt-in-your-mouth structure and a fishy flavor. The grain sizes are larger than the others.

Kaluga: Caviar produced from Huso dauricus eggs. It is one of the largest sturgeon species and is found in the Amur and Harbor Rivers in China. The eggs are similar to the eggs of young Acipenser gueldenstaedtii and are processed with 6% salt.

Osetra: It is caviar produced from the eggs of Acipenser gueldenstaedtii, known as Russian sturgeon. Its color is lighter gray-green or brown compared to Beluga caviar. It has a pleasant “nutty and creamy” flavor.

Schip: It is caviar produced from Acipenser nudiventris eggs. It is usually packaged as Sevruga or Osetra depending on the egg size, but its eggs are more sensitive to processing.

Sevruga: It is the smallest grained caviar produced from Acipenser stellatus eggs. These gray-black eggs are fine and small-grained and very tasty. It is considered to be of lower quality than Osetra and Beluga caviar.

Sterlet: Caviar produced from Acipenser ruthenus eggs. It is small grained and blackish.

Tarama: It is a product obtained from carp eggs. The eggs are passed over the screening sieve and separated from the membranes and subjected to the washing process. It is mixed in a bowl with the addition of olive oil until it reaches a creamy consistency. Then salt is added. This product is specially made in Greece (Şengör et al., 2002; Özpolat, 2006; Özden et al., 2018).

Waxy caviar: It is obtained from mullet eggs. It is obtained by pressing dried mullet eggs and coating them with wax.

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Use of Dietary Fibers in Fish and Fish Products

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Abstract
Fish and fish products are high quality and easily digestible proteins and contain other essential nutrients such as polyunsaturated fatty acids beneficial to health and vitamins and minerals essential for human nutrition. Despite its high nutritional value, seafood is one of the nutrients that tend to deteriorate quickly due to the loose connective tissue and the polyunsaturated fatty acids they contain. For this reason, manufacturers add or additives to prevent these problems. Low-calorie, healthy meat and meat products are produced with the addition of functional components (dietary fibers) with many beneficial properties in order to avoid unwanted substances such as fat and salt or to reduce them to appropriate limit values. Today, functional foods that protect health and minimize the risk of disease while feeding, attract more attention by consumers. Various functional components are used in order to improve the sensory properties of the product, to reduce the production cost, and to take more place in the diets of consumers, in addition to their positive effects on health. In addition to its high technological properties, dietary fibers have found the opportunity to be used in processed meat and meat products, as they have a protective effect against many diseases such as cardiovascular diseases, hypertension, diabetes, obesity, constipation problems, and various types of cancer. In this review, use of dietary fibers in fish and fish products wiil be mentioned.
Key Words: *Dietary Fibers, Fish, Health*

Balık ve Balık Ürünlerinde Diyet Liflerinin Kullanımı

Özet
Balık ve balık ürünleri, yüksek kaliteli ve kolay sindirilebilir proteinler olup, sağlığa faydalı çoklu doymamış yağ asitleri ve insan beslenmesi için gerekli olan vitamin ve mineraller gibi diğer gerekli besinleri içermektedir Besleyicilik değeri yüksek olmasına rağmen su ürünleri gerek bağ dokusunun gevşek olması gerekse içerdikleri çoklu doymamış yağ asitleri sebebiyle çabuk bozulmaya eğilimi gösteren besin maddelerindendir. Bu nedenle üreticiler bu problemleri önleyecek işlemleri veya katkı maddeleri ilavesini yapmaktadırlar Düşük kalorili, sağlıklı et ve et ürünleri, yağ ve tuz gibi istenmeyen maddelerden kaçınmak veya bunları uygun sınır değerlere indirmek için birçok faydalı özelliğe sahip fonksiyonel bileşenlerin (diyet lifleri) eklenmesiyle üretilir. Günümüzde sağlığı koruyan ve beslenirken hastalık riskini en aza indiren fonksiyonel gıdalar tüketiciler tarafından daha fazla ilgi görmektedir. Ürünün duyusal özelliklerini iyileştirmek, üretim maliyetini düşürmek ve tüketicilerin diyetlerinde daha fazla yer almak için sağlığa olumlu etkilerinin yanı sıra çeşitli fonksiyonel bileşenler kullanılmaktadır. Diyet lifleri kalp-damar hastalıkları, hipertansiyon, diyabet, obezite, kabızlık, kolon kanseri çeşitli kanser türlerine karşı koruyucu etkiye sahip olduğundan işlenmiş et ürünlerinde kullanım imkanı bulmuştur. Bu derlemede diyet liflerinin balık ve balık ürünlerinde kullanımına değinilecektir.
Anahtar Kelimeler: *Havyar, Su ürünleri, Besdin değeri, Üretim teknolojisi*

Introduction
In this modern age, intense work life and physical fatigue have increased people's tendency to foods that can be prepared practically without wasting much time (Kılınççeker and Karahan, 2019). In addition, people have begun to give more importance not only to foods that meet their nutritional needs, but also to foods that are richer in nutritional value, prevent diseases that may occur in the body and improve health (Kesemen, 2018). Consumers prefer foods that are suitable for health and low in calories. In recent years, consumers prefer easy-to-prepare and standing food (Kılınççeker and Karahan, 2019).

- the materials used in the product,
- production methods,
- they also take into account the energy provided by the product

The food industry has started to offer alternatives for people with diseases such as celiac, diabetes, cardiovascular diseases or digestive disorders by producing different products (Keskin and Kaplan-Evlice, 2015). Also, recently the meat industry has focused on producing healthier meat products by reducing components that are commonly perceived as "negative" and/or adding health benefits (Fernandez-Lopez et al., 2021). Today, a balanced diet for a healthy life has become an increasingly common habit. Since consumer preferences are also directly effective on food producers, different applications have been made especially in meat and products (Kilincceker and Karahan, 2019).

Various flours are used in meat, fish cakes and similar products in order to increase the physical, chemical and sensory properties of the product, due to its water-binding and barrier properties against oil absorption. The addition of different plant-based flours to food products is increasing day by day due to its components and benefits to human health. Plant-based flours can extend the shelf life of fish products due to their high protein, starch and fiber content (Kılınççeker, 2015). Fish meat is rich in nutritional content and is a very important food, especially in terms of protein, fatty acids and minerals. Despite its high nutritional value, seafood is one of the nutrients that tend to deteriorate quickly due to the loose connective tissue and the polyunsaturated fatty acids they contain. For this reason, manufacturers add processes or additives to prevent these problems (Kılınççeker and Karahan, 2019). Since dietary fibers have a protective effect against various types of cancer such as cardiovascular diseases, hypertension, diabetes, obesity, constipation, colon cancer, they have found the opportunity to be used in processed meat products (Ergene and Bingöl, 2019). Seafood contains high-quality and easily digestible proteins, polyunsaturated fatty acids beneficial to health, and vitamins and minerals necessary for human nutrition (Jayasinghe et al., 2013). Despite these functional properties, fish products do not contain fiber. Adding fiber to fish products is receiving a lot of attention, not only as a way to improve the functionality of food products, but also as a way to create functional foods with health benefits (Borderias et al., 2005).

Dietary Fibers

In the production of various meat products, fibers are used as filler, binder and fat replacer. Dietary fibers are the most widely used in foods and are accepted as providing functional content in food (Borderias et al., 2005).
Various studies have been carried out on this subject by including various fiber sources such as oats, sugar beet, soy, peas, and psyllium in the formulation of some meat products such as meatballs and sausages (Mehta et al., 2013).
Dietary fiber is a class of compounds that cannot be decomposed and digested by the human body, such as cellulose, hemicellulose, pectin, lignin, gums, resistant starch, and other non-carbohydrate components. Scientific studies of nutritionists have shown that human health is inextricably linked with eating habits, and high dietary fiber intake can reduce many health hazards such as obesity, diabetes type II, cardiovascular complications, gastrointestinal disorders, and some types of cancer (Lin et al., 2019).
Adding fiber to meat products can have the following technological effects (Zinina et al., 2019):
1) increase the moisture holding capacity of minced products,
2) improve the stability of emulsions,
3) changing the used oil or reducing the oil content
4) increase the yield of the product,
5) improve the texture of meat products,
6) maintaining the shape of the product after heat treatment and
7) increasing storage time by stabilizing fats and proteins
Dietary fibers, dried fruits, vegetables and cereal fibers isolated from various plant sources have been used in the food industry and have shown promising results (Mehta et al., 2013).
Besides different dietary fibers such as pea, apple, sugar beet, soy and citrus fibers, inulin and gums are now included in foods due to their nutritional properties or functional and technological properties.
In addition, from a technological point of view, the addition of fibers, especially in cases where the raw material used is of low functional quality, products made with minced muscle (Borderias et al., 2005);
• Water binding,
• Volumizing,
• Emulsion capacity,
• Gelling properties,
• It improves the texture of the product

With Use of Dietary Fibers in Fish and Fish Products Related Studies

Amalia et al. (2016), in a study on the use of mangrove fruit in the processing of fish nuggets, mangrove fruit flour used in different ratios (0%, 20%, 30%, 40%) instead of wheat flour had a significant effect on the water, oil, protein and ash content of the product effect has been reported. It has been reported that higher substitution of mangrove fruit meal increases the protein content of fish nugget products, thus mangrove fruit meal has the potential to increase the nutritional value of fish nugget.
Santillan-Alvarez et al. (2017), in a study investigating the effects of adding 0-8 g/100 g chia seeds to carp meat on physicochemical and sensory properties, carp meat prepared with the addition of chia had higher nutritional value (higher fiber and protein content) than the control group. It was determined that it showed better cooking properties (higher cooking efficiency and moisture retention). In addition, it was determined that the addition of chia increased the a* and b* values of the samples and decreased the L* values. The hardness value of the samples increased with the addition of chia, however, it was reported that results similar to the control group were obtained in the samples prepared with 4% or 8% chia in terms of sensory.

Kılınçççeker (2015) examined the quality characteristics of the samples in their study with carp fish balls produced with different flours of plant origin. In the raw samples, the lowest pH was found in the group prepared with pepper seed flour, while the number of thiobarbutiric acid was reported to be lower in the groups containing control, wheat, barley, oat and pepper seed flours. It was determined that the moisture content of the fried fish balls in the group with oat flour and the oil content in the groups with barley and rye flour decreased significantly.

Ali et al. (2019), pumpkin puree or mashed potatoes were used in the formulation of tilapia fish burger in their study, and their cooking properties, chemical quality, color, texture and sensory properties were examined. Fish burgers formulated with different substitution levels of pumpkin or potatoes puree had higher moisture and carbohydrate content and lower protein, fat, ash and energy value than the control fish burger. Total volatile nitrogen (9.45–11.20 mg N/100 g), trimethylamine (2.24–2.59 mg N/100 g) and thiobarbituric acid (0.185–2.51 mg malonaldehyde/kg) values in fish burgers formulated with pumpkin or potatoes puree were found to be lower in the control group.

Kılınççeker and Karahan (2019) mixed carp (Cyprinus carpio) meatballs with breadcrumbs and teff flour in different proportions (100% breadcrumbs (control), 1:2 tambourine: breadcrumbs, 2:1 tambourine:breadcrumbs and In the study examining the effects of adding 7% (100% teff flour) to some properties, it was reported that teff flour did not affect the L* and a* values in raw samples and reduced the b* value. While it increased the diameters of the fried samples, it decreased the color criteria a* and b* values when added at a high rate. In addition, it had a similar effect with breadcrumbs on the yield, L* value, moisture retention and oil absorption properties of fried meatballs, and showed an increasing effect on the smell, which is only a sensory feature. According to the results, it was determined that the ratio of teff flour: breadcrumb flour, especially 1:2 and 2:1 ratios, can provide some physical and sensory advantages in fish cake production.

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Carbon Footprint

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Abstract
Climate change and global warming are among the most discussed issues in the global sense in recent years. The main culprit of global warming is the very rapid increase in the rate of gases that cause greenhouse effect in the atmosphere. Carbon dioxide (CO2) gas, which is emitted into the atmosphere by the use of fossil fuels (petroleum, coal, natural gas), is one of the gases that create the greenhouse effect. Carbon footprint is a measure of the damage caused by human activities to the environment in terms of the amount of greenhouse gas produced, measured in units of carbon dioxide. Carbon footprint is the largest component of the total ecological footprint on a global scale, as well as the most important part of Turkey's Footprint constitutes. In this study, it is aimed to explain the carbon footprint in detail.
Key Words: *Greenhouse gas, Carbon dioxide, Carbon footprint*

Karbon Ayak İzi

Özet
İklim değişikliği ve küresel ısınma son yıllarda küresel anlamda en çok tartışılan konuların başında gelmektedir. Küresel ısınmanın nedeni atmosferde sera etkisine neden olan gazların oranındaki hızlı artıştır. Fosil yakıtların (petrol, kömür, doğal gaz) kullanılmasıyla atmosfere salınan karbondioksit (CO_2) gazı, sera etkisi yaratan gazlardan biridir. Karbon ayak izi, birim karbondioksit cinsinden ölçülen, üretilen sera gazı miktarı açısından insan faaliyetlerinin çevreye verdiği zararın bir ölçüsüdür. Karbon ayak izi, küresel ölçekte toplam ekolojik ayak izinin en büyük bileşeni ve Türkiye'nin ayak izi bileşenlerinin de en önemli parçasıdır. Bu çalışmada karbon ayak izinin detaylı olarak anlatılması amaçlanmaktadır.
Anahtar Kelimeler: *Sera gazı, Karbondioksit, Karbon ayak izi*

Introduction
Climate change and global warming are among the most discussed issues in the global sense in recent years. The main culprit of global warming is the very rapid increase in the rate of gases that cause greenhouse effect in the atmosphere. Carbon dioxide (CO2) gas, which is emitted into the atmosphere by the use of fossil fuels (petroleum, coal, natural gas), is one of the gases that create the greenhouse effect. The concept of "footprint", which has been developed by environmental scientists in the last ten years, generally refers to the measurement of how much natural resources are used by people. Ecologists measure human footprints in three dimensions. These; ecological footprint is expressed as carbon footprint and water footprint (Birkan, 2013; Bıyık and Civelekoğlu, 2020). The most important component of the ecological footprint in Turkey is the carbon footprint with a rate of 46% (Erden Özsoy, 2015).

Historically, the definition of carbon footprint comes from the definition of ecological footprint, of which it is a branch. The concept of ecological footprint emerged in the 1990s; The agricultural land footprint was defined as the combination of carbon footprint, structured area footprint, forest footprint, grassland footprints and fishing field footprints. The result of carbon footprint calculations is kg or tonne equivalent CO_2 in units expressed in terms. The carbon equivalent indicates how many times greater the heat storage potential of non-carbon greenhouse gases than the same amount of carbon. Thus, by bringing together all greenhouse gases in an equivalent denominator, the measurement of actual emissions is understandably simplified (Karakaş, 2021).

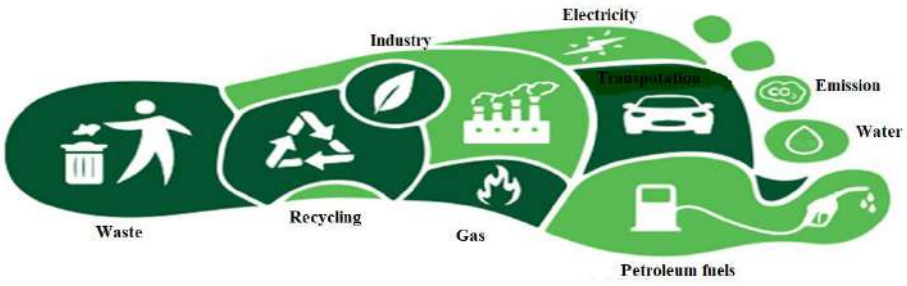

Figure 1. Carbon footprint (Anonymous, 2022)

The carbon footprint is calculated by determining the amount of CO2 that a person releases into the environment in a year. Transportation, heating, eating, drinking, etc. The amount of carbon formed as a result of the products produced and consumed by the activities determines the carbon footprint. The carbon footprint determines the share of people in global warming. In other words, a carbon footprint is the ratio of the greenhouse gases released to the nature as a result of a person, institution or any product in the overall total. Carbon footprint calculation, total distance traveled by vehicles, amount of energy used for heating, etc. It includes many parameters. In this regard, care should be taken when determining the primary and secondary traces of carbon. (Kumaş et al., 2019).
Carbon footprint is examined in two groups as personal and corporate carbon footprint.

1. Personal carbon footprint; It is a term that evaluates the amount of individual liability resulting from the emission released to nature as a result of anthropogenic activities. The aim here is to create personal awareness and to start the reduction of emissions from individuals. Personal carbon footprint is also divided into two groups among themselves.

- Primary Carbon Footprint: It is the amount of CO_2 emissions caused by fossil fuels consumed by humans in homes or vehicles (car, airplane, etc.).

- Secondary Carbon Footprint: The products used by human beings indirect CO_2 in the cradle-to-grave cycle is the amount of emissions.

2. Corporate Carbon Footprint: It is the concept that shows the emissions that organizations leave to the nature as a result of their activities during the year. The corporate carbon footprint is divided into three groups;

- Direct Carbon Footprint: The fossil fuels used by the vehicles owned by the institution or the institution and the emissions indicating the environmental impact of the fossil fuels used for heating and the production process are within the scope. The organization must calculate direct greenhouse gas emissions and removals from facilities located within its boundaries.

- Indirect Carbon Footprint: Obtained from an institution by another institution. Emissions caused by hot water, cooling water and steam are included in this scope.

- **Other Indirect Carbon Footprint**: It is the most difficult footprint to calculate since the availability of the required information is related to the affiliated organizations. (Birkan, 2013; Karakaş, 2021).

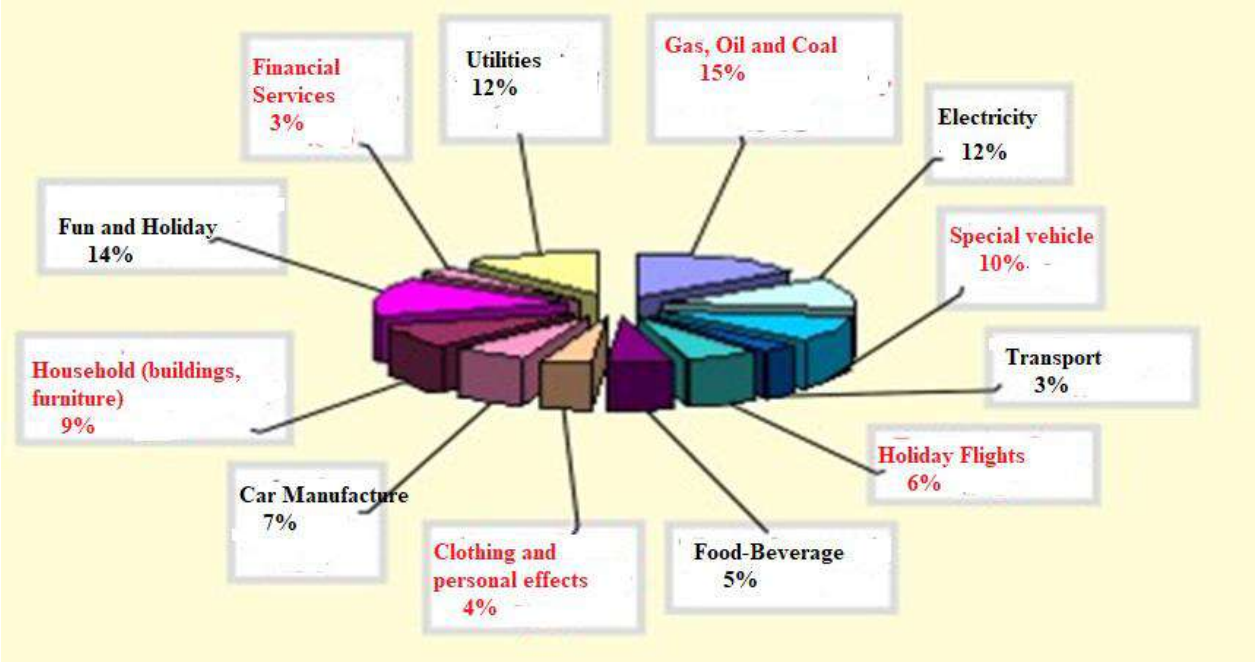

Figure 2. Elements and ratios of carbon footprint (Argun et al., 2019)

On the other hand, dividing the carbon footprint into certain categories will affect individuals' resource use and facilitates the monitoring of their sustainability. However, these categories are creates awareness that they need to take more responsibility in terms of the component. Moreover
individuals, under these categories, their individual and social status as determined by the Kyoto protocol. By evaluating it within the framework of emission standards, it has the chance to compare with other countries and have the opportunity to create solutions (Yaka et al., 2015).
Carbon Footprint is calculated in terms of forest area, which is the land type that provides the highest absorption in Footprint calculations. According to the NFA methodology, there is no separately calculated carbon biocapacity,

instead, there must be forest land that is not used for forest product production in order to store every tonne of carbon released into the atmosphere. If the size and productivity of this forest land is not sufficient to store the amount of carbon released into the atmosphere, carbon sequestration ecological deficit occurs in the category. Carbon Footprint, as well as being the largest component of the total Footprint on a global scale, also constitutes the most important part of Turkey's Footprint. 46-49% of the total Ecological Footprint from consumption in Turkey (per capita) 1.24-1.36 kha) is the Carbon Footprint. About 21% of CO2 emissions in the country come from products, 19% from personal transportation and 17% from food consumption. Apart from Personal Footprint, capital accumulation also has a significant share and constitutes 20% of the total Carbon Footprint (WWF, 2012).

Carbon Footprint in the World

The carbon footprint is a tool that enables the monitoring and measurement of greenhouse gas emissions as well as the control of abatement practices at different scales. The carbon footprint caused by greenhouse gases, the effects of which became evident with the spread of industrialization in the 1930s, was 9411 MtCO2 in 1960, while it was measured as 36153 MtCO2 in 2017. While the 5 countries with the highest total greenhouse gas emissions were the USA, Russia, Germany, China and England in 1960, the top 5 countries in 2017 were China, USA, India, Russia and Japan, respectively. While the total amount of emissions of the 5 countries that caused the most greenhouse gas emissions in 1960 was calculated as 5955 MtCO2, this amount reached 20474 MtCO2 in 2017 (Ahmetoğlu, 2019).

As a result, it is very important for the measures to be taken to reduce the carbon footprint. In order to prevent carbon emissions caused by the consumption of natural gas, renewable energy sources should be used and buildings should be insulated. Electricity consumption is generally due to the use of heating, cooling, office vehicles and elevators. Using energy-saving lamps, turning off unnecessary office equipment, choosing high-efficiency air conditioners, and choosing stairs instead of elevators for both the environment and our health will reduce carbon emissions from electricity. Low-volume engines and energy-saving vehicles should be used to reduce emissions caused by fuel consumption. A minimum level of energy consumption should be ensured by taking into account the daily distances used by staff and students.

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Effect Of Amrec Technologies Of Federal University Of Agriculture Abeokuta On Income Level Of Cassava And Soya-Bean Farmers In Ogun-State, Nigeria

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Abstract

The study analysed the effect of Agricultural Media Resources and Extension Center (AMREC) technologies of Federal University of Agriculture Abeokuta (FUNAAB) on income level of cassava and soya bean farmers in Ogun-state, Nigeria. The study describes the socio-economic characteristics of the respondents, examines the utilization level of AMREC technologies on cassava and soya beans transferred to farmers, Communication methods used to reach respondents on these technologies, and the problems encountered by farmers towards utilization of AMREC innovations. A total of 120 respondents constituted the sample size. Descriptive statistics such as frequency counts and percentages were used to describe the data. However, T-test analysis were used in to establish the significance difference between the variables. The study found out that most of the respondents 61.7% were between ranges of 41-60years and majority of the respondents 73.3% were male and married. Also, (66.7%) of the respondents highly utilized cassava hybrid, 43.3% of the respondents utilized soya bean hybrid. All the respondents (100%) claimed that individual contact, radio, television were not used to reach them. T-test analysis shows that there is significant difference in the amount realized per annum (₦) from cassava and soya-bean productions before and during benefiting from AMREC technologies ($t = 18.102$, $p = 0.003$). Conclusively, there is improvement in the amount realized per annum during their participation in AMREC project. The study therefore recommended that efforts should be made by AMREC to sustain transferring of technologies related to cassava and soya-bean production because of its significance contribution to their income level.
Key Words: *AMREC, Technology, Cassava and Soya-bean, Income level, Innovation*

Introduction

The Federal University of Agriculture, Abeokuta (FUNAAB), as one of the specialized Universities of Agriculture in Nigeria, had at its inception in January 1988, the tripartite mandates of Teaching/Training (Manpower Development), Research (particularly Problem Directed and Result Oriented Research) and Extension Services (Transfer of Proven Technologies and Community Development). The Agricultural Media Resources and Extension Centre (AMREC) is the leg upon which the extension mandate rests. Agricultural extension services have crucial roles to play in agricultural development employ strategies that involve training, demonstration, adaptive research and communication to help farmers and other stakeholders in agriculture form opinions and adopt new knowledge and technologies that will enhance agricultural productivity and ultimately improve their livelihoods (AMREC, 2019)

In an effort to spread AMREC extension activities, Tribune Online (2022) reported that the Agricultural Media Resources and Extension Centre (AMREC) of the Federal University of Agriculture, Abeokuta, (FUNAAB) has extended skill acquisition to farming families and out-of-school youths in Alagbede community and its environs in Odeda Local Government Area of Ogun State. The training workshop, under the programme, tagged: 'Gender Issues and Youth Development' (GIYD) was targeted toward empowering primary school students and the general populace of the community. Similarly, The Guardian (2019) reported that AMREC of Federal University of Agriculture, Abeokuta Ogun State, in collaboration with Premier Feed Mills, has enlightened secondary school students in Abeokuta, on importance of egg to human health. One could conclude that technology transfer is the hub of extension activities.

Application of scientific discoveries to solve or ease problem(s) is termed technology. Most people use one or combination of technology every day of their lives. Indeed, (2022) observed that there are many different types of technology, and each one has unique functions that aim to make certain processes more efficient. Technology is the product of transferring scientific knowledge to practical use. Different forms of technology are the result of people trying to find more efficient ways to do things and testing new ideas. Technology is constantly improving and generally aims to make processes easier for people. Technology cut across several sectors such as electrical, communication, computer and agriculture.

The scale of demand for agricultural products and resources has grown so much that it has become impossible to meet these requirements with manpower only. As a result, agricultural technologies appeared on the market to

streamline and automate farming activities, and by those technologies, it means every tech-based solution that helps farmers to manage fields, treat crops, and monitor them. Technologies that focus on local farmers condition are classified as appropriate technologies. Appropriate technology is an approach based on scalable and sustainable solutions that improve smallholder farmers' livelihood and protect the environment. (Bartosinska, 2021).

Agricultural technology development are the works of agricultural research institutes, Universities of Agriculture, Faculties or colleges of Agriculture and veterinary medicines. Kyama (2015) stated that Universities need to become even more productive in terms of generating research – around seed technologies, better planting methods, ways of analyzing soil, and understanding and mitigating the impacts of climate change – because much of what is going to happen in the agricultural sector has to do with operating within a knowledge-based global economy. Universities have been accused, in Africa and elsewhere, of not responding quickly enough to changing market needs in terms of skills. However, many are starting up incubators aimed at creating new technologies that can be commercialized and contribute towards industrial growth.

Linquip Technews (2022) revealed that in the agricultural sector, innovation doesn't start in the farms or factories. It rather starts in universities. From there, it spreads to: the farms, transportation systems of agricultural produce, manufacturing and distribution systems. The university research departments play an important role in innovation. They invest resources into each department. Researchers collaborate with students to innovate new technologies. Students learn from the researchers and teachers. And when they develop new technologies, the researchers and teachers learn from them too.

Nigerian universities have played roles in the development of agriculture, especially in the research and extension spheres. Five universities have been designated as agricultural universities and specifically train graduate and post graduate students in agriculture and food security. Many other universities have faculties of agriculture, where they train graduate and postgraduate students in different agricultural disciplines. However, the response to this challenge is constrained by inadequate research and training facilities (Okolo, 2010).

Cassava and Soybean were among the crops given attention by AMREC. Cassava production is usually faced with myriad of problems ranging from pests and diseases (cassava mosaic disease, cassava bacterial blight, cassava anthracnose disease, cassava bud necrosis, root rots, mealybugs, green mite, weather related problems, poor soil, land dilapidation, damage by livestock, danger imposed by excessive use of fertilizers, scarcity of cuttings, poor accessibility to markets, and all these problems affects the yield (Emmanuel, 2016). Olufolaji (2018) reported that challenges in the Nigeria crop production sector are numerous, some of which include: Post-harvest handling (sorting, grading and cold storage); low utilization of improved seeds and seedlings (Nigeria uses 5%; East Africa 25% and Asia uses 60% improved seed/seedlings); low rate of fertilizer usage: Nigeria uses an average of 13kg/hectare (Western World uses 100kg/hectare and Asia uses 150kg/hectare); low yield: Crop yield in Nigeria is only

Ekott (2021) reported that the central problem responsible for perennial low cassava production is that Nigerian farmers use local varieties that yield poorly. Nigeria produces less than 10 tonnes per hectare whereas top exporters like Thailand produce up to 40 tonnes per hectare. Nigeria is ranked largest producer of cassava in the world based on its annual production, not yield per hectare. Another problem is poor control of weed, a major inhibitor of cassava productivity that can cause as high as 90 per cent of yield loss and insecurity of farmers due to herdsmen invasion.

Donley (2021) stated that Soybean production and imports in Nigeria continue to rise as the country's demand for the oilseed is expanding for both food and feed use. Although soybean production is mostly cultivated in the northern parts of the country, Nigeria's northern states are experiencing security challenges, resulting from Boko Haram activities as well as conflict between pastoralists and farmers. This study therefore evaluated the effect of Agricultural Media Resources and Extension Center (AMREC) technologies of Federal University of Agriculture Abeokuta (FUNAAB) on income level of cassava and soya bean farmers in Ogun-state, Nigeria. Specifically, the study describes the socio-economic characteristics of the respondents, examines the utilization level of AMREC technologies on cassava and soya beans transferred to farmers, Communication methods used to reach respondents on these technologies, and the problems encountered by farmers towards utilization of AMREC innovations.

Materials and Methods

Text The study was carried out in AMREC catchment areas of Ogun state, Nigeria. Britannica (2020) described Ogun state, western Nigeria as a state created in 1976 and comprising former Abeokuta and Ijebu provinces of former Western state, the latter carved out of former Western region in 1967. Ogun is bounded by Oyo and Osun states to the north, Lagos state to the south, Ondo state to the east, and the Republic of Benin to the west. It is covered predominantly by tropical rain forest and has wooded savanna in the northwest. Agriculture, the economic mainstay of Ogun, produces rice, corn (maize), cassava (manioc), yams, plantains, and bananas. Cocoa, kola nuts, rubber, palm oil and palm kernels, tobacco, cotton, and timber are the main cash crops.

AMREC is an extension arm of Federal University of Agriculture Abeokuta. The University commenced extension and outreach services in 1990 while the AMREC was inaugurated and established in November 1, 1991 and charged with the responsibility of fulfilling the extension mandate of FUNAAB to stakeholders (Extensionists,

Farmers, Processors, Industrialists and Marketers among others) across the Southwestern states of Nigeria. AMREC's approach to extension activities involves the adoption of model extension villages and the use of an Inter-disciplinary Extension System in agricultural technology transfer. The overall governing body of the Centre is the AMREC Policy Board under the Chairmanship of the Vice-Chancellor. The Board is to ensure that AMREC runs its activities in line with the laid down regulations of the University, relates closely with the various Colleges within the University as well as Research Organizations, Agencies and Institutions in the Country, with a view of jointly proffering lasting solutions to identified farmer-centred problems from time to time (AMREC, 2019).
The study focused on cassava and soya-bean farmers benefited from AMREC project. Simple random selection was used to select 10% respondents from the list of beneficiary (1196) provided, thus 120 respondents constituted the sample size. Interview schedule was used to collect data from selected towns and village benefitted from the project such as: Odeda, Osiele, Oluga, Olugbo, Ilugun, Olodo, olokemej, Obantoko, Adao and Alabata. The dependent variable is the effect of AMREC technologies of Federal University of Agriculture Abeokuta on production level of cassava and soya bean farmers. It was measured by asking the respondents amount realized from cassava and soya-bean before and during benefiting from AMREC technologies. Descriptive statistics such as frequency counts and percentages were used to describe the data. However, T-test analysis was used in to establish the significance difference between amounts realized per annum from cassava and soya-bean productions before and during benefiting from AMREC technologies.

Results and Discussion

Socio-economic characteristic of the respondents

Table 1 reveals that (73.3%) of the respondents were male while (26.7%) were female. This means that male dominated the beneficiary of AMREC project. Also, (6.7%) of the respondents were between the age of 25-30 years, those between the age of 31-40years were (21.7%), those between 41-50 years were (26.7%), those between 51-60years were 35% and the respondents with ages from 61above were (10%). This means that most of the respondents were middle aged which implies that they will be able to cope with rigorous activities on the farming activities. The data represented on Table 1 also showed that (6.7%) of the respondents were single, 8.3% were separated, (6.7%) were divorced, (5.0%) were widowed and (73.3%) were married. This means that most of the respondents in the study area were married which implies that there will be availability of family labour to assist in farming activities.
Table 1 also showed that respondents with household number from the range of 5-10 persons were (28.0%) while (71.7%) fell between the range of less than or equal to five (≤ 5) persons. This means that respondents in the study area were having small household size. The table further showed (66.7%) of the respondents had no formal education, (21.7%) had primary education, (6.7%) had secondary education (3.33%) had tertiary or post-secondary education, (1.67%) had adult education .This means that most of the respondents were illiterates which could distort extension information communicated to them. Similarly, table 1 revealed that (56.7%) of the respondents are Christians, (36.7%) are Muslims while (6.7%) are traditionalists. This implies that religion is not a barrier to benefit from AMREC project. The table also indicates the primary occupation of the respondent in which farming constituted (91.7%), (1.7%) were civil servants, while the artisans were (6.7%). This implies that agricultural production constitute major economic activity in the area. Also table 1 showed the secondary occupation of the respondents in which farming recorded (3.31%), (41.7%) were traders, (45.0%) were artisans. This means that respondents engaged in other income generating activities.
Also, 66.7% of the respondents belong to social organizations while 33.3% of the respondents does not belong to any social organization.

Utilization level of AMREC technologies transferred on Cassava and Soya-bean production

Table 2 revealed that (66.7%) of the respondents moderately utilized cassava hybrid. This implies that respondents accepted cassava hybrids in the area. (50.0%) of the respondents utilized cassava spacing. This implies that the respondents averagely utilized cassava spacing. (53.3%) of the respondents highly utilized chemical weeding. Use of chemical weeding could be linked to affordability and availability of these chemicals. Also, (33.3%) of the respondents practiced right time cassava harvesting. When hybrid cassava tubers were left for long period in the soil, it tends to deteriorate. Also, (38.3%) of the respondents utilized cassava processing technology. AMREC provided big container to assist them in processing cassava tubers to local swallow called *fufu* which is in high demand in the area.
Furthermore, 43.3% of the respondents moderately utilized soya bean hybrid, (38.3%) of the respondents never utilized modern soya bean spacing. This implies some respondents still utilized the local/previous spacing of soya-bean. Also, (36.7%) never utilized chemical weeding for soya-bean. This could be attributed to technicalities involved in the use of chemical to control weed in soya-bean farm. Similarly, 38.3% of the respondents never utilized timely soya bean harvesting. Most of the respondents (61.7%) never practiced soya bean processing. This behavior could be linked to the fact that some sponsors of AMREC bought their produce directly from the farmers.

Table 1: Distribution of respondents by their socio-economic characteristics, n=120

Socio-economic characteristics	Frequency	Percentage (%)
Gender		
Female	32	26.7
Male	88	73.3
Age (years)		
25-30	8	6.7
31-40	26	21.7
41-51	32	26.6
51-60	42	35
61 and above	12	10.0
Marital status		
Single	8	6.7
Separated	10	8.7
Divorced	8	6.3
Widowed	6	5.0
Married	88	73.3
Household size (number of persons)		
≤ 5	86	71.7
5-above	34	28.3
Educational status		
No formal education	80	66.7
Primary education	26	21.7
Secondary education	8	6.7
Tertiary education	4	3.33
Adult literacy	2	1.57
Religion		
Christianity	68	56.7
Islam	44	36.7
Traditional	8	6.6
Primary occupation		
Farming	110	91.5
Civil servant	2	1.7
Trader	0	0
Artisan	8	6.7
Secondary Occupation		
Farming	4	3.3
Trader	50	14.7
Artisan	46	38.3
Social organization		
Yes	80	66.7
No	40	33.3

Source: Field survey, 2021.

Table 2: Distribution of respondents according to their utilization level of AMREC technologies transferred on Cassava and Soya-beans productions, n=120

AMREC Technologies	Utilization Level			
	High	Moderate	Low	Never
Cassava				
Cassava hybrid	14(11.7)	80(66.7)	10(8.3)	16(13.3)
Planting (spacing)	36(30.0)	60(50.0)	8(6.7)	16(13.3)
Weeding (chemical)	10(5.0)	64(53.3)	32(26.7)	18(5.0)
Timely harvesting	36(30.0)	40(33.3)	26(21.7)	18(15.0)
Processing (fufu flour)	18(15.0)	46(38.3)	12(10.0)	44(36.7)
Soya-bean				
Soya bean hybrid	6(5.0)	52(43.3)	20(16.7)	42(35.0)
Planting (spacing)	10(8.3)	44(36.7)	20(16.7)	46(38.3)
Weeding (chemical)	6(5.0)	34(28.3)	36(30.0)	44(36.7)
Timely harvesting	10(8.3)	38(31.7)	26(21.7)	46(38.3)
Processing(soya cheese, milk)	2(1.7)	30(25.0)	14(11.7)	74(61.7)

Source: Field survey 2021.
( ) Represent percentages.

Communication methods used to reach respondents on agricultural innovations

Table 3 showed that all of the respondents (100%) claimed that individual contact, radio, television, and internet were not used to reach respondents in the study area. Few (13.3%) of the respondents were reached using demonstration plots while (100%) of the respondents claimed use of seminars. This implies that seminars and demonstration plots were used to reach the respondents in the study area.

Table 3: Distribution of respondents according to communication methods used to reach respondents on agricultural innovations, n=120

*Communication methods	Frequency	Percentage (%)
Individual contact	0	100
Seminar	120	100
Demonstration	16	13.3
Radio	0	100
Television	0	100
Internet	0	100

Source: field survey 2021, * represent multiple responses.

Problems encountered toward utilization of AMREC technologies

Table 5 shows that (100%) of the respondents claimed that they had no problem regarding language used to disseminate innovation, (95.0%) of the respondents claimed that they had a mild problem on sustainability of the innovation. The table also shows that majority (91.7%) of the respondents experienced severe financial constraint. Almost half, (51.6%) of the respondents claimed that they had a mild problem in relating to the university agents. Also, 53.3% of the respondents claimed that they had no problem with the teaching methods used by university agents. Majority, (83.3%) of the respondents experienced severe infrastructural problem such as electricity. This means that respondents experienced combination of problems with different levels of severity which could influence the utilization of AMREC technologies.

Table 5: Distribution of respondents according to problems encountered towards the utilization of AMREC technologies.

*Problem	Severe problem	Mild problem	Not a problem
Language barrier	0	0	120(100)
Sustainability of innovation	0	114(95.0)	6(5.0
Financial constraints	110(91.7	8(6.7	2(1.7)
Harshness of university agents	2(1.7	62(51.7	46(46.6)
Teaching method	0	56(46.7	64(53.3)
Social Infrastructure	100(83.3	16(13.3	4(3.3

Source: Field survey, 2021, * Multiple response, ( ) represent percentages

T-test analysis showing the significant difference between amounts realized per annum from cassava and soya-bean productions before and during benefiting from AMREC technologies.

T-test analysis shows that there is significant difference in the amount realized per annum (₦) from cassava and soya-bean productions before and during benefiting from AMREC technologies (t = 18.102, p = 0.003). This means there is improvement in the amount realized when the respondents are benefiting from the project. This improvement could be credited to utilization of AMREC technologies from Federal university of Agriculture Abeokuta transferred to them.

T-test analysis showing the significant difference between amounts realized per annum from cassava and soya-bean productions before and during benefiting from AMREC technologies.

Amounts realized (₦) per annum from cassava and soya-bean productions	**mean**	**t-value**	**p-value**	**remark**
Before	575,112			
		18.102	0.003	Significant
During	1,710,003			

Source: Computed Data, 2021.

Conclusion and recommendations

Conclusively, respondents utilized several technologies such as hybrid cassava and agro chemicals for weed control. There is improvement in the amount realized per annum during their participation in AMREC project. The study therefore recommended that

- There should be improvement in radio programmmes to create awareness about AMREC programmes.
- Efforts should be made by AMREC to sustain transferring of technologies related to cassava and soya-bean production because of its significance contribution to their income level.

Acknowledgements

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ID:445

The Effect of Drying Methods on Drying and Thermo-Physical Properties of Apricot Kernels

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Abstract

Apricot kernels are used in medicine as pain reliever, antimutagenic, anti-inflammatory and antimicrobial. In addition, the sweet ones of apricot kernels are consumed as snacks, and the bitter ones are used as raw materials in the cosmetics industry. It is important to determine the effect of the methods in the apricot kernel drying process, which is thought to affect the usage areas indirectly or directly. In this study, apricot kernels were dried in an oven (50, 60,70 °C) in an air-conditioning cabinet at 30 % relative humidity at 50, 60, 70 °C and in the shade. When the drying times of the drying processes were examined, the longest drying was found in the shade drying method with 22 hours, and the shortest drying was determined in an oven at a drying temperature of 70 °C with 4 hours. According to the mathematical model data, Page estimated the best Midilli-Küçük model (R2:0.9999) among the drying data among Yağcıoğlu and Midilli-Küçük drying models. When the color values are examined, it has been determined that the methods closest to the color values of fresh apricot kernels are the processes carried out at 70 °C 30% RH in the air-conditioning cabinet and at 70 °C in the oven. In thermo-physical properties, the highest specific heat, thermal conductivity and thermal diffusivity values were determined in the shade drying method, while the highest specific mass values were determined in the samples that were dried in an oven at 60 °C.
Keyword: *Apricot kernels, Drying process, color properties, drying parameters*

Kayısı Çekirdeğinin Kuruma ve Termo-Fiziksel Özelliklerine Kurutma Yöntemlerinin Etkisi

Özet

Kayısı çekirdeği ağrı kesici, antimutajenik, iltihap önleyici ve antimikrobiyal olarak tıp alanında kullanılmaktadır. Ayrıca kayısı çekirdeklerinin tatlı olanları çerez olarak tüketilmekte, acı olanları ise kozmetik sanayisinde hammadde olarak değerlendirilmektedir. Kullanım alalarını dolaylı veya doğrudan etkileyeceği düşünülen kayısı çekirdeği kurutma işleminde yöntemlerin etkisinin belirlenmesi önemlidir. Bu amaçla yapılan çalışmada, kayısı çekirdekleri etüvde (50, 60,70 °C) iklimlendirme kabininde %30 bağıl nemde 50, 60, 70 °C ve gölgede kurutulmuştur. Kurutma işlemlerinin kuruma süreleri incelendiğinde en uzun kuruma 22 saat ile gölgede kurutma yönteminde, en kısa kuruma ise 4 saat ile 70 °C kurutma sıcaklığında etüvde tespit edilmiştir. Matematiksel model verilerine göre Page, Yağcıoğlu ve Midilli-Küçük kurutma modelleri arasında kuruma verilerinin genelinde en iyi Midilli-Küçük modeli (R^2:0.9999) tahmin etmiştir. Renk değerleri incelendiğinde taze kayısı çekirdeğinin renk değerlerine istatistiksel açıdan en yakın yöntemler iklimlendirme kabininde 70 °C %30 RH ve etüvde 70 °C sıcaklıkta yapılan işlemler olduğu tespit edilmiştir. Termo-fiziksel özellikler de ise en büyük özgül ısı, termal iletkenlik, termal difüzivite değerleri gölgede kurutma yönteminde belirlenirken, en büyük özgül kütle değerleri ise etüv 60 °C de kurutulan örneklerde belirlenmiştir.
Anahtar kelime: *Kayısı çekirdeği, Kurutma işlemi, renk özellikleri, kuruma parametreleri*

ID: 446

Impacts of Insects As Feedstuffs on Animal Immune System

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Abstract

Recent studies emphasize that insects can be used as an alternative feed source in animal nutrition. In addition to the nutrient contents of insects, some studies indicate that they can be a source of valuable compounds that have positive effects on the immune system. Researches focus on which compounds can be effective on the immune system. Among these, it is stated that antioxidant peptides, chitin, and antimicrobial peptides in the structure of insects can stimulate the immune system and regulate the intestinal microbiome in animals that consume it. In this context, it is stated that the consumption of edible insects may have effects by increasing gastrointestinal health and immune functions, thereby reducing the risk of bacterial infection. Scientific studies, especially on antimicrobial peptides, are increasing in the fields of medicine, food, and feed production. It is stated that the risk of bacterial resistance to antimicrobial peptides that can be obtained from insects is low. On the other hand, it is thought that bactericidal insect antimicrobial peptides can protect animals against viruses and fungi. Another view on this subject is that chitin, which is a component of the exoskeleton of insects, and chitin derivatives can stimulate immune cells. It is also known that lauric acid, a medium-chain fatty acid found in insects, has antiviral and antibacterial activity. In terms of animal nutrition, it is necessary to carry out comprehensive and multidisciplinary studies to determine the nutrient content of insects as well as to reveal their effects on the immune system. Only in this way can the effects on the health and performance of the animal be reflected comprehensively and accurately.

Key Words: *Insects, Immune system, Feed additives, Protein sources*

Yem Hammaddesi Olarak Böcek Kullanımının, Hayvanların Bağışıklık Sistemi Üzerine Etkileri

Özet

Son yıllarda yapılan çalışmalar, böceklerin hayvan beslemede alternatif bir yem kaynağı olarak kullanılabileceğini vurgulamaktadır. Böceklerin besin madde içerikleri yanı sıra, yapılan bazı çalışmalarda bağışıklık sistemi üzerinde olumlu etkileri olan değerli bileşiklerin kaynağı olabilecekleri üzerinde durulmaktadır. Yapılan araştırmalar, hangi bileşiklerin bağışıklık sistemi üzerine etkili olabileceği üzerinde yoğunlaşmaktadır. Bunlar arasında böceklerin yapısındaki antioksidan peptitler, kitin ve antimikrobiyal peptitlerinin bağışıklık sistemini uyarabileceği ve tüketen hayvanlarda bağırsak mikrobiyomunu düzenleyebileceği belirtilmektedir. Bu kapsamda yenilebilir böceklerin tüketimi; gastrointestinal sağlığı ve bağışıklık fonksiyonlarını artırarak, bu sayede bakteriyel enfeksiyon riskini azaltıcı etkileri olabileceği belirtilmektedir. Özellikle antimikrobiyal peptitler üzerine yapılan bilimsel çalışmalar tıp, gıda ve yem üretimi alanlarında giderek artış göstermektedir. Böceklerden elde edilebilecek antimikrobiyal peptitlere karşı bakteri direnci oluşma riskinin düşük olduğu ifade edilmektedir. Diğer yandan bakterisidal etkili böcek antimikrobiyal peptitlerinin, hayvanı virüslere ve mantarlara karşı da koruyabileceği düşünülmektedir. Bu konudaki bir başka görüş de böceklerin dış iskeletinin bir bileşeni olan kitin ve kitin türevlerinin bağışıklık hücrelerini uyarabildiği yönündedir. Yine böceklerde bulunan orta zincirli bir yağ asidi olan laurik asidin antiviral ve antibakteriyel aktiviteye sahip olduğu da bilinmektedir. Hayvan besleme açısından, böceklerin besin madde içeriklerini belirlemenin yanı sıra bağışıklık sistemi üzerine olan etkilerinin de ortaya konabilmesi için geniş kapsamlı ve multidisipliner araştırmaların yapılmasının gerekliliği ortaya çıkmaktadır. Ancak bu sayede, hayvanın sağlığı ile performansı üzerindeki etkileri kapsamlı ve doğru bir şekilde yansıtılabilir.

Anahtar Kelimeler: *Böcekler, Bağışıklık sistemi, Yem katkı maddeleri, Protein kaynakları*

Giriş

Hayvanlar aleminde toplam hayvan biyokütlesinin %95'ini böcekler oluşturmaktadır, bu sayede de yaygın olarak üretimi ve tüketimi mümkün olabileceği düşünülmektedir (De Castro ve ark., 2018). Böcek üretiminin avantajları olarak; tükettikleri besinleri hızlı şekilde verime çevirme, hayvan ve insan atıklarını değerlendirmeleri ile ekolojik kirliliğin önüne geçilmesi, çiftlik hayvanlarına göre sera gazı üretimine daha az oranda katkıda bulunması, yüksek protein üretimi için daha az suya ve araziye gereksinimin bulunması gösterilebilir (Van Huis ve ark., 2013; Van Huis, 2017; Mulia, 2019; Barbi ve ark., 2020). Böcekler; yüksek düzeyde protein içermekte, bununla birlikte esansiyel aminoasitler, esansiyel yağ asitleri ve çeşitli vitaminler açısından da zengin bir kaynak olmaları sebebiyle değerli bir besin kaynağı olarak kabul edilmektedir. Böcek türlerine ve oluşum evrelerine göre

değişiklik göstermekle birlikte, kuru maddede %10'a kadar kitin içerdikleri de bildirilmiştir (Rumpold ve Schlüter, 2013; Belluco ve ark., 2013; Tzompa-Sosa ve ark., 2014; Belluco ve ark., 2017; Paul ve ark., 2017).

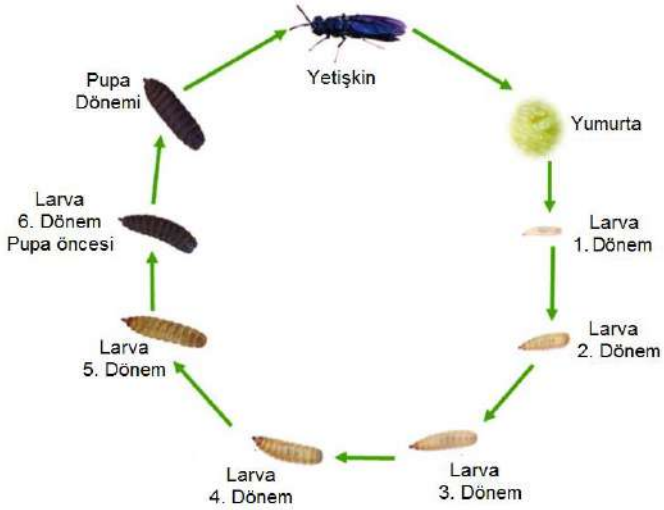
Tablo 1. Avrupa Birliği' nde 7 Eylül 2021 itibari ile yürürlüğe giren İşlenmiş Hayvansal Proteinlerin (İHP) yemlerde kullanım kısıtlamaları

AB'nde (2021/1372 sayılı) 7 Eylül 2021 itibari ile hayvansal protein kaynaklarının yemlerde kullanım kısıtlamaları	Kürk hayvanları dışındaki çiftlik hayvanları için yem					Pet ve kürk hayvanları için yem
	Ruminantlar	Tek mideli hayvanlar (Balık hariç)			Balıklar	
		Domuzlar	Kanatlılar	Diğerleri		
▪ Ruminantlardan elde edilen İHP (kan unu dahil) ▪ Ruminantlardan elde edilen kan ürünleri						
▪ Ruminantlardan elde edilen jelatin ve kolajen		2021	2021	2021	2021	
▪ Hidrolize proteinler (tek mideli hayvanlardan ve ruminantların deri ve postlardan elde edilenler dışındakiler)						
▪ Domuzlardan elde edilen İHP			2021		2013	
▪ Kanatlılardan elde edilen İHP		2021			2013	
▪ Diğer tek mideli hayvanlardan elde edilen İHP (kan unu dahil, fakat balık unu hariç)					2013	
✓ Böceklerden elde edilen İHP		2021	2021		2017	
▪ Balık unu ▪ Tek midelilerden elde edilen kan ürünleri ▪ Hayvansal orijinli di ve trikalsiyum fosfat ▪ Hayvansal proteinler (tabloda adı geçen ürünlerin dışında kalanlar)						
▪ Hidrolize proteinler (Tek midelilerden ve ruminantlardan elde edilen deri ve postlardan elde edilenler) ▪ Tek midelilerden elde edilen jelatin ve kolajen ▪ Yumurta, yumurta ürünleri, süt, süt ürünleri, kolostrum						

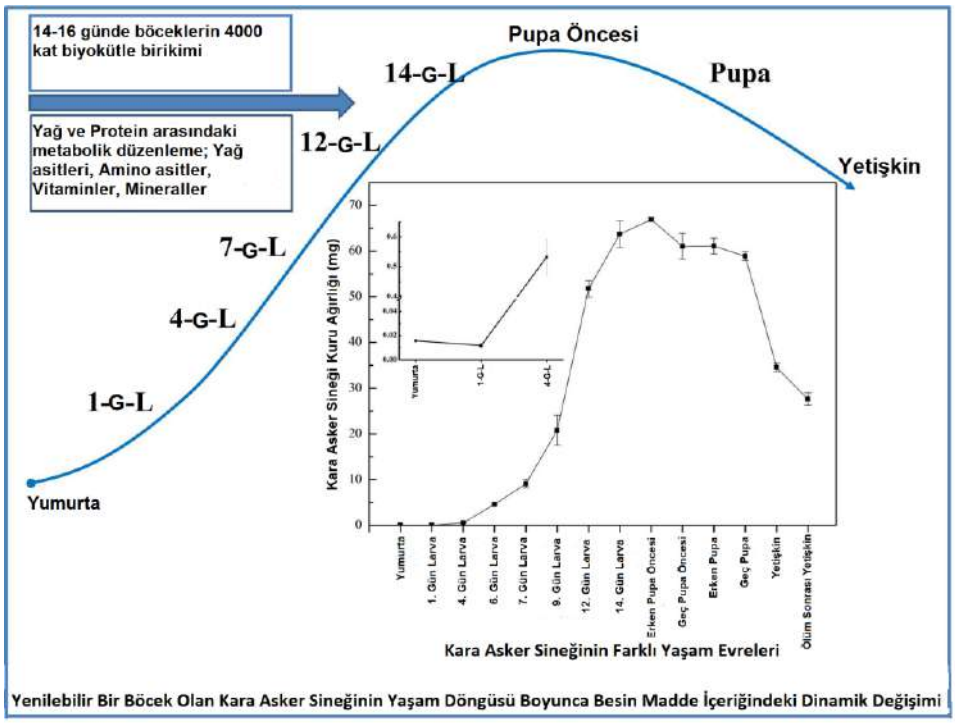
Avrupa Birliği (AB) komisyonunun 2021/1372 sayılı ve 17 Ağustos 2021 tarihinde tek mideli çiftlik hayvanlarının yemlerinde hayvansal protein kaynağı kullanımına yönelik olarak hazırladığı düzenleme ile birlikte 7 Eylül 2021 tarihi itibari ile kanatlı hayvanların yemlerinde böcek türlerinden elde edilen işlenmiş ürünlerin kullanılabileceği belirtilmiştir. Bununla birlikte, ruminant hayvanların yemlerinde kullanımlarına henüz izin verilmemektedir (Tablo 1).

Farklı Yetiştirme Evrelerindeki Böcek Türlerinin Besin Madde İçerikleri

Kara asker sineğinin yaşam döngüsü; yumurta, larva, pupa ve ergin fazları olmak üzere dört faza ayrılabilir (Liu ve ark., 2017). Şekil 1'de böceklerin yaşam döngüsüne örnek olması amacıyla, Kara asker sineğinin (*Hermetia illucens*) yaşam döngüsü verilmiştir (Chia, 2019).



Şekil 1. Kara asker sineğinin yaşam döngüsü (Chia, 2019)



Grafik 1. Kara asker sineğinin yaşam döngüsüne bağlı olarak besin madde içeriği ve biyokütle birikimindeki değişikler (Liu ve ark., 2017; Tüm sonuçlar kuru kütle olarak verilmiştir. G-L: günlük yaştaki larva.

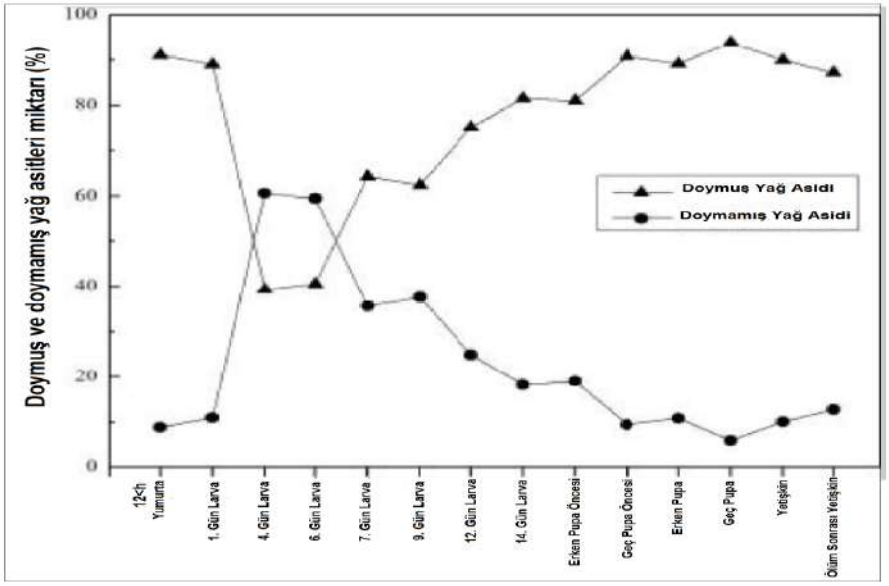
Böcekler; yaşamlarının değişik dönemlerinde, farklı besin madde içeriklerine sahiptirler. Grafik 1'de Kara asker sineğinin yaşam evresine göre besin madde içeriği ve biyokütle değişimleri ortaya konmuştur. Tablo 2'de ise ham protein (%), ham yağ (%), ham kül (%) içeriklerindeki değişimler gösterilmiştir. Ham protein içerikleri ise tüm dönemler incelendiğinde en düşük %38 (12 günlük yaşta larva), en yüksek ise %57,6 (ölüm sonrası ergin birey) olarak ortaya konmuştur. Ham yağ içeriği yumurta evresinde %16; 14 günlük yaştaki larva döneminde %28; prepupa döneminde %24-28; Pupa döneminde %7-8; ergin dönemde %30-32 olarak belirtilmiştir. Ham kül içerikleri bakımından ise en düşük değerler, ergin dönemdeki Kara asker sineklerinde saptanmıştır (Liu ve ark., 2017).

Tablo 2. Kara asker sineğinin besin madde içeriği değişimleri (Liu ve ark., 2017)

Yaşam döngüsü	Ham protein (%)	Ham yağ (%)	Ham kül (%)
Yumurta (<12 saat)	45,0±0,12^{e}	15,8±0,06^{f}	4,0±0,15^{gh}
1 günlük yaştaki larva	56,2±0,06^{b}	4,8±0,08^{j}	5,0±0,17^{g}
4 günlük yaştaki larva	54,8±0,28^{c}	5,8±0,26^{j}	10,5±0,40^{a}
6 günlük yaştaki larva	54,2±0,15^{c}	9,6±0,06^{h}	10,0±0,06^{abc}
7 günlük yaştaki larva	46,0±0,21^{d}	13,4±0,17^{g}	9,2±0,25^{bcde}
9 günlük yaştaki larva	42,0±0,10^{g}	22,2±0,28^{e}	8,4±0,23^{def}
12 günlük yaştaki larva	38,0±0,35^{j}	22,6±0,15^{e}	7,8±0,41^{f}
14 günlük yaştaki larva	39,2±0,06^{i}	28,4±0,06^{c}	8,3±0,26^{ef}
E-prepupa	40,2±0,15^{h}	28,0±0,25^{c}	8,8±0,21^{cdef}
G-prepupa	40,4±0,21^{h}	24,2±0,28^{d}	9,6±0,06^{abcd}
E-pupa	46,2±0,12^{d}	8,2±0,12^{i}	9,6±0,15^{abcd}
G-pupa	43,8±0,21^{f}	7,2±0,03^{i}	10,2±0,32^{ab}
Dişi	43,8±0,06^{f}	30,6±0,26^{b}	2,8±0,06^{h}
Erkek	44,0±0,10^{f}	32,2±0,42^{a}	3,0±0,06^{h}
P-ergin	57,6±0,26^{a}	21,6±0,36^{e}	3,6±0,23^{h}
Soya fasulyesi küspesi	44,51	1,84	6,13
Balık unu	66,0	10,8	21,8

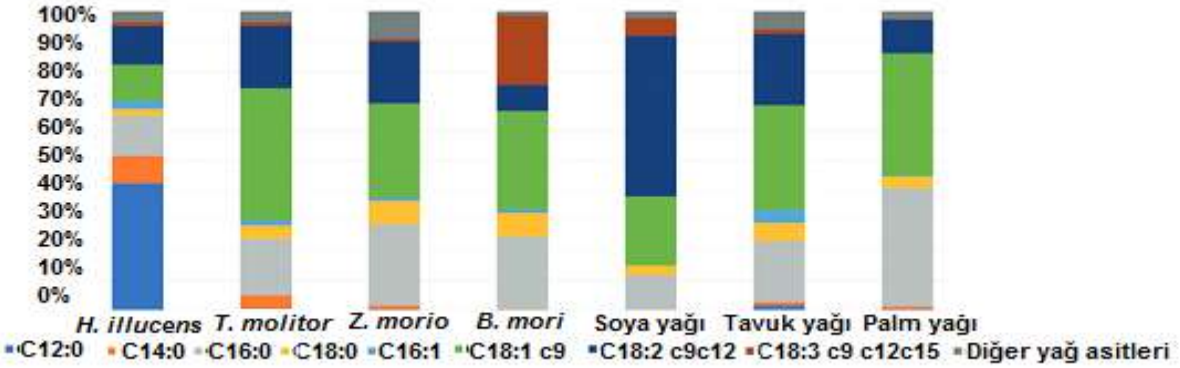
E-prepupa: erken prepupa, G-prepupa: geç prepupa, E-pupa: erken pupa, G-pupa: geç pupa, P-ergin: ölüm sonrası yetişkin.
Veriler ortalama ± S.E olarak ifade edilir; farklı üst simgelere sahip bir sütun içindeki değerler birbirinden farklıdır (P<0.05).

Liu ve ark. (2017) yaptıkları çalışmada, Kara asker sineğinin yaşam döngüsündeki doymuş ve doymamış yağ asit miktarı Grafik 2'de gösterilmiştir. Buna göre 6 günlük yaştaki larva döneminden itibaren doymuş yağ asiti içeriklerinin arttığı, doymamış yağ asiti içeriklerinin ise azaldığı gözlenmiştir.



Grafik 2. Kara asker sineğinin içerdiği doymuş ve doymamış yağ asitlerinin değişimi (Liu ve ark., 2017; Tüm sonuçlar kuru kütle ile hesaplanmış haliyledir.)

Soya, tavuk ve palm yağı gibi yaygın kullanılan yağlar ile *H. illucens, T. molitor, Z. morio, B. mori* böceklerinden elde edilen yağların, yağ asit profilleri Grafik 3'te derlenmiştir.



Grafik 3. Böcek yağlarının ve kullanımı yaygın olan yağlardan bazılarının yağ asiti profilleri (Benzertiha ve ark., 2020a)

Kitin

Tek mideli canlılar tarafından sindirilemeyen bir bileşen olan kitin; eklembacaklıların dış iskeletinde bulunan bir polisakkarittir. Ham selüloz özelliğinde olup, β 1-4 glikozidik bağlarına sahip bir polimerdir. Kitin komposizyonunun türlere ve gelişim dönemlerine göre faklılık gösterdiği bildirilmiştir. Örneğin; çekirgelerde %8,7; *Cirina forda* larvasında ise kitin miktarının %9,4; Kara asker sineğinin larvasında ise %5-8,7 olduğu belirtilmiştir (Sánchez-Muros ve ark., 2014; Kar ve ark., 2018).

Günümüzde araştırmacılar, kitin ve kitosanın yem katkısı olarak kullanımının biyolojik açıdan yararlı etkilerine ortaya koyan çalışmalara yönelim göstermektedir. Bu yararlı etkilerinin arasında büyüme performansını olumlu etkilemeleri ve serum kolesterol düzeyini azaltmaları sayılabilir. Bununla birlikte araştırmalarda birbirinden farklı sonuçlar da saptanmıştır. Bu sebeple, kitin ve kitosanın etkilerinin ortaya konulabilmesi için daha çok araştırmaya ihtiyaç duyulmaktadır (Lokman ve ark., 2019). Lokman ve ark. (2019) çalışmalarında çekirge ve karidesten elde edilen kitin ve kitosanın ayrı ayrı etlik piliçlerin yemlerine 0,5 g/kg ilavesi ile performans üzerindeki etkilerini ortaya koymayı amaçlamışlardır. Muamele grupları; kontrol, çekirge kitin (0,5g/kg), çekirge kitosan (0,5g/kg), karides kitin (0,5g/kg), karides kitosan (0,5g/kg) şeklinde planlanmışlardır. Çekirge kitin ve kitosanını kendileri ekstrakte ederken, karidesinkini ticari bir firmadan (Sigma-Aldrich, ABD) satın almışlardır. Etlik piliçlerin büyüme döneminin ilk 21 gününde performans değerleri bakımından muameleler arasında bir farklılık gözlenmemiştir. Performans döneminin tamamı göz önüne alındığında (0-42 gün) ise çekirge kitin ilavesi ile

büyüme performansı, karkas kalitesi ve organ karakteristikleri çekirge kitosan tüketen gruptan istatistiki olarak daha iyi olarak saptanmıştır. Kontrol grubunun canlı ağırlık artışı ve yağ düzeyi yüksek bulunmuştur. Çekirge kitini tüketen hayvanlarda ise yağ oranı en düşük olarak saptanmıştır ($p<0,05$). Yine aynı dönemde çekirge kitini, kontrol, karides kitin ve kitosanı tüketen gruplar arasında canlı ağırlık ve canlı ağırlık kazancı bakımından istatistiki olarak bir farklılık gözlenmemiştir.

Antimikrobiyal peptidler (AMP)

Böceklerin yapısında yüksek oranlarda bulunan antimikrobiyal peptidler (AMP), doğal antibiyotikler olarak da adlandırılmaktadır ve son yıllarda ilgi çeken bilimsel araştırma konularından biri haline gelmiştir. Genel olarak en önemli özelliklerinden birinin bakteriyel direncin gelişimine yol açmaması olduğu düşünülmektedir. Böceklerin yapısında bulunan AMP'lerin çoğunun küçük, katyonik protein yapısında oldukları, bakteri ve/veya funguslara, belirli bazı parazitlere ve virüslere karşı etki gösterdikleri bildirilmiştir. Buna ilave olarak, AMP'lerin bakteri hücresi üzerindeki antibakteriyel etkisinin, bakteri hücre zarfının yok edilmesini içerdiği ortaya konmuştur. Böcek AMP'lerinin en büyük grubu defensinler olup, bunlar altı korunmuş sistin içeren 34-51 kalıntıdan oluşan peptitler olarak bildirilmiştir. Böcek defensinleri, esas olarak Gram pozitif bakterilere (*Micrococcus luteus, Aerococcus viridians, Bacillus megaterium, Bacillus subtilis, Bacillus thuringiensis ve Staphylococcus aureus* dahil olmak üzere) karşı aktif olduğu gözlenmiştir. Bunun yanı sıra, Gram negatif bakterilere (*Escherichia coli* gibi) karşı da aktif olanlar ve anti-fungal özellikler ortaya koyanlar da saptanmıştır. Böcek antimikrobiyal peptitleri, antibiyotiklere karşı artan küresel bakteriyel direnç sorunu nedeniyle büyük umut vaat etmektedir. Böcek AMP'lerinin antimikrobiyal mekanizması, uzun yıllar boyunca şekillenmiş ve çok konservatif yapıdadırlar. Bu durum ise, bakteri direncinin gelişimini hızla indükleyen antibiyotiklerin aksine, AMP bileşiklerinin pratikte kullanılmalarının bakterilere karşı etkili kalabileceği şeklinde açıklanmaktadır (Józefiak ve ark., 2016; Józefiak ve Engberg, 2017).

Kitin ve AMP nin bağışıklık sistemi üzerindeki etkileri

İmmunoglobulinler, plazma hücreleri tarafından üretilen glikoprotein moleküllerdirler, antikor gibi davranırlar ve antijenlere yanıt olarak sentezlenirler. İmmunoglobulinler, 5 ana sınıfa (IgG, IgM, IgA, IgD, IgE) ayrılırken, kanatlı hayvanlarda ise IgA, IgM ve IgY (=IgG) gruplarına rastlanmaktadır (Carlander ve ark., 1999; Benzertiha ve ark., 2020b).

Józefiak ve ark. (2018), etlik piliçlerin sindirim kanalında olası patojenik bakterilerin inhibisyonunun ve mikrobiyotanın pozitif modülasyonunun, potansiyel olarak salinomisin gibi iyonofor grubu koksidiyostatların etkilerine benzer şekilde sonuçlar ortaya koyan tam yağlı böcek unlarından kaynaklanabileceğini bildirmişlerdir. Ayrıca, Kar ve ark. (2018) kitinin, sekum florasını etkilediği ve ortamda yüksek bütirik asit üretimine sebep olduğunu ifade etmişlerdir. Bütirik asitin ise, bağırsak hücreleri için önemli bir enerji kaynağı olduğu, bağırsak mukozası kan akışını arttırdığı bildirilmiştir. Buna bağlı olarak, doku oksijenasyonunun ve emilimin arttığını öne sürmüşlerdir (Kar ve ark., 2018).

Benzertiha ve ark. (2020b) yürüttükleri çalışmalarında, tam yağlı böcek unlarıyla beslenen muamele gruplarında immünoglobulin sınıflarından IgM ve IgY'nin seviyelerinin azaldığını saptamışlardır, bunun da AMP'ler ve kitin gibi böcek bileşenlerinin antimikrobiyal etkileri ile açıklanabileceğini belirtmişlerdir. Ayrıca, çalışmalarının sonuçları, nispeten küçük tam yağlı böcek unu ilavesinin salinomisine benzer şekilde immünoglobulin seviyelerini azaltabileceğini göstermiştir. IgA, sindirim kanalındaki seromukus sekresyonlarda bol miktarda bulunur, ve sindirim kanalında IgA, birçok bakteri ve virüse karşı ilk savunma hattı olarak görev yapar (Pleass ve ark., 2001). Benzertiha ve ark. (2020b), yürüttükleri her iki çalışmada da, salinomisin ilaveli gruplarda ve tam yağlı böcek unları ile takviye edilmiş gruplarda IgA seviyeleri üzerinde bir etkinin gözlenmemesinin sebebi olarak, hayvanlarda devam eden sindirim kanalı iltihabının olmamasını belirtmişlerdir.

AMP'lerin ise, bağışıklık savunmasının ilk hattında yer aldığı ve farklı mekanizmalar yoluyla enfeksiyöz ajanlara karşı inhibe edici aktiviteye sahip oldukları belirtilmiştir. Bu nedenle, Benzertiha ve ark. (2020b) çalışmalarındaki immünoglobulin seviyelerinin, böceklerin AMP içerikleri ile de ilişkili olabileceğini bildirmişlerdir. Ayrıca, birinci çalışmalarında IgM salgısındaki azalma ile canlı ağırlık artışındaki ($r=-0,4845$) ve yem tüketimlerindeki ($r=-0,4986$) artışın, hayvanların sağlık durumuyla ilişkili olabileceğini ilave etmişlerdir. Sonuç olarak ise, etlik piliçlerin diyetine az miktarda (%0,2 ve %0,3) *T. molitor* ve *Z. morio* tam yağlı unlarının ilave edilmesinin, büyüme performansını iyileştirebileceğini ve bağışıklık sistemi özelliklerini değiştirebileceğini saptamışlardır.

Böceklerin, Hayvan Beslemede Yem Hammaddesi ve/veya Yem Katkısı Olarak Kullanımlarının Etkileri

Son yıllarda yapılan çalışmalar ile böceklerin hayvan beslemede alternatif yem kaynağı olabileceği vurgulanmaktadır. Böceklerin besin madde içeriklerinin yanı sıra, hayvan sağlığını olumlu yönde etkileyen ve böylece hayvansal üretimde antibiyotik kullanımını azaltılmasına imkan sağlayacak, değerli bileşiklerin kaynağı olabilecekleri üzerinde durulmaktadır. Yem katkı maddesi olarak böceklerdeki antioksidan peptitler, kitin ve

antimikrobiyal peptitlerinin bağışıklık sistemini uyarabileceği ve hayvanlarda bağırsak mikrobiyomunu modüle edebileceği belirtilmektedir (Gasco ve ark., 2020). Yapılan çalışmalarda böceklerin, probiyotik özellikleri olan bakterileri arttırdığı (Stull ve ark., 2018; De Carvalho ve ark., 2019), anti-inflamatuar etki gösterdiği, LDL-kolesterol seviyesini düşürdüğü, antioksidan enzimlerin aktivitesini arttırdığı (Ahn ve ark., 2014), hipertansiyonu azalttığı (Vercruysse ve ark., 2005), anti-diyabetik etki gösterdiği saptanmıştır (Jung ve ark., 2010; Han ve ark., 2016; Nongonierma ve FitzGerald, 2017). Kitin ve kitin türevlerinin de bağışıklık hücrelerini uyarabildiği ifade edilmektedir. Örneğin, karides kabuklarından ekstrakte edilen kitin veya kitosanın yemlere eklenmesinin bağışıklık sistemini uyardığı ve yosun orfoz *Epinephelus bruneus*' ta enfeksiyonlara karşı direnci sağladığı belirlenmiştir (Gasco ve ark., 2018). Ayrıca kitinin prebiyotik etki göstererek, gastrointestinal sağlığı iyileştirdiği, bağırsakta yararlı mikrobiyotanın çoğalmasını teşvik ettiği, gıda kaynaklı mikrobiyal hastalık etmenlerinin ve gıda sindirim güçlüklerinin önlenmesine yardımcı olduğu bildirilmiştir (Fernandes ve ark., 2008; Selenius ve ark., 2018; Benzertiha ve ark., 2020b). Yapılan çalışmalarda *Salmonella typhimurium, Escherichia coli* ve *Vibrio cholera* gibi patojenik mikroorganizmaların, bağırsaklarda gelişimini azalttığı da tespit edilmiştir (Fernandes ve ark., 2008; Selenius ve ark., 2018). Bunlara ilave olarak, böceklerin yapısında bulunan orta zincirli bir yağ asidi olan laurik asidin (C12:0) anti-viral ve anti-bakteriyel aktiviteye sahip olduğu da belirtilmiştir. Böceklerin bulundukları evreye göre, içerdikleri laurik asit miktarlarında değişim görülmektedir. Gasco ve ark. (2018), bu yağ asitinin gram pozitif bakterilere karşı da etkili olduğunu bildirmişlerdir.

Böceklerin, içerdikleri besin maddelerinin ve sağlığa yararlı etkilerinin yanı sıra, beslendikleri ortama ve materyale bağlı olarak eksojen ve endojen risk faktörleri taşıyabildikleri de belirtilmiştir. Örneğin; doğal ortamlarından toplanan böceklerin pestisit kalıntısı taşıyan bitki örtüsü veya ekinler ile beslenebilecekleri (Saeed ve ark., 1993; Gao ve ark., 2014; Charlton ve ark., 2015; Houbraken ve ark., 2016; Van der Spiegel, 2016; Poma ve ark., 2017) ya da tükettikleri yemlerin mikotoksin barındırabilecekleri bildirilmiştir. Pestisitler ve mikotoksinler ise, akut ve kronik etkilerinden dolayı sağlığa zararlı olabilirler (Simpanya ve ark, 2000; Braide ve ark., 2011; Musundire ve ark., 2016; Wynants ve ark., 2017; Van der Fels-Klerx ve ark., 2018). Bunun yanı sıra böceklerin, tükettikleri yemlere bağlı olarak anti-besleme faktörleri taşıyabilecekleri de bildirilmiştir. Ayrıca, bazı çalışmalar ile kimi böcek türlerinde anti-besleme faktörlerinden fitat ve tanenler de tespit edilmiştir (Ekop ve ark., 2010; Musundire ve ark., 2014). Bunlara ilave olarak, böceklerin çevresel faktör ve tükettikleri yemler ile birlikte ağır metalleri, patojenik mikroorganizmaları ve parazitleri taşıyabildiklerini belirten çalışmalar da bulunmaktadır (Chai ve ark., 2009; Zhang ve ark., 2009; Banjo ve ark., 2010; Schabel ve ark., 2010; Garofalo ve ark., 2017; Vandeweyer ve ark., 2017). Nyangena ve ark. (2020) ise sözü edilen tüm bu olumsuz etkili olabilecek etmenlerin, böceklerin kızartma, kaynatma, kavurma, kurutma vb. işlemler görmesi ile ortadan kaldırılabileceğini bildirmişlerdir. AB'nin yönetmeliğinde (2021/1372) de "işlenmiş böcek unları" şeklinde ifade edilmektedir.

Yapılan bir araştırmada yemlik olarak kullanılan böcek unlarının (*Tenebrio molitor*), balıkların bağışıklık düzeyine olan etkileri araştırılmıştır. Çalışma sonucunda larva unu ile beslemenin Küçük Avrupa levreklerinde (*Dicentrarchus labrax*) anti-inflamatuvar etkilere sebep koyduğu gözlenmiştir. Bu durum ise; böcek unlarının bağışıklık sistemi üzerindeki etkilerinin, hastalıklara karşı geliştirilmiş bir dirence dönüşme durumunun ortaya konulabilmesi için bakteriyel veya parazitik faktörleri içeren daha fazla araştırmaların gerekliliğine dikkat çekmektedir (Henry ve ark., 2018a).

Etlik piliçlerde yapılan bir çalışmada, hazırlanan bazal yemin üzerine tam yağlı böcek larva unları (*Tenebrio molitor* ve *Zophobas morio*) ilave edilmiştir, araştırmada hayvanların büyüme performansı ile bazı kan ve bağışıklık sistemi parametreleri incelenmiştir. Çalışma sonucunda larva unlarının %0,2 veya %0,3 oranlarında ilavesinin büyüme performansını arttırdığı ve bağışıklık sistemi özelliklerini değiştirdiği sonucuna varılmıştır (Benzertiha ve ark., 2020b). Un Kurdu (*Tenebrio molitor*) ile yapılan başka bir çalışmada ise bağırsak mikrobiyotasındaki *Lactobacillus* ve *Bifidobacterium* bakterilerin canlılığı ve metabolik aktivitesi üzerindeki etkisi incelenmiş, böcek ununun probiyotik bakteri canlılığı ve büyümesi üzerindeki etkileri açısından hiçbir olumsuz etkisinin saptanmadığı ve kısa zincirli yağ asitleri ile laktat üretiminde ise bir artış olduğu tespit edilmiştir (De Carvalho ve ark., 2019).

Beagle köpekleri üzerinde yapılan bir çalışmada %0,1 ve %0,2 düzeyinde diyetlerine Kara asker sineği larvası ilave edilmiştir. Kara asker sineği'nin diyette kullanımının artması ile albümin ve glutatyon peroksidaz (GPx) düzeyleri yükselmiş, tümör nekroz faktörü-α konsantrasyonu ise lineer olarak azalmıştır. Bu çalışma ile böcek proteinlerinin, tek mideli hayvanlarda antioksidan olarak etki gösterme potansiyeline sahip olabileceği bildirilmiştir (Lei ve ark., 2019). Henry ve ark. (2018b)'nın yürüttüğü çalışmada ise, Gökkuşağı alabalığı (*Oncorhynchus mykiss*) diyetlerine %25 ve %50 oranında sarı un kurdu larvalarının (*Tenebrio molitor*) ilave edilmesinin sonucunda, antioksidan bağırsak enzimleri aktivitesinin arttığı ve lipid peroksidasyonunun ise azaldığı tespit edilmiştir. Ayrıca, kanda tripsin inhibisyonunun ve antibakteriyel aktivitenin de hızlı bir şekilde arttığı gözlenmiştir.

Sonuç ve Öneriler

Dünya nüfusunun her geçen yıl artmasının etkisi ile gıda talebinde ve tüketiminde de artış görülmektedir. İnsanların artan tahıl ve bakliyat ihtiyacı sebebiyle, çiftlik hayvanlarının beslenmesinde insan gıdası olarak kullanılan hammaddelerin kullanımlarını azaltmak, sürdürülebilirlik için ön plana çıkmıştır. Bu durum, bilim insanlarını çiftlik hayvanlarının beslenmesi için alternatif yem hammaddeleri arayışına yönlendirmiştir. Yem hammaddesi olarak, çeşitli böcek türlerinin kullanımının sebepleri ve avantajları olarak; Hayvanlar aleminin büyük bir kısmını oluşturmaları, yemden yararlanma oranlarının ve verimliliklerinin yüksek olması, gıda artıklarını değerlendirmeleri ile hem ekonomik hem de ekolojik olarak fayda sağlanması, sınırlı alanlarda fazla miktarlarda üretimlerinin yapılabilmesi, çiftlik hayvanları ile karşılaştırıldığında üretim sürecinin ekoloji üzerindeki etkisinin daha az olması, yüksek miktarda protein, esansiyel aminoasit, esansiyel yağ asitleri içermeleri sayılabilir. Bu nedenlerden dolayı böcek türleri, çiftlik hayvanları için üzerinde durulması gereken bir yem hammaddesi olarak önem kazanmakta ve dikkat çekmektedir. Bunun yanı sıra kanatlı hayvanlar açısından bakıldığında, doğal yaşam ortamlarında böcekleri yediklerini de hayvan refahı ve ihtiyaçları bakımından da göz önünde bulundurmakta fayda bulunmaktadır. Yapılan araştırmalar sonucunda, rasyonlara yem hammaddesi olarak böcek unları veya katkı maddesi olarak böceklerden elde edilen kitin ve AMP ilavelerinin, verim ve immun sistem üzerine olumlu etkileri olduğu ortaya konmuştur. Hayvan yemlerinde büyütme faktörü olarak antibiyotik kullanımının 2006 yılından itibaren yasaklanması ile birlikte gereksinim duyulan bakteriyel rezistansa sebep olmayan, doğal yem katkısı ihtiyacını karşılayabilecekleri düşünülmektedir. Bu sayede hayvanların sağlık ve refahını olumlu yönde etkileyerek, sağlıklı hayvan ve sağlıklı hayvansal gıda elde edilmesi amacına ulaşılmasına yardımcı olabilme potansiyeline sahiptirler. Böceklerin hayvan beslemede kullanımına dair çalışmalar son yıllarda artış göstermiş olmakla birlikte, etki mekanizmalarını ortaya koymaya yönelik daha çok sayıda araştırmaya ihtiyaç duyulmaktadır.

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Economic, Cultural and Environmental Impacts of EXPO`21 HATAY in the Scope of Sustainability

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Abstract

EXPO, which is used as the abbreviation of the word 'exposition', which means 'World Exhibition' or 'World's Fair' in English; It is a global event that has been organized around the world since the 19th century and aims to promote the city and country in which it is held in the national and international arena, raise awareness, educate the public, share innovations, produce, support development and encourage cooperation.

Our country participated in this event for the first time with the 1851 London Expo Organization during the Ottoman Empire Period. It was hosted for the first time with the Expo Organization held in Antalya in 2016, and it is the host country for the second time with the Expo organization held in Hatay on April 1, 2022.

Expo 2021 Hatay, whose full name is 'International Horticulture Fair Hatay, Turkey 2021'; It was accredited as a Class B international Expo by the International Association of Horticultural Producers (AIPH) on January 23, 2017 and registered according to the decision of the AIPH Board of Directors.

Within the scope of this study, the economic, cultural and environmental effects of the EXPO'21 Hatay organization, which is a very important tool for the national branding and development of Hatay, were evaluated, and suggestions were made about the correct reuse of the fairgrounds and their sustainability after the organization was over.

Key Words: *Expo, Turkey, Hatay, Sustainability, Landscape Architecture*

EXPO`21 HATAY'ın Sürdürülebilirlik Kapsamında Ekonomik, Kültürel ve Çevresel Etkileri

Özet

İngilizcede 'Dünya Sergisi' ya da 'Dünya Fuarı' anlamlarına gelen 'exposition' sözcüğünün kısaltılmış şekli olarak kullanılan EXPO; dünya genelinde 19. yüzyıldan bu yana düzenlenen, düzenlendiği kenti ve ülkeyi ulusal ve uluslararası arenada tanıtmayı, farkındalığı arttırmayı, halkı eğitmeyi, yenilikleri paylaşmayı, üretmeyi, kalkınmayı desteklemeyi ve işbirliğini teşvik etmeyi amaçlayan küresel bir etkinliktir.

Bu etkinliğe ülkemiz ilk kez Osmanlı Devleti Döneminde 1851 Londra Expo Organizasyonu ile katılmıştır. 2016 yılında Antalya ilinde düzenlenen Expo Organizasyonu ile ilk kez ev sahipliği yapmış olup, 1 Nisan 2022 tarihinde Hatay da açılışı gerçekleştirilen Expo organizasyonu ile de ikinci kez ev sahibi ülke olarak yer almaktadır.

Tam ismi 'Uluslararası Bahçe Bitkileri Fuarı Hatay, Türkiye 2021' olan, Expo 2021 Hatay; 23 Ocak 2017 tarihinde Uluslararası Bahçe Bitkileri Üreticileri Birliği (International Association of Horticultural Producers / AIPH) tarafından B sınıfı uluslararası Expo olarak akredite edilmiş ve AIPH Yönetim Kurulu kararına göre tescil edilmiştir.

Bu çalışma kapsamında, Hatay' ın ulusal markalaşması ve kalkınması yolunda çok önemli bir araç olan EXPO'21 Hatay organizasyonunun ekonomik, kültürel ve çevresel etkileri değerlendirilmiş olup, organizasyon bittikten sonra da fuar alanlarının doğru bir şekilde yeniden kullanımı ile sürdürülebilir olması konusunda önerilerde bulunulmuştur.

Anahtar Kelimeler: *Expo, Türkiye, Hatay, Sürdürülebilirlik, Peyzaj Mimarlığı*

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Determination and Evaluation of Field Adequacy by Ankara Göksu Park Users

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Abstract
Centrally located, one of the biggest city parks of Ankara, people can easily reach in daily use, walking, jogging, sitting, picnic, play, etc. Göksu Park, which provides opportunities for activities such as, is built on the old Susuz pond in Eryaman. The park was opened in 2003. In this study, a 3-stage method was applied to determine and evaluate the area adequacy of the park. In the first stage, the first picture selection was made with the team of landscape architects in the park, using the nominal group technique, among the photographs taken in the area, obtained from the municipality and received the most likes from social media accounts with many followers. In the second stage, the criteria for the evaluation of field adequacy with the Delphi technique were determined in consultation with the faculty members in the Department of Landscape Architecture, Faculty of Agriculture, Ankara University, who were selected as experts on the subject. Then, using the observation and comparison tables, the survey questions were prepared and after the application of the survey to the visitor group and park staff, as the third step, the survey data was based on whether the difference between the observed frequencies (GF) and expected frequencies (BF) was statistically significant with the help of SPSS 25 statistical program. Chi-square independence analysis, which is a test, and linear regression analysis were performed. By counting the frequencies, the relevant photographs will be examined and the relationship between density and field adequacy has been interpreted. With this study, it will contribute to the plans and designs of new projects so that the green areas and parks that people need due to the increasing population and urbanization can be used adequately in the future..
Key Words: *Göksu Park, Field adequacy, Landscape Architecture, City Park, Ankara*

Ankara Göksu Parkının Kullanan Kişiler Tarafından Alan Yeterliliğinin Tespit Edilmesi ve Değerlendirilmesi

Özet
Merkezi konumda yer alan, Ankara'nın en büyük kent parklarından biri olan, insanların günlük kullanım içinde rahatlıkla ulaşabilecekleri, yürüyüş, koşu, oturma, piknik yapma, oyun vb. gibi aktivitelere olanak sağlayan Göksu Parkı, Eryaman'daki eski Susuz göleti üzerine kuruludur. Park, 2003 yılında hizmete açılmıştır. Bu çalışmada parkın alan yeterliliğinin tespit edilmesi ve değerlendirilmesi için 3 aşamalı bir yöntem uygulanmıştır. Birinci aşama, alanda çekilen, belediyeden temin edilen ve çok takipçili sosyal medya hesaplarından en çok beğeni almış fotoğraflar arasından nominal grup tekniği ile parkta bulunan peyzaj mimarları ekibi ile ilk resim seçimi yapılmıştır. İkinci aşama da Delphi tekniği ile alan yeterliliğinin değerlendirilmesindeki kriterlerin konunun uzmanı olarak seçilen Ankara Üniversitesi Ziraat Fakültesi Peyzaj Mimarlığı bölümündeki öğretim üyelerine danışılarak belirlenmiştir. Daha sonra gözlem ve karşılaştırma tabloları kullanılarak, anket soruları hazırlanmış ve anketin ziyaretçi grup ve park çalışanlarına uygulanmasının ardından üçüncü aşama olarak anket verilerinin SPSS 25 istatistik program yardımıyla gözlenen frekanslar (GF) ile beklenen frekanslar (BF) arasındaki farkın istatistiksel olarak anlamlı olup olmadığı temeline dayanan bir test olan Ki-kare bağımsızlık analizi, doğrusal regresyon analizi yapılmıştır. Frekansların sayımı yapılarak ilgili fotoğraflar incelenecek ve yoğunluk ile alan yeterliliği arasındaki ilişki yorumlanmıştır. Yapılan bu çalışma ile artan nüfusa ve kentleşmeye bağlı olarak insanların ihtiyaç duyduğu yeşil alanlar ve parkların gelecekte de yeterli şekilde kullanılabilmesi için yeni projelerin plan ve tasarımlarına katkı sağlanacaktır.
Anahtar Kelimeler: *Göksu Park, Alan yeterliliği, Peyzaj Mimarlığı, Kent Parkı, Ankara*

ID: 449

Research on Measuring the Healthy Nutrition Knowledge Levels of Gastronomy Students

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Abstract
This study was planned and carried out in order to determine the extent of healthy nutrition knowledge of the students of the Gastronomy Department and to make suggestions in terms of Gastronomy education
A total of 196 students from each class of Gastronomy Departments of Universities in Istanbul participated in the research using the Google Form. In addition to the demographic characteristics, nutritional habits, weight and height measurements which has been stated by participants and "YETBİD scale, which is a healthy nutrition knowledge level scale developed for adults has been included in the questionnaire. The data collected during the research were recorded in the IBM SPSS Statistics 25.0 program for analysis, and appropriate statistical analyzes were made accordingly. In the research, 38.8% of the participants were male, and 61.1% were female. 86.7% of the participants stated that they had received education in healthy nutrition, and it was detected that 50.0% of them received this education within the scope of the course in the curriculum of the department. Body Mass Indexes calculated from the height and weight values stated by the participants were determined as 25.3±4.74 and 23.1±4.35 kg/m2 for men and women, respectively (p=0.000). Male and female individuals got 52.2±7.00 and 53.6±7.18 points out of 80 full points, which is the YETBİD scale Basic Nutrition Score (p>0.05), It was also found that they scored an average of 38.5±6.23 points out of 48 full points on YETBID scale of Food Preference score. There is no significant difference between the mean scores of Basic Nutrition and Food Preferences and their marital status, class of education, place of residence (p>0.05). The average food preference score of individuals who received healthy nutrition education was higher than the average score of individuals who did not receive nutrition education (p=0.009). In line with the data obtained from this research, it has been determined that the students studying in the Gastronomy departments, including the grades when they have the education, mostly have a moderate level of healthy nutrition knowledge. Considering how the awareness and practice of healthy nutrition marks the significance for the graduates who will continue this profession in the future, it has been understood that it is extremely important to include both theoretical and practical courses such as "Healthy Nutrition, Nutrition Principles and Applications" in the curricula of Gastronomy Departments.
Keywords*: Gastronomy, Healthy nutrition, YETBİD, Body Mass Index, Nutrition Preference*

Gastronomi Öğrencilerinin Sağlıklı Beslenme Bilgi Düzeylerinin Araştırılması

Özet
Bu çalışma Gastronomi Bölümü Öğrencilerinin sağlıklı beslenme bilgi düzeylerini saptamak ve Gastronomi eğitimi açısından bu konuda öneriler getirmek amacıyla planlanmış ve yürütülmüştür. Araştırmaya İstanbul'da bulunan Üniversitelerin Gastronomi Bölümlerinin her sınıfından toplam 196 öğrenci Google Form ile katılmıştır. Araştırmada kullanılan soru formu katılımcıların demografik özellikleri, beslenme alışkanlıkları, beyana dayalı ağırlık ve boy ölçümlerinin yanı sıra, yetişkinler için geliştirilmiş sağlıklı beslenme bilgi düzeyi ölçeği olan "YETBİD" ölçeği uygulanmıştır. Araştırma sırasında toplanan veriler IBM SPSS Statistics 22 programına analizi yapılması için kaydedilmiş, uygun istatistiksel analizleri yapılmıştır. Araştırmada katılımcıların %38,8'inin erkek, %61,1'inin kadındır. Bunların %86,7 gibi bir çoğunluğu sağlıklı beslenme eğitimi aldığını belirtmiş, bunların da %42,3 kadarının bu eğitimi, bölüm müfredatında bulunan ders kapsamında aldıkları saptanmıştır. Katılımcıların beyana dayalı olarak belirttikleri boy ve ağırlık değerlerinden hesaplanan Beden Kütle İndeksleri erkek ve kadınlarda sırasıyla 25,3±4,74 ve 23,1±4,35 kg/m^2 olarak belirlenmiştir (p=0,000). Erkek ve kadın bireylerin, YETBİD ölçeği Temel Beslenme Puanı olan 80 tam puan üzerinden 52,2±7,00 ve 53,6±7,18 puan aldıkları (p>0,05) tespit edilmiş olup, YETBİD ölçeği Besin Tercihi Puanı olan 48 tam puan üzerinden de ortalama 38,5±6,23 puan aldıkları bulunmuştur. Bu puanlar puan sınıflamasında çoğunlukla orta düzeydedir. Temel Beslenme ve Besin Tercihi puan ortalamaları ile, medeni durum, öğrenim görülen sınıf ve yaşanılan yere göre anlamlı bir farklılık yoktur (p>0,05). Sağlıklı beslenme eğitimi alan bireylerin besin tercihi puan ortalaması, beslenme eğitimi almayan bireylerin puan ortalamasına göre daha yüksektir (p=0,009). Bu araştırmadan elde edilen veriler doğrultusunda eğitim görülen sınıf da dahil, Gastronomi bölümlerinde eğitim gören öğrencilerin çoğunlukla orta düzeyde bir sağlıklı beslenme bilgisine sahip olduğu, sağlıklı beslenme bilinci ve uygulamasının, ileride bu mesleği sürdürecek mezunlar için ne denli önemli olduğu düşünüldüğünde, Gastronomi Bölümlerinin müfredatlarında "Sağlıklı Beslenme, Beslenme İlkeleri ve Uygulamaları" gibi teorik ve pratik derslerin yer almasının son derece önemli olduğu anlaşılmıştır.
Anahtar Kelimeler: *Gastronomi, Sağlıklı beslenme, YETBİD, Beden kütle İndeksi, Besin tercihi*

Giriş

Gastronomi eğitimi birçok bilim dalı ile multidisipliner bir ilişki içerisindedir (Bodur 2015). Günümüzde Gastronomi bilimi ile besin, sağlıklı beslenme/sağlıklı mutfak uygulamaları önem kazanmıştır. Bu önem toplum sağlığı açısından sağlıklı beslenmenin son derece temel faktör olmasından da kaynaklanmaktadır. Günümüzde tüketiciler de yedikleri yiyecek ve içeceklerde doyuruculuk, lezzet ve görünümün yanı sıra sağlıklı ve güvenilir olmasına da önem vermektedirler (Bilici 2008, Baysal 2011, Whang 2016, Sezen 2018, Samancı 2020).

Sağlıklı beslenme, sağlıklı çevre ve sürdürülebilir uygulamalar kapsamında ABD'de Boston'da 1990 yılında restoranlara bu açıdan sertifikasyon programları düzenlemek amacıyla "Green Restaurant Association" adında bir birlik/organizasyon/dernek kurulmuştur (Gruia et al 2018).

Geleceğin yetişkinleri olacak olan üniversite gençlerinin sağlıklı beslenme bilincini ve beslenme alışkanlıklarını araştıran çalışmalarda, gençlerin çoğunlukla sağlıklı beslenme bilgisi ve alışkanlıklar yönünden yetersiz oldukları ileri sürülmüştür. Bu durum toplum sağlığı açısından önemli olduğu kadar, geleceğin şefleri konumunda olacak olan gastronomi alanında yetişen üniversite öğrencileri açısından çok daha önem arz etmektedir. Zira günümüzde Gastronomi alanında "sağlıklı mutfak, sağlıklı beslenme" eğilimi giderek ön plana çıkmaktadır (Tomas 2021).

Üniversite öğrencilerinde sağlıklı beslenme bilgisi ve alışkanlıkları üzerine yapılmış birçok araştırma olmasına rağmen, geleceğin şefleri konumunda olacak olan Gastronomi öğrencileri ile ilgili bir çalışmaya rastlanmamıştır. Buradan yola çıkarak ve "Gastronomi Öğrencilerinin Sağlıklı Beslenme Bilgi Düzeylerinin Araştırılması" üzerine çalışma yapma ihtiyacını da göz önünde bulundurarak, bu araştırma planlanmış ve yürütülmüştür

Materyal ve Yöntem

Bu araştırma üniversitelerin Gastronomi Bölümü öğrencilerinin sağlıklı beslenme bilgi düzeylerini belirlemek amacıyla yapılmış, nitel bir çalışmadır.

Araştırmanın evrenini araştırma olanağı bulunan, farklı üniversitelerin Gastronomi bölümünde 2021-2022 eğitim öğretim döneminde eğitim gören öğrenciler oluşturmuştur. Örneklem büyüklüğü Power Analiziyle 192 olarak saptanmış olup, toplam 196 öğrencide araştırma tamamlanmıştır. Örneklem büyüklüğü hesabında lisanslı MedCalc istatistik paket programı 2021 yılı sürümü kullanılmıştır. Katılımın gönüllülük esasına göre yapılmasına özen gösterilmiştir.

Veri toplama aracı olarak 2 bölümden oluşan anket uygulanmıştır. Anket formu ve ölçek katılımcılara Covit-19 pandemi sürecinin halen devam ediyor olması ve yüz yüze görüşme olanaklarının sınırlı olması nedeniyle internet ortamında, daha önce oluşturulan Google Form aracılığı ile uygulanmıştır Anketin ilk bölümünde araştırma kapsamına alınan bireylerin, demografik özellikleri, sigara, alkol alışkanlıkları, yaşadıkları yer, antropometrik ölçümleri (boy/cm, kilo/kg.) ve beslenme düzenleri sorgulanmıştır.

Beyana dayalı olarak öğrencilerden alınan boy (cm), ve ağırlık (kg.) verilerinden yararlanılarak, bireyin beslenme durumunun pratikte kolay saptanma yollarından birisi olan "Beden Kütle İndeksleri "(BKİ) hesaplanmıştır. Kilogram cinsinden ölçülen beden ağırlığının santimetre cin sinden ölçülen boyun karesine bölünmesi ile elde edilen BKİ'nin 18,5-24,9 arasında olması normal iken; 25-29,9 arası kilolu, 30 ve üstündeki değerler ise obez olarak kabul edilmiştir (WHO 2001).

Anketin ikinci bölümü öğrencilerin beslenme bilgi düzeylerini ölçen ve kısaca "YETBİD" ölçeği adı verilen "Yetişkinler İçin Beslenme Bilgi Düzeyi" ölçeğinden oluşmuştur. Öğrencilerin sağlıklı beslenme konusundaki bilgi düzeylerini ölçmek amacıyla kullanılan bu ölçek, Batmaz (2018) tarafından geliştirilmiş ve geçerlik güvenirlik çalışması yapılmış bir ölçektir. Bu ölçek "Temel Beslenme Besin Sağlığı" başlığı altında "20" ve "Besin Tercihi" başlığı altında 12 olmak üzere toplam "32" sorunun yanı sıra, 2 adet de değerlendirme sorusundan oluşmaktadır.

Kullanılan ölçekten alınan puanlar "Tablo 1" deki ölçütlere göre değerlendirilmiştir (Batmaz 2018)

Elde edilen veriler, IBM Statistical Package for the Social Sciences (SPSS) 22 sürüm programının veri tabanına aktarılmıştır. Anketlerden elde edilen sürekli değişkenler ortalama ($\bar{x}$), standart sapma (SD), alt-üst ile kesikli değişkenler sayı (n) ve yüzde (%) olarak ifade edilmiştir. Verilerin normal dağılıma uygunluğu Kolmogorov-Smirnov testi ile analiz edilmiştir. Kategorik değişkenlerde gruplar arasındaki ilişkinin analizi "ki kare testi", normal dağılıma uygun olmayan verilerde iki grup arasındaki anlamlılığın analizi için "Mann Whitney U" testi, ikiden fazla grup arasındaki anlamlılığın analizi için "Kruskal Wallis" testi" kullanılmıştır. Sayısal ölçümlerin arasındaki ilişkinin analizi için normal dağılıma uygun olan verilerde "Pearson Correlation" testi" kullanılmıştır. Testlerde istatistiksel anlamlılık düzeyi olarak $p<0,05$ alınmıştır.

Bulgular ve Tartışma

Gastronomi ve Mutfak Sanatları lisans öğrencilerinin, sağlıklı beslenme bilgi düzeylerinin belirlemesi amacıyla planlanan çalışmanın verileri, analiz edilmiş ve bu bölümdeki tablolarda sunulmuştur.

Tablo 1. Katılımcıların Cinsiyete Göre Demografik Özellikleri (n:196)

	Erkek		Kadın		Toplam		p
	N (76)	**%** 38,8	**N** (120)	**%** 61,2	**N** (196)	**%** (100)	
Medeni durum							
Evli	2	2,6	7	5,8	9	4,6	0,487+
Bekar	74	97,4	113	94,2	187	95,4	
Öğrenim gördüğü sınıf							
1.sınıf	24	31,6	55	45,8	79	40,3	0,174•
2.sınıf	21	27,6	28	23,4	49	25,0	
3.sınıf	14	18,4	21	17,5	35	17,9	
4.sınıf	17	22,4	16	13,3	33	16,8	
Yaşanılan yer							
Evde aile	34	44,7	58	48,3	92	46,9	**0,026•**
Evde arkadaşıyla	8	10,5	11	9,2	19	9,7	
Evde yalnız	18	23,7	11	9,2	29	14,8	
Yurtta	16	21,1	40	33,3	56	28,6	
Toplam	**76**	**100**	**120**	**100**	**196**	**100**	
Yaş (yıl)	$\bar{x}$±SS		$\bar{x}$±SS		$\bar{x}$±SS		
	22,6±6,58		22,3±5,73		22,4±6,05		0,268**

**Mann Whitney U Testi , +Fisher's Exact Testi, •Ki Kare Testi

Tablo 2. Beslenme bilgi düzeyi ölçeğinin değerlendirilme ölçütleri

Puan Aralığı	Sınıflandırma
Temel Beslenme (toplam puan 80)	
<45	Kötü Orta
45-55	İyi
56-65	Çok iyi
>65	
Besin Tercihi (toplam puan 48)	
<30	Kötü Orta
30-36	İyi
37-42	Çok iyi
>42	

(Batmaz 2018)

Tablo 1'de görüldüğü gibi, çalışmaya katılan katılımcıların %38,8'i erkek, %61,2'i kadındır ve yaş ortalamaları sırasıyla 22,6±6,58 ve 22,3±5,73'dir; çoğunluğunu kadın öğrenciler ile 1. sınıf öğrencileri (%40,3) oluşturmuştur. Öğrencilerin sınıflara ve cinsiyete göre dağılımları arasında istatistiksel olarak anlamlı bir fark bulunamamıştır ($p>0.05$). Evde yalnız ve arkadaşıyla yaşama oranı erkeklerde daha yüksek orandadır ($p<0.05$).
Birinci sınıftan dördüncü sınıfa kadar üniversite öğrencileri üzerinde yapılan diğer çalışmalarda da, öğrencilerin yaş ortalamaları bizim çalışmamızla benzerlik göstermektedir (Tütüncü ve Karaismailoğlu 2013, Erçim 2014, Ülker 2021).
Güldiken ve Özekicioğlu (2004), öğrencilerin barınma yerleri ve sorunları konusunda yaptıkları bir çalışmada, kiralık evde barınan öğrencilerin, kiraların yüksek olması, evde kalan öğrenci sayısının 3'ten fazla olması nedeniyle yeterince ders çalışma imkânlarının olmadığını; devlet yurtlarında kalan öğrencilerin de temizlik, TV izleyememe, ders çalışamama ve giriş-çıkış saatleri gibi bazı sorunlarının olduğunu saptamışlardır. Bizim çalışmamızda aile yanında yaşayanların oranının kadın öğrencilerde erkeklere göre daha fazla olması ($p<0.05$), erkek öğrencilerin de çok yüksek olmamakla birlikte, yaklaşık dörtte birinin evde yalnız yaşıyor olması, üniversite öğrencilerinin barınmadan kaynaklanabilecek olası sorunları yaşamamaları açısından olumludur.

Tablo 2'de, katılımcıların cinsiyete göre sağlıklı besleneme eğitimi ile ilgili bilgilerinin dağılımı gösterilmiştir. Öğrencilerin %86,7'sinin sağlıklı beslenme eğitimi aldığı, bu eğitimin de bireylerin çoğunluğunca (%42,3) konu ile ilgili ders kapsamında olduğunun belirtildiği görülmektedir.
Kadınlarda daha yüksek oranda olmak üzere bireylerin %69,9'u;, temel beslenme eğitimi almak istediklerini belirtmişlerdir ($p<0.05$).

Tablo 2. Katılımcıların Cinsiyete Göre Sağlıklı Beslenme Eğitimi ile İlgili Bilgileri

	Erkek		Kadın		Toplam		p
	n (76)	% 38,8	n (120)	% 61,2	n (196)	% (100)	
Sağlıklı beslenme ile ilgili bilgi alma durumu							
Evet	66	86,8	104	86,7	170	86,7	0,972*
Hayır	10	13,2	16	13,3	26	13,3	
Sağlıklı beslenme bilgisinin edinildiği yer							
Konuyla ilgili ders kapsamında	38	50,0	45	37,5	83	42,3	0,182*
Diyetisyenden	11	14,5	24	20,0	35	17,9	
Diğer sağlık personelinden	4	5,3	3	2,5	7	3,6	
Basın yayın organlarından	6	7,9	20	16,7	26	13,3	
Sosyal medya	7	9,2	12	10,0	19	9,7	
Temel beslenme dersi almayı isteme durumu							
Evet	44	57,9	93	77,5	137	69,9	**0,004+**
Hayır	32	42,1	27	22,5	59	30,1	
Toplam	**76**	**100**	**120**	**100**	**196**	**100**	

*Ki Kare Testi

Sağlıksız beslenme alışkanlığının temelini, genellikle kişilerin yetersiz beslenme bilgisine sahip olunması oluşturmaktadır. Yeterli besin ve ekonomik olanaklar olsa bile, beslenme bilgisi yetersizliği bireyin yanlış beslenme alışkanlıklarına sahip olmasına neden olmaktadır (Şanlıer, Konaklıoğlu, ve Güçer, 2009). Bireyde beslenme bilgisinin yetersiz olması, onda yanlış beslenme tutum ve davranışlarına yol açmakta, bu alışkanlıkların giderek yerleşmesi de bu yanlış alışkanlıkların düzeltilmesi olasılığını da azaltmaktadır (Çekal, 2008).
Çalışmamızda öğrencilerin beslenme konusunda, çoğunlukla bilgi sahibi olduklarını belirtmeleri olumlu bir bulgudur. Buna rağmen, bu bilginin ancak yarıya yakınının gördükleri ders kapsamında öğrenildiğinin belirtilmesi, yiyecek içecekle ilgili bir bilim dalı olan Gastronomi Bilim alanında eğitim gören öğrencilerde, bu oranın daha yüksek oranda olması beklenen ve istenen bir durum olması açısından önemlidir.

Tablo 3' te katılımcıların BKİ sınıflamasına göre dağılımları verilmiştir.

Tablo 3. Katılımcıların BKİ sınıflamasına göre dağılımı

	Erkek		Kadın		Toplam		p*
	n	%	n	%	n	%	
BKİ sınıflandırması							
Zayıf (< 18,5 9 kg/m^2)	4	5,3	12	10,0	16	8,2	**0,019**
Normal (18,5-24,9 kg/m^2)	36	47,4	77	64,2	113	57,7	
Hafif Şişman (24,9-29,9 kg/m^2)	23	30,3	19	15,8	42	21,4	
Obez (≥30 kg/m)	13	17,1	12	10,0	25	12,8	

*Ki kare testi

Tablodan da görüldüğü gibi, araştırmaya katılan bireylerin %57,7'si normal (E: %47,4, K: %64,2) BKİ sınıfında yer almaktadır. Hafif şişman ve obez erkeklerin oranı sırasıyla; %30,3 ve %17,1 olarak belirlenmiştir. Kadınlarda ise bu oranlar sırasıyla; %15,8 ve %10,0 olarak saptanmıştır. Cinsiyet ve BKİ sınıflaması arasında istatistiksel olarak anlamlı bir fark olduğu saptanmıştır ($p<0.05$).
Pamukkale Üniversitesi öğrencileri üzerinde yapılan bir çalışmada, BKİ sınıflandırmalarına göre öğrencilerin; normal ağırlık sınıflamasında olanların %71,8 olarak, bizim çalışmamızdakinden daha yüksek bulunmuştur (Ülker 2021). Bu sonuç yiyecek içecekle ilgili bir bölüm olan Gastronomi Bölümlerinde eğitim gören öğrencilerin beden ağırlığı ile ilgili farkındalıklarının daha yüksek düzeyde olması gerektiğini düşündürmektedir.
TBSA 2017 verilerinde (TBSA 2019) ve ülkemizde gerçekleştirilen diğer ulusal çalışmalarda ise, obezite sınıflamasında bizim çalışmamızdan daha yüksek oranlarda BKİ değerleri ve şişmanlık görülürken, bizim çalışmamızın aksine kadınlarda şişmanlık oranının erkeklere göre daha yüksek oranda olduğu saptanmıştır (Dinççağ ve ark., 2017, TBSA 2019).
Bu durum, gastronomi öğrencilerinin vücut ağırlığı yönünden farkındalıklarının, toplumun diğer kesimlerinden daha yüksek düzeyde olduğunu göstermektedir. Tablo 4' te cinsiyete göre öğrencilerin YETBİD ölçeğinden aldıkları puan sınıflamasına göre dağılımları görülmektedir.

Tablo 4. Katılımcıların Cinsiyete Göre YETBİD Ölçeğinden Aldıkları Toplam Puan Sınıflaması

	Erkek		Kadın		Toplam		p
	n (76)	% 38,8	n 120	% (61,2)	n 196	% 100	
Temel Beslenme (toplam puan 80)							
Kötü (<45 puan)	7	9,2	12	10,0	19	9,7	0,111*
Orta (45-55 puan)	50	65,8	59	49,2	109	55,6	
İyi (56-65 puan)	17	22,4	41	34,2	58	29,6	
Çok iyi (>65 puan)	2	2,6	8	6,7	10	5,1	
Besin Tercihi (toplam puan 48)							
Kötü (<30 puan)	5	6,6	8	6,7	13	6,6	0,464*
Orta (30-36 puan)	26	34,2	30	25,0	56	28,6	
İyi (37-42 puan)	22	28,9	46	38,3	68	34,7	
Çok iyi (>42 puan)	23	30,3	36	30,0	59	30,1	

*Ki kare testi

YETBİD ölçeği Temel Beslenme puan sınıflaması kötü, orta, iyi ve çok iyi olan bireylerin oranı sırasıyla; %9,7, %55,6 %29,6 ve %5,1 olarak belirlenmiştir. Cinsiyet ve Temel Beslenme puan sınıflaması arasında anlamlı bir fark saptanmamıştır (p>0,05).

Katılımcıların, Besin tercihi puanı; kötü, orta, iyi ve çok iyi olan bireylerin oranı sırasıyla; %6,6, %28,6, %34,7 ve %30,1 olarak belirlenmiştir. Cinsiyet ve Temel Beslenme puanları sınıflaması ile, Besin Tercihi puan sınıflaması arasında anlamlı bir fark bulunamamıştır (p>0,05). Gastronomi öğrencilerinden her iki cinste de YETBİD puanları, puan sınıflaması açısından orta düzeyde bulunmuştur.

Pamukkale Üniversitesinin çeşitli bölümlerinden öğrencilerin dahil edildiği bir çalışmada, bizim çalışmamızda uygulamış olduğumuz YETBİD testi öğrencilere uygulanmış, temel beslenme bölümünde kadın ve erkek öğrencilerin bilgi seviyeleri arasında anlamlı bir fark bulunmazken (p=0,085); besin tercihi bölümünde anlamlı fark olduğu (p=0,002) saptanmış, kadın öğrencilerin bilgi düzeylerinin erkek öğrencilerinkinden daha yüksek olduğu belirlenmiştir (Ülker 2021). Ülker'in yaptığı bu çalışmada YETBİD puanlarının her iki cinste de düzeyinin, bizim çalışmamızdan daha yüksek olması, yiyecek içecekle ilgili eğitim alan gastronomi öğrencileri açısından düşündürücüdür.

Katılımcıların demografik özelliklerine göre YETBİD ölçeği toplam puan ortalaması Tablo 5' te verilmiştir.

Tablo 5. Katılımcıların Demografik Özelliklerine Göre YETBİD Ölçeği Toplam Puan (80) Ortalaması

		Temel Beslenme (80 puan)	Besin Tercihi (48 puan)
	n	$\bar{x} \pm S$	$\bar{x} \pm S$
Medeni durum			
Evli	9	56,4±3,68	37,7±10,38
Bekar	187	52,9±7,21	38,5±6,00
p*		0,080	0,686
Öğrenim gördüğü sınıf			
1.sınıf	79	52,7±6,54	37,8±5,60
2.sınıf	49	53,2±7,33	38,7±6,69
3.sınıf	35	52,5±7,83	37,8±6,34
4.sınıf	33	54,2±7,55	40,4±6,67
p+		0,701	0,090
Yaşanılan yer			
Evde aile	92	53,0±7,35	38,6±6,40
Evde arkadaşıyla	19	54,4±6,54	39,6±4,41
Evde yalnız	29	51,7±8,32	37,2±7,19
Yurtta	56	53,3±6,28	38,5±5,98
p+		0,477	0,138

*Man Whitney U Testi, +Kruskal-Wallis Testi

Tablodan da görüleceği gibi, Temel Beslenme ve Besin Tercihi puan ortalamalarının, medeni durum, öğrenim görülen sınıf ve yaşanılan yer arasında anlamlı bir fark bulunamamıştır (p>0,05). Buna karşın Tablo 6 da görüldüğü gibi, sağlıklı beslenme eğitimi aldığını belirten bireylerin "Besin Tercihi" puan ortalamasının, beslenme eğitimi almayan bireylerin puan ortalamasına göre daha yüksek olduğu saptanmıştır (p<0.05).

Tablo 6. Katılımcıların Beslenme Eğitimi Alma Durumlarına Göre YETBİD Ölçeği Toplam Puan (80) Ortalaması

		Temel Beslenme (80 puan)	Besin Tercihi (48 puan)
	n	$\bar{x} \pm S$	$\bar{x} \pm S$
Sağlıklı beslenme ile ilgili bilgi alma durumu			
Evet	170	53,4±6,85	38,9±5,94
Hayır	26	50,5±8,43	35,2±7,12
p*		0,068	**0,009**
Sağlıklı beslenme bilgisinin edinildiği yer			
Konuyla ilgili ders kapsamında	83	53,1±7,57	39,2±5,97
Diyetisyenden	35	53,4±5,44	39,0±7,11
Diğer sağlık personelinden	7	56,1±8,57	39,9±5,81
Basın yayın organlarından	26	53,4±6,74	37,4±5,26
Sosyal medya	19	54,1±5,63	39,8±4,34
p+		0,856	0,468

*Man Whitney U Testi, +Kruskal-Wallis Testi

Bizim çalışmamıza benzer şekilde beslenme bilgi düzeyi ile çeşitli değişkenler arasındaki ilişkinin incelendiği, Tütüncü ve Karaismailoğlu'nun (2013) Sağlık Yüksek Okulu Öğrencilerinde yaptığı bir çalışmada, öğrencilerin cinsiyet, sınıf, beden kütle indeksi durumuna göre beslenme bilgi puanları arasında farklılık olmadığı bulunmuştur (p> 0.05). Beslenme eğitimi alma durumunun, beslenme bilgi puanını olumlu yönde etkilediğini gösteren çalışmalar bizim çalışmamızın sonuçlarını destekler niteliktedir. (Şimşek 1991, Karayormuk 2002, Güler 2003, Erten 2006, Miller et al. 2015, Koldaş 2017). Nitekim Kızıltan (2000) bu konuda, beslenme eğitimi alan öğrencilerle almayanlar arasındaki farkı gösteren bir çalışma yapmıştır. Üniversite öğrencilerinin beslenme bilgi düzeyi ve beslenme eğitiminin, beslenme durumuna etkisini inceleyen bu çalışmada, BKI'lerine göre beslenme eğitimi öncesi ve sonrası kız öğrencilerin %24.3'ünün zayıf, erkeklerin ise %14.3'ünün şişman olduklarını saptamıştır. Bu çalışmada, sağlıklı beslenme eğitimi sonrasında, şişman kız ve erkek öğrencilerin BKI değerlerinde önemli bir azalma olmasının, konu ile ilgili verilen eğitimin ne denli etkili olduğunu göstermesi açısından önemli bir sonuç olarak ileri sürülmüştür.

Çalışmamızdan ortaya çıkan veriler doğrultusunda, özellikle eğitim alanı yiyecek içecekle ilgili bir alan olan; yiyecek ve içecekle, dolayısıyla iyi yemek yeme kavramını odak noktası alan Gastronomi Bölümlerinde öğrenim gören gastronomi öğrencilerinin, sağlıklı beslenme bilgi ve beceri düzeylerinin daha üst düzeye çıkarılması gerekmektedir. Bunun için müfredatlara temel beslenme, Beslenme İlkeleri vb. derslerin her sınıfta zorunlu ve/veya seçmeli derler olarak eklenmesi, gastronomi mezunlarının, hem topluma bu yönden hizmet verecek meslek mensupları olmaları, hem de topluma rol model olmaları açısından ayrı bir önem taşımaktadır.

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ID:451

The Effect of Egg Weight and Hatching System on Hatch time, Hatchability and Gosling Quality Traits in Turkish Geese

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Abstract

This study was performed to determine the effect of egg weight (heavy and light) and hatching system (house and hatcher) on hatch time, hatchability and some gosling quality traits. A total of 389 eggs (fertile of candling) from 2-year-old Turkish Native Goose were used in the study. Before the incubation process, all eggs were individually numbered and weighed. Eggs were divided into light (<160 g) and heavy (≥160 g) eggs according to average weight (160 g), and these eggs were placed in similar numbers in two hatching system. Pip time was delayed for about 7 h and 5 h in heavy and house eggs compared to light and hatcher, respectively. With regard to hatch time, it was calculated approximately 12 h and 8 h delay for the eggs in the heavy and house compared to the light and hatcher, respectively. Weight and length of goslings that hatched from heavy eggs were higher than those that hatched from light eggs. The activity and navel score of goslings in the house and hatcher systems were 3.38, 5.59 and 9.54, 11.06, respectively, at 32 d. The study results showed that the pip and hatch-time was delayed in heavy and house system eggs. It has been determined that the goslings hatched from heavy eggs were heavier and longer. House hatching system also negatively affected the activity and navel score of goslings.

Key Words: *Egg weight, Gosling quality, Hatchability, Hatching system, Pip time*

Türk Kazlarında Yumurta Ağırlığı ve Çıkım Sisteminin Çıkış Zamanı, Kuluçka Randımanı ve Palaz Kalite Özellikleri Üzerine Etkisi

Özet

Bu çalışma, yumurta ağırlığı (ağır-hafif) ve çıkım sisteminin (çıkım makinesi-kümes) çıkış zamanı, kuluçka randımanı ve bazı palaz kalite özellikleri üzerine etkilerini belirlemek amacıyla yürütülmüştür. İki yaşlı Yerli Türk kazlarından elde edilen toplam 389 yumurta (lamba döllülüğü) kullanılmıştır. Kuluçka öncesinde tüm yumurtalar bireysel olarak numaralandırılıp tartılmıştır. Ortalama yumurta ağırlığına göre (160 g) yumurtalar hafif (<160 g) ve ağır (≥160 g) olmak üzere iki gruba ayrılmıştır ve çıkım dönemi benzer sayıda yumurtalar iki çıkım sistemine bölünmüştür. Pip zamanı ağır yumurta ve kümes çıkımında hafif ve makine çıkımına göre sırasıyla 7 ve 5 saat gecikmiştir. Çıkış zamanı da benzer şekilde 12 ve 8 saat gecikmiştir. Ağır yumurtalardan çıkan palazların ağırlık ve uzunlukları hafif yumurtalardan çıkanlara kıyasla daha yüksek bulunmuştur. Kuluçka bitiminde (32. gün) palazların aktivite ve göbek skorları kümes ve makine çıkım sistemlerinde sırasıyla 3.38, 5.59 ve 9.54, 11.06 olarak hesaplanmıştır. Çalışma sonuçlarına göre ağır yumurta ve kümes çıkım sisteminde pip ve çıkış zamanı gecikmiştir. Ağır yumuralardan daha ağır ve uzun palazlar elde edilmiş ve ayrıca kümes çıkım sistemi palaz kalite özelliklerini (aktivite ve göbek skoru) olumsuz etkilemiştir.

Anahtar Kelimeler: *Yumurta Ağırlığı, Palaz Kalite, Kuluçka Randımanı, Çıkım Sistemi, Pip Zamanı*

ID:453

Ukraine – Russian Conflict Creates a Series Food (Grain) Security Threat for Turkish Agriculture/Economy and Vulnerability Evaluations on Innovated Per Adult Human Unit Method (PAHUM) vs. Per Capita

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Abstract

There's no doubt that the war in Ukraine is having a tremendous toll on civilians. Since 24th of February, after Russia's horrific invasion of Ukraine, we're seeing the acute impact on food insecurity for Ukrainians as they are forced to hide or flee their homes. And the emerging signs of the impacts on global food insecurity are becoming more evident. Take wheat, for example: Russia is the world's largest wheat exporter; together, according to U.N Food and Agriculture Organization Ukraine and Russia account for 14 percent of the global supply of wheat. Turkey imports more than one-third of its grain from those two nations. And that the grain poor nations (Middle East and North African countries) are seeing its worst food crisis in the past decade and millions of people are going hungry. In addition to devastating short-term increases in hunger, the long-term impacts of the war on food security and the global food supply are echoing around the globe. Most of the economists and politicians indicate that global prices, already on the rise, are only going to continue to spike as the war interrupts planting and harvesting seasons, affects access to fuels and ports, and reduces labour availability especially in Ukraine and to some extend in Russia. Russia's attacks on Ukraine the high wheat trade volume with these two countries are shown as the main reason for this problem. While Turkey meets 78% of its wheat import from Russia and Ukraine, the war between the two countries causes a crisis not only in wheat market also in barley that is used as livestock feed and for the brewery sector. As a matter of fact, wheat prices saw the highest level since 2012, when Russia started to invade Ukraine. We suggest evaluations of major foodstuff (cereal, oil and other foodstuffs) made on innovated Per Adult Human Unit Method PAHUM = Age and gender corrected PC^{agc} (Copyright©1989 – Hasimoglu-USA) instead of error bound PC will be more realistic because the PAHUM considers the age and gender differences of the target populations, but the PC used as a UNIT does not.

Key words: *Grain, cereal, Per Adult Human Unit Method, Per Capita, Food consumption*

ID:454

Opportunity Cost and Hindrances to Climate Adaptation among Cassava Farmers in Southwest, Nigeria: A Panacea for Food Security

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Abstract

This study analyses adaptation to climate change among cassava farmers in Southwest Nigeria. The primary data used for this study were collected through a well-structured questionnaire and Focus Group Discussion sessions (FGDs). The analytical tools used were descriptive statistics, paired samples test and exponential multiple regression. The results showed that majority (72%) of the sampled respondents claimed that temperature has been on increase over the years with 57%, 80% and 80% of the sampled respondents from Ondo, Ogun and Oyo States, respectively. Results also showed that about 56% of them perceived that rainfall has been decreasing over the years with about 63% and 69% of the sampled respondents from Ondo and Ogun States respectively. About 55% of the respondents in Oyo State perceived that rainfall has been increasing over the years. Analysis also revealed that majority (55%) of the sampled cassava farmers employed: Planting Different Varieties and Use of Agrochemicals as their main adaptation strategies. The results revealed that inadequate funds and shortage of labour were the major constraints to adaption in the study area. The results of opportunity cost on net revenue and costs using paired samples test revealed that cassava farmers derived and perceived utility and the net benefit from using adaptation measures than when it is not used. The result of exponential multiple regression showed age, experience, family size, farm size and temperature were the main determinants of net revenue in the area. The study, therefore, suggests the costs of adaptation resources should be subsidized by the Government at affordable prices to the farmers.

Key Words: *adaptation, climate change, farmers, perceptions, opportunity cost, Nigeria*

Introduction

Achieving the goal of food security by reducing the number of undernourished people has been a major challenge to the Nigeria's government and the world at large (FAO, 2016). Despite the advances in food production and technologies that could lead to adequate food at a reduced cost (Hwang et al., 2005), the ubiquitous role of climate change has been a major challenge of achieving food security due to the incidence of high temperature, erratic rainfall regimes, coupled with low adoption of modern technologies (IPCC 2007; World Bank, 2010; Issahaku and Abdulai, 2019). Nigeria and other developing countries' development prospects are closely linked to climate and this makes them the most vulnerable to the negative effects of climate change, as the regions heavy reliance on rain-fed agriculture (Tol, 2018; Issahaku and Abdulai, 2019). Due to the susceptibility of Nigeria's agriculture to the vagaries of climate change, food production has drastically decreased with negative profits over the years (Oyebola et al., 2018). The country faces varying degrees of climate risk such as rising temperature, changing rainfall

pattern, distribution and volume, and extreme climate events (BNRCC, 2011; Onyeneke et al., 2019). These risks affect the production of food crops in the country and also threaten the objective of meeting the food needs of over 200 million of Nigerians.

Again, diverse ecological problems being observed in the country have been directly linked to continuous climate change (Adefolalu, 2007; Fellmann, 2018). Erosions caused by excessive rainfall, as an example, pose danger to crops and farmlands. According to Nhemachera & Hassan (2007), in a bid to mitigate the negative impacts of these climatic conditions, cassava farmers, like other crop farmers, adopt certain adaptation methods which include the planting of new crop varieties and stocking improved livestock species that are better suited to drier conditions, irrigation, crop diversification, adoption of mixed crop and mixed farming systems and changing planting dates. The outcomes of these adaptation measures have had little or no effect on food availability as the cost associated with these adaptation measures (especially in the case of small holder farmers with weak adaptive capacity) could be a major factor for non- impressive yield. Intergovernmental Panel on Climate Change [IPCC] (2014) likened 'adaptation' to adjustment in natural or human systems in response to actual or expected climate stimuli or their effects which moderate harm or exploits beneficial opportunities. Cassava is of interest in this study because the crop is multipurpose and could be described as 'hunger breaker' as it plays a key role in poverty alleviation, value-addition, job creation and revenue generation.

Studies on adaptation strategies from Uddin, Wolfgang, and Jason (2014); Hoa., Loi,Phuong and Tuan (2017); Muzamhind, Mtabhen , Jiri, Mwakiwa, Hanyani-Mlambo (2015); Ojo and Baiyegunhi (2018); Alhassan et al.(2018) employ Logistic and OLS regression models to address factors influencing farmers' decisions to adopt climate change adaptation measures; perceptions of the farmers on climate change effects and the adaptation

strategies employed by the farmers. None of these studies addresses cost-benefit analysis on adaptation strategies. This study introduces the concept of opportunity cost (OC) in addressing cost-benefit analysis of adapting to climate change effects with a focus on the cassava farmers. Findings from this research are expected to aid the understanding of farmers' responses and adaptation strategies to climatic variation, help in designing appropriate policy framework that will enhance adaptive and sustainable coping strategies as well as food security. In filling this gap, the study empirically addressed the following specific objectives which are to:
i. ascertain the awareness of the farmers about climate change;
ii. examine the perception of the farmers about the changes in climate;
iii. identify the main adaptation strategies used by the farmers;
iv. describe the main hindrances to adaptation to climate change in the area;
v. estimate the opportunity cost of adopting adaptation strategies for inputs and output outcomes; and
vi. determine the effect of climate change adaptation on the net revenue of the farmers.

Materials and Methods

This study was conducted in Southwest, Nigeria comprising Ogun, Osun, Ondo, Oyo, Lagos and Ekiti States. The study area is agrarian and agriculture remains the hub of the economy providing employment for over 70 percent of the population. Primary data used for this study were collected through direct personal interview schedule and Focus Group Discussion session (FGDs) with the aid of structured questionnaire. A multi-stage sampling procedure was used for the selection of the respondents. Stage one involved the purposive selection of three (3) States (Ondo, Ogun and Oyo) in Southwest Nigeria, being the leading cassava producing States in the area. The second stage involved a random selection of three (3) Local Government Areas (LGAs) from each State. In the third stage, five (5) communities were randomly selected from each LGA. Finally, stage four involved a random selection of five (5) registered cassava farmers from each community, therefore making a total of 225 respondents but 221 respondents' data were valid and employed for this study. Opportunity cost approach, Ordinary Least Squares (OLS) and descriptive statistics such as percentages, mean, standard deviation, and tables with a Likert Rating Scale (LRS) were used for the analysis of this study.

The Concept of Opportunity Cost: Opportunity Cost exists when there are at least two courses of action and the decision maker can select either course. The value of the rejected choice is sacrificed or given up by the decision maker and this sacrificed value is the (opportunity) cost of the choice. A fundamental principle of economics is that every choice has an opportunity cost. OC focuses on the quantitative evaluation of adaptation strategies impacts on cassava farmers' revenue. This approach identifies the adaptation strategies employed in the households and for each adaptation strategy, the total costs incurred and benefits accrued before and after the strategy were compared using Paired Samples Test.

Paired samples test of difference of two means was used to determine whether the mean differences in the net revenue and costs as proxy to opportunity cost of adopting an adaptation measure are significant or not. It is given as:

$$T = \frac{x_1 - x_2}{\sigma\sqrt{1/n_1 + 1/n_2}} \quad (1)$$

$$\sigma = \sqrt{\frac{n_1 s_1{}^2 + n_2 s_2{}^2}{n_1 + n_2 - 2}} \quad (2)$$

Where:
T = the Paired Samples test distribution
Degree of Freedom (df) =$n_1 + n_2 - 2$
x_1 = mean (costs and revenue) before adoption of adaptation strategies
x_2 = mean (costs and revenue) when adopting adaptation strategies
σ =Standard deviation of x_1 and x_2
$n_1$and n_2 = number of observations
s_1 = standard deviation before adoption of adaptation strategies
s_2 = standard deviation when adopting adaptation strategies

Model Specification for OLS: An estimated Production function was used to estimate how socioeconomic and climate factors affect the net revenue of the crop farmers in the study area. The implicit form of the regression model is expressed as;

$Yi = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8)$ (3)

The regression model is stated explicitly and the model variables are defined as follows.

$Yi = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_{7+} b_8X_8 + U_i$ …….. (4)

Where,

Yi = Net Farm Revenue (Naira)

X_1 = Age (years)

X_2 = Family size (numbers)

X_3 = Farm size (hectares)

X_4 = Education (years of schooling)

X_5= Experience (years)

X_6= adopt Adaptation strategies (dummy: yes = 1, and 0, otherwise)

X_7= Perceived rainfall (dummy: increased = 1, and 0, otherwise)

X_8= Perceived temperature (dummy: increased = 1, and 0, otherwise)

U_i = error terms

The production function was estimated using the ordinary least square regression technique. The following functional forms were estimated for the production function and the one that best satisfies the theoretical, statistical and econometric criteria for a production function was selected as lead equation. The functional forms that were estimated are: Linear, semi log, double log and exponential.

Linear function:

$Yi = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_{7+} b_8X_8 + Ui$

Semi-Log:

$Yi = b_0 + b_{1log}X_1 + b_{2log}X_2 + b_{3log}X_3 + b_{4log}X_4 + b_{5log}X_5 + b_{6log}X_6 + b_{7log}X_{7+} b_{8log}X_8 + Ui$

Exponentials:

$Log\ Yi = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_{7+} b_8X_8 + Ui$

Double log

$Log\ Yi = b_0 + b_{1log}X_1 + b_{2log}X_2 + b_{3log}X_3 + b_{4log}X_4 + b_{5log}X_5 + b_{6log}X_6 + b_{7log}X_{7+} b_{8log}X_8 + Ui$

Results and Discussion

Awareness of Effects of Climate Change on Cassava Production

The results in Table 1 indicated that about 89% of the respondents were aware of climate change impacts on cassava production while 11% of them claimed that they were not aware that changes in climate affect production of cassava over the years. It was also observed across the States that 93%, 85% and 89% of the respondents from Ondo, Ogun and Oyo States respectively were aware of climate change in the area. Again, the study went further to investigate the level of awareness on how climate change affects cassava production from those that claimed to be aware of the changes in climate. Majority (54%) of the respondents claimed to have moderate level of awareness followed by about 32% of them that had high level of awareness and then 14% of the sampled respondents had low level of awareness in the area. In Ondo State, it was recorded that about 12%, 67% and 21% of the respondents claimed to have low, moderate and high level of awareness of climate change effects on cassava production in the area over the years respectively. Moreover, results from Ogun State revealed that nearly 11%, 44% and 44% of the respondents affirmed low, moderate and high level of awareness of climate change effects on cassava production in the area respectively. In Oyo State, about 19%, 49% and 31% of the respondents attested to low, moderate and high level of awareness of climate change effect on cassava production respectively in the area. Though the results depicted a varied level of awareness, a considerable increase in the awareness of the respondents was observed; more still needs to be done to enlighten them on the impacts of climate change on cassava production. This will guide respondents in adopting necessary adaptation measures to combat negative impacts of climate change on cassava production and as well channel their thinking towards mitigating strategies that could revert the environment to normalcy as also reported by Fatuase (2016) and Olutumise et al. (2017).

Table 1: Awareness of Climate Change by the Respondents

Awareness	State of the Respondents						Pool Sample	
	Ondo State		Ogun State		Oyo State			
	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
No	5	6.9	11	14.9	8	10.7	24	10.9
Yes	67	93.1	63	85.1	67	89.3	197	89.1
Total	72	100.0	74	100.0	75	100.0	221	100.0
Level of Awareness								
Low	8	11.9	7	11.2	13	19.4	28	14.2
Moderate	45	67.2	28	44.4	33	49.3	106	53.8
High	14	20.9	28	44.4	21	31.3	63	32.0
Total	67	100.0	63	100.0	67	100.0	197	100.0

Source: The Authors

Perceptions of Respondents on Selected Climatic variables (Temperature and Rainfall)

The perceptions of the respondents were sought on temperature and rainfall over the years. Therefore, Table 2 presents the perceptions of the respondents in the study area on the selected climatic variables. The results of the analyses on cassava farmers' perceptions on temperature showed that majority (72%) of the sampled respondents claimed that temperature had been on increase over the years while about 20% of them claimed that temperature had been decreasing over the years in the study area. About 4% of the respondents perceived that temperature had remained the same over the years and 3% reported that they do not know whether temperature has changed or not. Looking through the States, it was observed that nearly 57%, 78% and 80% of the sampled respondents perceived that temperature has increased over the years in Ondo, Ogun and Oyo States respectively and this formed the majority in the study area. In the case of rainfall, the results showed that many (56%) of the respondents perceived that rainfall had been decreasing over the years while 36% of them perceived that rainfall had been on increase over the years. Nearly 3% of the respondents perceived that rainfall had remained the same over the years and 5% reported that they do not know whether rainfall has changed or not. Moreover, across the States, it was observed that about 63% and 69% of the sampled respondents perceived that rainfall decreased over the years in Ondo and Ogun States respectively and this formed the majority in the study area. Majority (55%) of the respondents in Oyo State perceived that rainfall has been increasing over the years as against the response from other States.

Table 2: Distribution of Respondents by Perceptions on Temperature and Rainfall

Perceptions	Temperature								Rainfall							
	State of the Respondents						Pool Sample		State of the Respondents						Pool Sample	
	Ondo State		Ogun State		Oyo State				Ondo State		Ogun State		Oyo State			
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Do not know	5	6.9	2	2.7	-	-	7	3.1	7	9.7	2	2.7	3	4.0	12	5.4
Decreasing	24	33.3	10	13.5	11	14.7	45	20.4	45	62.5	51	68.9	27	36.0	123	55.7
Stay the Same	2	2.9	3	4.1	4	5.3	9	4.1	-	-	3	4.1	4	5.3	7	3.2
Increasing	41	56.9	59	79.7	60	80.0	160	72.4	20	27.8	18	24.3	41	54.7	79	35.7
Total	72	100.0	74	100.0	75	100.0	221	100.0	72	100.0	74	100.0	75	100.0	221	100.0

Source: The Authors

Major Adaptation Measures Commonly Employed by Cassava Farmers in the Study Area

According to Hannah et al. (2017), Bouroncle et al. (2017) and; Eitzinger et al. (2017), adaptation measures that farmer choose may be profit driven rather than climate change driven. This study, as also established by Fatuase and Ajibefun (2014), assumed that their actions are driven by climate factors. As indicated in Table 3, majority of the cassava farmers (51%) identified use of agrochemical as means of adaptation strategy used in the study area. The greater use of agrochemicals as an adaptation method could be associated with the availability of agrochemicals and its effectiveness when applied by farmers. It has also caused reduction in the use of change of farmland in the area. Again, about 50% of the respondents employed mixed cropping as an adaptation in the study area. The reason suggested by farmers was that it serves as a supplement to the income accrued from cassava production when they plant other crops with cassava. About 45% of the cassava farmers adopted planting different varieties as their adaptation measure while 32% of them employed the method of different planting dates so as to guide against uncertainty in the area. About 41%, 20% and 15% of the sampled respondents employed soil management technique, moving to different site and practicing crop diversification respectively as adaptation strategies in the study area. These adaptation measures mentioned by farmers were similar to the other findings in the literature (Donatti et al., 2017 and Ullah et al., 2017). In Ondo State, it was observed that majority (38.9%) of the respondents employed mixed cropping as their adaptation strategies to combat effect of climate change followed by 36.1% of them who used planting of different varieties and then 34.7% who employed mixed cropping as their adaptation measure in the area. Nearly 44.6% of the respondents in Ogun State formed the majority of respondents that used mixed cropping as their means of adaptation measure while 40.5% apiece stated that they used soil management techniques and use of agrochemicals in the area. In Oyo State, it was observed that 72.0% of the respondents formed the majority that employed the use of agrochemicals as a means of adaptation measure followed by mixed cropping as adaptation measure which was 70.7% of the respondents and then 60.0% of the respondents adopted planting different varieties as the adaptation measure in the area.

Table 3: Major Adaptation Measures Employed by Cassava Farmers in the Study Area

SN	Adaptation Strategies	State of the Respondents						Pool Sample	
		Ondo State		Ogun State		Oyo State			
		Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
1	Planting Different Varieties (PDV)	26	36.1	28	37.8	45	60.0	99	44.8
2	Practicing Crop Diversification (PCD)	7	9.7	26	35.1	1	1.3	34	15.4
3	Different Planting Dates (DPD)	21	29.2	27	36.5	22	29.3	70	31.7
4	Mixed Cropping (MC)	25	34.7	33	44.6	53	70.7	111	50.2
5	Soil Conservation Techniques (SCT)	21	29.2	30	40.5	39	52.0	90	40.7
6	Use Of Agrochemicals (UAC)	28	38.9	30	40.5	54	72.0	112	50.7
7	Move To Different Site (MDS)	14	19.4	25	33.8	6	8.0	45	20.4

Source: The Authors

Main Barriers to Adaptation Strategies in the Study Area

The analysis of major barriers to adaptation to climate change among cassava farmers in the study area is presented in Table 4. It showed that ten main constraints were identified by the farmers in the area. These constraints were identified by some farmers as an impediment to adaptation while others identified them as a result of their inadequacy or shortage of the measures in the area. They include: inadequate funds, inadequate information, shortage of labour, shortage of land, inadequate technology knows how and others such as bad road network, lack of good and resistant planting materials, rapid infestation of pests and diseases, and non-availability of agrochemicals. Most of these constraints are associated with poverty and negligent of agricultural sector by the government (Fatuase and Ajibefun, 2014). The results showed that 63.3% of the sampled cassava farmers attested those inadequate funds were their main hindrance in adopting adaptation strategies in the area. The trend was similar across the States where 66.7%, 45.9% and 77.3% of the respondents from Ondo, Ogun and Oyo respectively complained inadequate funds.

The probable reason for this complaint by majority of the respondents could be attributed to the fact that money limits and incapacitates farmers from getting the necessary resources most especially inputs and technologies needed to facilitate adaptation to climate change. About 55.7% of the respondents complained shortage of labour as their main barriers to adaptation to climate change. This also reflected across the States where 51.4%, 47.3% and 68.0% of the respondents from Ondo, Ogun and Oyo attested that shortage of labour was their main challenges in adopting adaptation measures. Adaptation to climate change is costly (Mendelson, 2004 and Deressa *et al*., 2008) and the need for intensive labour use may contribute to this cost.

Thus, if farmers do not have sufficient family labour or the financial means to hire labour, they cannot adapt. Farmers in the study area are now losing their family labour to other sectors of the economy most especially education to the extent that youths find it hard to engage in farming activities as they now see it as a dirty job (Fatuase and Ajibefun, 2014). Again, nearly 43.9% of the respondents affirmed that poor road network and transportation problem were the main constraints to adaptation strategies in the area. It was also noted that 52.5%, 44.6% and 34.7% of the respondents from Ondo, Ogun and Oyo States respectively also claimed to be affected by same problem. It was reported that most of the roads that lead to their farms are in bad condition, unmotorable and inaccessible. Farmers in this study area are not poor neither are they rich but cannot afford to invest on the construction of roads and purchase of new technologies to adapt to climate change. Non-availability of agrochemicals was observed to be a constraint by 49.0% of the respondents while 44.4% and 13.5% of the respondents from Ondo and Ogun States attested to same problem. About 31.2% of the sampled cassava farmers claimed that shortage of land was responsible for their inability to adopt adaptation strategies in the area.

Added to this, 50.0%, 14.9% and 29.3% of the sampled respondents from Ondo, Ogun and Oyo States also agreed with the shortage of land as a constraint. It was observed from the study area that shortage of land has been associated with communal land tenure system practice and development of other sectors such as infrastructures, residential houses, institutions and among others. These have forced farmers to farm on a small plot of land and impede them from adaptation practices that compete with agricultural land. Inadequate climate information was also identified by 29.9% of the respondents where 47.2%, 27.0% and 16.0% of the respondents from Ondo, Ogun and Oyo States respectively also shared the same view. Inadequate information on appropriate adaptation options could be attributed to the dearth of research on climate change and adaptation options as well as inefficient meteorological stations in the country. The information on climate change is not reaching farmers who are the major stakeholder in this scene because the means of disseminating the climate information is inaccessible and

unaffordable to the farmers. Rapid infestation of pests and diseases accounted for 25.8% of the respondents where 44.4% and 33.8% of the respondents from Ondo and Ogun attested to the same problem. Other constraints mentioned by the respondents were poor potentials for irrigation (24.0%), lack of good and resistant planting materials (27.6%) and inadequate technology know-how (19.0%). Again, the levels of technological know-how of these farmers are very low when compared with developed countries. They identified inadequate technological know-how as one of the local knowledge gaps to adapt to climate change.

Table 4. Main Hindrances to Adaptation Strategies in the Study Area

SN	Hindrances/barriers to adaptation	State of the Respondents						**Pool Sample**	
		Ondo State		**Ogun State**		**Oyo State**			
		Freq.	Percent	Freq.	Percent	Freq.	Percent	**Freq.**	**Percent**
1	Inadequate information	34	47.2	20	27.0	12	16.0	66	29.9
2	Inadequate funding	48	66.7	34	45.9	58	77.3	140	63.3
3	Shortage of labour	37	51.4	35	47.3	51	68.0	123	55.7
4	Shortage of land	36	50.0	11	14.9	22	29.3	69	31.2
5	Poor potential for irrigation	32	44.4	21	28.4	-	-	53	24.0
6	Inadequate technology know-how	28	38.9	14	18.9	-	-	42	19.0
7	Lack of good and resistant planting materials	31	43.1	27	36.5	3	4.0	61	27.6
8	Rapid infestation of pests and diseases	32	44.4	25	33.8	-	-	57	25.8
9	Non-availability of agrochemicals	32	44.4	10	13.5	-	-	42	19.0
10	Poor road/transportation problem	38	52.8	33	44.6	26	34.7	97	43.9

Source: The Authors

Opportunity Cost of Adaptation Strategies of the Costs and Returns by the Farmers

The study examined the costs and benefits before and after using adaptation measures in the area. Table 5 revealed that cassava farmers incurred additional cost of N2, 386.38 on labour utilization as a result of adopting any of the adaptation measures identified in this study. It was further observed that the difference was not statistically significant ($P > 0.05$) using paired samples test. Again, despite insignificant difference in cost of fertilizer incurred by the farmers, it was noted that additional costs of N5,085.06 was incurred by the farmers as a result of adopting adaptation to climate change. In case of area expansion under cultivation, a statistically significant difference ($P < 0.05$) was observed and additional costs of N10, 550.00 were recorded. Additional cost incurred on pest management was N2, 648.49 and it was not statistically different. As regards planting materials, there was a statistically significant difference ($P < 0.05$) on additional cost incurred before and when using adaptation (N13, 217.87).

Moreso, the benefits derived from the using climate adaptation strategies were also presented in the Table. It was noted that an average of about N18,242.46 per hectare (35,937.64/1.97) was additional income accrued from cassava stem cutting as a result of using adaption strategies in the area, while N255,395.37 per hectare (503,128.88/1.97) was additional revenue accrued from the sales of cassava tubers when using adaptation strategies in the area. The mean difference between the values of revenue accrued before using adaptation strategies and when using adaptation strategies showed significance at 1% level. This implies that cassava farmers made additional N237,637.83 per hectare when using adaptation strategies in the area. It is an indication that adaptation strategies significantly boost the production of cassava vis-à-vis increase the revenue per hectare in the area. The results were expected because agricultural technology adoptions are based on farmers' utility or profit maximizing behaviors (Weersink and Fulton, 2020). Deressa et al. (2011) and Fatuase (2016) opined that farmer adopts a new technology only when the perceived utility or profit from using this new technology is significantly greater than the traditional or the old method. Thus, households with higher income and greater assets are in better position to adopt new farming technologies which is used as proxy to adaptation strategies in the case of cassava farmers in the study area.

Table 5. Distribution of respondents by Costs and Benefits on Adaptation Strategies

Items	Before Adaptation	When using Adaptation	Difference	t-value	Sig.
Average Costs Incurred					
Labour (N)	38,120.0	40,506.38	2,386.38	0.348	0.201
Fertilizer (N)	11,947.37	17,032.43	5,085.06	1.487	0.103
Area expansion under cultivation (N)	5,583.33	16,133.33	10,550.00	2.655**	0.001
Pest Management (N)	3,533.33	6,181.82	2,648.49	1.521	0.101
Planting Materials (N)	13,280.00	26,497.87	13,217.87	5.619***	0.000
Average Benefit Accrued					
Sales from stem cuttings (N)	21,633.33	57,570.97	35,937.64	8.982***	0.000
Sales from cassava tubers (N)	303,392.86	806,521.74	503,128.88	32.631***	0.000
Total Revenue (N)/ha	164,987.91	438,625.74	273,637.83		

Source: The Authors

Effect of Climate Change Adaptation on the Net Revenue of the Farmers

The variable estimates were analyzed using a multiple regression model and presented in Table 6. The data were subjected to various functional forms with a priority to climate variables. The exponential model gave the best fit and was chosen as the lead equation with a coefficient of multiple determination (R-Squared) of 0.861 which implies that about 86.1% variations in the effect of climate change adaptation on the net revenue of the farmers are explained by the explanatory variables. The estimated functions were evaluated in terms of the statistical significance of the R-squared, F-value, the significance of the coefficient, and the signs of the coefficients. The estimated variables of age, farm size, and experience were positive and statistically significant while, that of family size, education, and perceived temperature were negative but statistically significant in explaining the farmers' net revenue.

The coefficient of age was positive and statistically significant. This implies that a unit increase in the age of the respondents would lead to a 2.8% increase in the net revenue of the respondents at a 1% significant level. This might be due to the farmers' continued economic and productive age, which would allow them to contribute to the impact of climate change adaptation. The results of Alam et al. (2016) agree with this, but contradict that of Ali & Ereinstein (2017), who found that the age of the household head was inversely correlated with the adoption of climate change adaptation strategies. At the 1% level, the family size coefficient was negative but statistically significant. This suggests that a family size increase would result in a 3.5% loss in net revenue. This further implies that when family size drops, farmers' net income in the research area likewise decreases, along with the availability of family labour and the facilitation of actions to adapt to climate change. This, however, conflicts with research from Arshad et al. (2018) and Keshavarz and Moqadas (2021). At a significant level of 5%, farm size and net revenue were positively correlated. This suggests that a unit increase in farm size would lead to a 3.3 percent rise in the net revenue of the respondent. This may be explained by the fact that larger farms tend to experience the effects of climate change adaptation more frequently than smaller ones. The results of Thinda et al. (2021); Langyintuo and Mungoma (2008) lend credence to this assumption. With a 5 percent statistical significance, the coefficient of experience was positive. This indicates that an increase in experience among the respondents of one unit would result in an increase in net revenue of 4.8%. This further suggests that seasoned cassava farmers in the study area possess a high level of expertise in farm management techniques as well as the capacity to manage risk when confronted with fluctuations in climate change, which increases their net income. The results of Arshad et al. (2018) advance credence to this claim. Finally, a statistically significant negative association between perceived temperature increase and net revenue at a threshold of 5% was found. This suggests that a unit rise in the perceived temperature will lead to a 9.7 percent loss in the net revenue of cassava farmers in the study area. This assumption is corroborated by the findings of Huong et al. (2019).

The study concluded that there is a moderate level of awareness and perceptions of climate change as it affects cassava production in the area. It was also concluded that cassava farmers perceived that temperature is increasing over the years while amount of rainfall were perceived to be deceasing over the years. It was observed that cassava farmers perceived that climate change had effect on cassava production over the years, and thereby employed adaptation measures to combat its effects. The main adaptation strategies employed by the cassava farmers are planting different varieties, practicing crop diversification, mixed cropping, soil conservation techniques, use of agrochemicals, and move to a different site. There was evidence of opportunity cost in the adoption of adaptation strategies. Furthermore, socio-economic factors such as (age, farm size, experience, and family size) and climatic factor i.e., perceived temperature positively and negatively influence the net revenue of cassava farmers in the study area. It is therefore concluded that cassava farmers derived and perceived utility and net benefit from using adaptation measures than when it is not used. Based on these findings, policies aimed at organizing and strengthening training programmes on climate change awareness and coping strategies since the farmers derived additional benefits from their choice of coping strategies. This could be achieved through the extension agents and

the meteorologists by using different media such as farm demonstration/show, seminar, radio, TV and social media. Since it has been established in the study that farmers are aware and perceived that climate is changing, substantive credit scheme should be provided by the Government to the cassava farmers in order to enhance their adaptation strategies. This should be made available, accessible and affordable to the farmers. Government should provide improved varieties of cassava that are very tolerant and resistant to the effects of drought and flood; and other modern techniques of cultivating cassava through the research institute and ministry of agriculture. The costs of improved varieties should also be subsided by the Government to the farmers.

Table 6: OLS Results for the Effect of Climate Change on the Net Revenue

Variables	Linear(P-value)	Double log(P-value)	Semi log(P-value)	Exponential (P-value)
Age	4.1(.239)	.008(.002) ***	1.329(.000) ***	27623.2(.001) ***
Family size	4.9(.004) ***	.010(.010) ***	-1.761(.000) ***	-35395.6(.001) ***
Farm size	6334.4(.077)	-.015(.888)	-.468(.436)	33531.7(.040) **
Education	1996.5(.000) ***	-.151(.001) ***	-2.182(.000) ***	-16612.6(.110)
Experience	991.6(.013) **	.023(.046) ***	1.788(.017) **	48480.4(.016) **
Adaptation strategies	3924.5(.042) **	.089(.117)	.372(.321)	14016.8(.164)
Perceived Rainfall	-1305.7(.730)	-.066(.555)	-.412(.278)	-5311.7(.600)
Perceived Temperature	-677.9(.135)	-.021(.127)	-.339(.063)	-9671.5(.048) **
(Constant)	8822.1(.774)	11.465(.000) ***	13.366(.001) ***	-74944.1(.466)
R^2	0.58	0.532	.736	0.861
F-value	11.07	6.85	21.96	42.01
***			Significant at 1 percent	
**			Significant at 5 percent	

Source: Field Survey, 2022

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ID:455

RASFF (Rapid Alert System for Food and Feed) Notifications for Food and Food Contact Materials in 2021

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Abstract

Rapid Alert System for Food and Feed (RASFF); is a system that provides rapid information flow between European Union member states when a risk threatening public health arises in terms of food safety. In this study, notifications originating from food and food contact materials for 2021 in the RASFF database were examined. All the data obtained were evaluated under the headings of notification basis, notification classification, risk decision, notification by, product category, notification subject, distribution status and measures taken using Microsoft Excel 2010 program and a detailed report was prepared. A total of 4438 notifications were detected. 4167 notifications were recorded for foods and 271 notifications were recorded for food contact materials. 30.82% of the notifications (n=1368) had emerged as a result of official controls in the market. When the notifications were classified, it was observed that 1455 notifications were alert notifications. This was followed by border rejection (n= 1433), information notification for attention (n=972), information notification for follow-up (n=564) and news (n=13) notifications. 58.29% of all notifications had serious risk. Germany was the most notifying country (n=725), followed by Spain (n=526) and the Netherlands (n=444). The food category with the highest number of notifications was fruits and vegetables with 952 notifications (21.45%). When all notifications were examined, it was determined that the main problem was pesticides. It had been reported that in the biggest portion of the cases the products were not (yet) placed on the market (n=1223). The most frequently taken measure was withdrawal of products from the market (n=603), followed destruction (n=542) and official detention (n=527).

Key Words: *Food Safety, Pesticide, Rapid Alert System for Food and Feed, RASFF, RASFF Notifications*

Gıda ve Yem için Hızlı Alarm Sistemi'nde Yer Alan 2021 Yılı Gıda ve Gıda ile Temas Eden Madde Bildirimleri

Özet

Gıda ve Yem İçin Hızlı Alarm Sistemi (RASFF); gıda güvenliği açısından halk sağlığını tehdit eden bir risk ortaya çıktığında, Avrupa Birliği üye ülkeleri arasında hızlı bir şekilde bilgi akışını sağlayan sistemdir. Bu çalışma kapsamında, RASFF veri tabanında 2021 yılına ait gıda ve gıda ile temas eden madde kaynaklı bildirimler incelenmiştir. Elde edilen tüm veriler bildirim kaynağı, bildirim türü, risk derecesi, bildirimde bulunan ülke, ürün kategorisi, bildirim konusu, ürünün dağıtım bilgileri ve uygulanan yaptırım başlıkları altında Microsoft Excel 2010 programı kullanılarak değerlendirilmiş ve ayrıntılı bir rapor hazırlanmıştır. Toplam 4438 bildirim tespit edilmiştir. 4167 bildirim gıdalar için, 271 bildirim ise gıda ile temas eden maddeler için oluşturulmuştur. Bildirimlerin %30.82'si (n=1368) piyasadaki resmi kontroller sonucunda ortaya çıkmıştır. Elde edilen bildirimler sınıflandırıldığında 1455 bildirimin alarm bildirimi olduğu gözlenmektedir. Ardından sınır iadesi (n=1433), dikkat gerektiren bilgi (n=972), takip gerektiren bilgi (n=564) ve haber (n=13) bildirimleri gelmektedir. Tüm bildirimlerin %58.29'u ciddi risk derecesine sahiptir. Almanya en fazla bildirimde bulunan ülke iken (n=725), onu İspanya (n=526) ve Hollanda (n=444) takip etmiştir. Hakkında en fazla bildirim bulunan gıda kategorisi 952 bildirim (%21.45) ile meyve ve sebzeler olmuştur. Tüm bildirimler incelendiğinde temel problemin pestisitler olduğu belirlenmiştir. Risk tespit edilen ürünlerin büyük bir kısmının (henüz) piyasaya sürülmediği (n=1223) bildirilmiştir. En sık alınan önlem ürünlerin piyasadan çekilmesi (n=603) olmuştur, ardından imha edilmesi (n=542) ve resmi olarak alıkonması (n=527) gelmiştir.

Anahtar Kelimeler: *Gıda Güvenliği, Gıda ve Yem için Hızlı Alarm Sistemi, Pestisit, RASFF, RASFF Bildirimleri*

ID:457

Combination of biochar with antagonistic microbes to control plant parasitic nematodes in different crops: A way forward to green plant protection strategies

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Abstract

Tomato (*Lycopersicon esculentum* Mill) is the second most produced and consumed vegetable worldwide and in Pakistan after potato. It is consumed on daily basis directly as raw and in the form of various processed items. Tomato is the most important vegetable after potato worldwide. Similarly, wheat is the mainstay of global food security. In spite of an increasing trend in the use of inputs and the adoption of new technologies, productivity of these crops is not responding in terms of yield growth. Tomato is affected by a variety of bacterial, fungal and viral pathogens. In addition to these diseases, root knot nematode (*Meloidogyne incognita*) has emerged as a serious threat to several vegetable crops with special reference to the tomato production in Punjab. *Meloidogyne incognita* is the most dangerous plant parasitic nematode on the earth planet because of very high host range of this nematode species. It infects more than 3000 plant species worldwide with very devastating effects especially in tomato. Root knot nematodes (*Meloidogyne* spp.) are serious problem involved yield and quality reduction in tomato and other vegetable crops. Likewise, root lesion nematode *Pratylenchus thornei* is an important wheat pest and causes significant losses. They are mostly controlled by using various nematicides which not only hazardous to the environment but also have negative impact on human health. The present study represents an easy to use and eco-friendly solution to this problem by amending the soil with biochar. Biochar is a carbon rich product obtained through pyrolysis of biomass and can be used for carbon sequestration by applying large amounts of carbon very resistant to decomposition. In the present study, the interaction of tomato and root knot nematode Meloidogyne incognita has been used as model system. In the study, the potential of three feedstocks (wheat straw, cotton sticks and green waste) at different concentrations were evaluated to control root knot nematodes in pot experiments. The biochar developed from best feedstock at best concentration was evaluated in the field using nematode sick beds in the department research area. Moreover, the best biochar was applied to tomato along with certain population of nematodes in addition to biocontrol agents to study the activation of defense related genes in tomato. The best biochar for growth promotion and nematode resistance was rice husk biochar which was added with bacterial (*Bacillus* sp.) and fungal (*Trichoderma* sp.) afterward. Our results from nematode resistance test and gene expression for defense related genes from different treatments demonstrated that 3% rice husk biochar in combination with *Bacillus* sp. was found best for growth promotion, nematode resistance and activation of defense related genes. Similar results were found in wheat in response to root lesion nematode *Pratylechus thornei* for biochar treatments. This study could be a way forward for organic management of root-knot nematodes in tomato.

Key Words: *Tomato, Root-knot nematodes, Biochar, Antagonists, Resistance*

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ID:458

Digitalisation In Aquaculture Management

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Abstract

Aquaculture is an economic production activity of fish, shellfish and aquatic plants with a certain investment in a certain period of time, taking into account many technical factors. Basically, these aquatic species are grown until the market and finally harvested, taking into account the welfare of these aquatic species. It is among the fastest growing industries in the world today. Production performance and quality depend on a combination of different factors, such as the quantity and periodicity of food, temperature, life cycle, and characteristics of the water used. With the increase in demand in recent times, the increase in production amounts and the development of the industry are realized with the use of many technological systems. These technological systems have increased the production and quality to the desired levels with the help of their sensors and communication network and programs containing advanced data analysis. In order to make the production and post-production quality management safer, the consumer and the seller have the opportunity to work with a safer product, thanks to the monitoring studies carried out to monitor the production and supply. Thus, while the producer can prove how high quality his production is, it is ensured that the consumer gets away from their concerns and possible misinformation. In addition, although digital technology requires an investment at first, it also has the effect of reducing the production cost over a long period of time. Because it is getting harder to find a high quality workforce day by day, and the need for personnel decreases as the digitalization infrastructure increases due to the possibility of success in production parallel to the success of the personnel. By providing almost all control through the measurements and data collected, estimates are produced at very close levels to the reality, thus ensuring a more efficient use of resources and much less exposure to possible diseases and risks. Thanks to digital data collection and processing, businesses are both easier to control and follow a more transparent production process. As the manufacturer digitizes, it gains the power to participate in the competition in the market, and it also becomes compatible with many applications, including Blockchain technology.

Key words: *Digitalisation, Aquaculture, Technology, Production control, Production management*

Su Ürünleri Yetiştiriciliği Yönetiminde Dijitalleşme

Özet

Su ürünleri yetiştiriciliği, balık, kabuklu deniz ürünleri ve su bitkilerinin belli bir zaman dilimi içinde belli bir yatırımla birçok teknik faktör gözetilerek yapılan ekonomik bir üretim faaliyetidir. Temel olarak bahsedilen bu sucul canlıların refahları gözetilerek Pazar boyuna kadar yetiştirilir ve sonunda hasat edilir. Günümüzde dünyanın en hızlı büyüyen sektörleri arasındadır. Üretim performansı ve kalitesi, gıda miktarı ve periyodikliği, sıcaklık, yaşam döngüsü ve kullanılan suyun özellikleri gibi farklı faktörlerin kombinasyonuna bağlıdır. Son dönemlerde talebin artmasıyla birlikte üretim miktarlarının artması ve endüstrinin gelişmesi, birçok teknolojik sistemin kullanımı ile gerçekleşmektedir. Bu teknolojik sistemler sahip oldukları sensörler ve iletişim ağı ile gelişmiş veri analizlerini içeren programlar yardımıyla üretimi ve kaliteyi istenilen seviyelere çıkartmıştır. Yapılan ölçümler ve toplanan veriler aracılığıyla neredeyse tüm kontrol sağlanarak gerçeğe çok yakın seviyelerde tahminler üretilerek, hem kaynakların daha verimli kullanılması sağlanmakta hem de olası hastalık ve risklerden çok daha az etkilenilmektedir. Üretimde ve üretim sonrası kalite yönetiminin daha güvenli yapılabilmesi için, üretimin ve tedarikin takibi için yapılan izleme çalışmaları sayesinde tüketici ve satıcı daha güvenli bir ürün ile çalışma olanağı bulmaktadır. Böylece üretici üretimini ne kadar kaliteli yaptığını ispatlayabilirken, tüketicinin kaygıları ve olası yanlış bilgi ediniminden uzaklaşması sağlanmaktadır. Ayrıca dijital teknoloji ilk başta bir yatırım gerektirmesine karşın üretim maliyetini geniş zamanda düşürme etkisine de sahiptir. Zira yüksek kalitede işgücü bulmak günden güne zorlaşmakta, üretimde başarı personelin başarına paralel olası nedeniyle dijitalleşme altyapısı arttıkça personel gereksinimi de bir o kadar azalmaktadır. Dijital veri toplama ve işleme sayesinde işletmeler hem daha kolay kontrol edilmekte hem de daha şeffaf bir üretim prosesi takip etmektedirler. Üretici dijitalleştikçe piyasadaki rekabete katılma gücü elde etmekte bunla birlikte Blockchain teknolojisi dâhil birçok uygulamaya uyumlu hale gelmektedir.

Anahtar Kelimeler: *Dijitalleşme, Su Ürünleri yetiştiriciliği, Teknoloji, Üretim Kontrolü, Üretim Yönetimi*

ID:459

Application of Blockchain Technology in Fisheries and Aquaculture Production Sector

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Abstract

Blockchain is a distributed database shared among the nodes of a computer network. As a database, a blockchain stores information electronically in digital form. Blockchains are best known for their important role in crypto currencies like Bitcoin to keep a secure and decentralized record of transactions. The innovation in blockchain is that it guarantees the fidelity and security of a data record and establishes trust without the need for a trusted third party. Today, blockchain combats commercial fraud by documenting long and complex production cycles for seafood and monitoring critical chain of custody, analysing by considering coastal, port, processing and end-market. These are crucial as fishery products pass through national and international supply chains, from harvesting, transhipment, landing and processing to the final consumer market. Every part of the country requires general control elements that must be in place, often forming the basis for traceability, tracking and data collection, and ensuring consumers have complete confidence in seafood. Aquaculture has become one of the most traded food groups worldwide and provides a livelihood for millions of people around the world. The growth rate of exports in developing countries has increased rapidly in the last ten years due to globalization and the transformation of the world economy with technological developments. With almost one-third of global fish stocks being overused, the ecological footprint of aquaculture and fisheries highlights the balance of the sustainable supply chain.

Key words: *Blockchain, Aquaculture Industry, Quality Management, Food Safety*

Blockchain Teknolojisi'nin Su Ürünleri Üretim Sektöründe Uygulaması

Özet

Blokchain (Blok zinciri), bir bilgisayar ağının düğümleri arasında paylaşılan dağıtılmış bir veri tabanıdır. Bir veri tabanı olarak, bir blok zinciri, bilgileri elektronik olarak dijital biçimde saklar. Blok zincirleri en iyi, güvenli ve merkezi olmayan bir işlem kaydını tutmak için Bitcoin gibi kripto para sistemlerindeki önemli rolleriyle bilinir. Blok zincirindeki yenilik, bir veri kaydının aslına uygunluğunu ve güvenliğini garanti etmesi ve güvenilir bir üçüncü tarafa ihtiyaç duymadan güven oluşturmasıdır. Bugün blockchain, deniz ürünleri için uzun ve karmaşık üretim döngülerini belgelemek ve kritik gözetim zincirini izlemek, kıyı, liman, işleme ve son Pazar gibi konuları dikkate alarak analiz yapmak suretiyle ticari olarak sahtekârlıkla mücadele etmektedir. Bunlar, balıkçılık ürünleri hasat, aktarma, karaya çıkarma ve işlemeden nihai tüketici pazarına kadar ulusal ve uluslararası tedarik zincirlerinden geçtiği için çok önemlidir. Ülkenin her bölümü, yerinde olması gereken genel kontrol öğelerini gerektirir, bunlar genellikle izlenebilirlik, izleme ve veri toplama için temel oluşturur ve tüketicilerin deniz ürünlerine tam olarak güvenmesini sağlar. Su ürünleri yetiştiriciliği, dünya çapında en çok ticareti yapılan gıda gruplarından biri haline gelirken dünya çapında milyonlarca insanın geçimini sağlamaktadır. Gelişmekte olan ülkelerde ihracatın büyüme hızı, küreselleşme ve dünya ekonomisinin teknolojik gelişmelerle birlikte dönüşmesi nedeniyle son on yılda çok hızlı bir artış göstermiştir. Küresel balık stoklarının neredeyse üçte birinin aşırı kullanımıyla, su ürünleri yetiştiriciliği ve balıkçılığın ekolojik ayakizi, sürdürülebilir tedarik zincirinin dengesine dikkat çekmektedir.

Anahtar Kelimeler: *Blokchain, Su Ürünleri Sektörü, Kalite Yönetimi, Gıda Güvenliği*

ID:460

Determination Of Zinc (Zn) Sorption Properties Of Gyttja, Leonardite And Compost

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Abstract

Leonardite and compost are used as soil regulator materials. Gyttja is a material which contains 30-40% lime and 40-50% organic matter with a reserve of approximately 4.8 billion tons in Afşin-Elbistan Thermal Power Plant basin. These materials are used in the production of organomineral fertilizers. Zinc (Zn) is one of the micro plant nutrients that plants need. Available Zn deficiency is observed in approximately 49% of Turkish soils. The aim of this study is to determine the Zn adsorption properties of gidya, leonardite and compost used in organomineral fertilizer production. The study was conducted under laboratory conditions. In order to determine the optimum adsorption conditions, the effect of pH, particle size, temperature, shaking time and solution concentration were determined. Then, adsorption properties were determined using linear Langmuir and Freundlich isotherm under optimum conditions. According to Langmuir isotherm, the maximum sorption capacity (qmax) was found to be 14.10 mg g^{-1} for gidya, 13.74 mg g^{-1} for leonardite and 15.67 mg g^{-1} for compost. In conclusion, gidya, leonardite and compost Zn sorption values were consistent with Langmuir and Freunlich isotherms. The maximum sorption capacity (qmax) of these materials is very close to each other. When these data are taken into consideration, it is seen that 1 kg of organic material can hold about 15 g Zn. It is useful to take these basic data into account in organomineral fertilizer production and sustainable Zn fertilization.

Key Words: Gyttja, leonardit, compost, zinc, adsorption

Gidya, Leonardit Ve Kompost'un Çinko (Zn) Adsorpsiyon Özelliklerinin Belirlernmesi

Özet

Leonardit ve kompost toprak düzenleyicisi olarak kullanılan materyallerdir. Gidya ise Afşin-Elbistan Termik Santralı havzasında rezervi yaklaşık 4.8 milyar ton olan %30-40 kireç ve % 40-50 organik madde içeren bir materyaldir. Bu materyaller organomineral gübre yapımında kullanılmaktadır. Çinko bitkilerin mutlak ihtiyaç duyduğu mikro bitki besin elementlerinden birisidir. Türkiye topraklarının yaklaşık % 49'unda bitkiler tarafından alınabilir çinko (Zn) noksanlığına rastlanmaktadır. Bu çalışmanın amacı, organomineral gübre yapımında kullanılan gidya, leonardit ve kompostun Zn adsorpsiyon özelliklerini belirlemektir. Çalışma laboratuvar koşullarında yürütüldü. Optimum adsorpsiyon koşullarını belirlemek için adsoprsiyonu etkileyen faktörlerden pH, tanecik iriliği, sıcaklık, çalkalama süresi ve çözelti konsantrasyonunun etkisi belirlenmiştir. Daha sonra optimum koşullarda linear Langmuir ve Freundlich izotermi kullanılarak adsorpsiyon özellikleri saptanmıştır. Langmuir izotermine göre maksimum sorpsiyon kapasitesi (q_{max}) gidya için 14,10 mg g^{-1}, leonardit için 13,74 mg g^{-1} ve kompost için 15,67 mg g^{-1} bulunmuştur. Sonuç olarak, gidya, leonardit ve kompostun Zn sorpsiyon değerleri Langmuir ve Freunlich izotermine uyum göstermiştir. Bu materyallerin maksimum adsorpsiyon kapasiteleri (q_{max}) birbirine çok yakındır. Bu veriler dikkate alındığında, 1 kg organik materyalin yaklaşık 15 gr Zn tutabileceği görülmektedir. Organomineral gübre üretiminde ve sürdürülebilir Zn gübrelemesinde bu temel verilerin dikkate alınmasında fayda vardır.

Anahtar Kelimeler: Gidya, leonardit, kompost, çinko, adsorpsiyon

ID:461

Determination of Antibacterial and Antioxidant Activities of *Eisenia fetida* (Savigny, 1826) Against Mastitis Pathogens

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Abstract

Eisenia fetida (Savigny, 1826) taxon, which has high environmental adaptation and reproductive capacity, can also show high tolerance and resistance to organic pollutants. Due to the sticky secretions they produce and the conversion of organic matter in the soil, these earthworms can increase microbial activity and nutrient availability of organic matter. *E. fetida* is the most commonly used species in the production of "vermicompost," which is an organic soil conditioner that is important for agricultural sustainability. In this study, it was aimed to determine the antibacterial activity of different extracts obtained from *E. fetida* species against mastitis pathogens as well as their non-enzymatic antioxidant activities. In this study, 150 *E. fetida* samples were obtained from Nevsehir Hacı Bektas Veli University Biology Research Laboratory. Mastitis pathogens used in the study were obtained from Mugla Sitki Kocman University Microbial Biotechnology Research Laboratory. In this study, different extracts of *E. fetida* (ethanol, methanol, water) were obtained by soxhlet apparatus. The antibacterial activity studies were determined by disk diffusion and Minimum Inhibitory Concentration (MIC) methods. The non-enzymatic antioxidant activity studies were determined using 2,2′-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS*), and 2,2-diphenyl-1-picrylhydrazyl (DPPH*) radicals. In this study, the highest antibacterial activity was determined as 9 mm against *Staphylococcus aureus*-18 from the methanol extract, while an inhibition zone diameter of 9 mm was obtained from the ethanol extract against Coagulase-negative *Staphylococcus*-36 (CNS-36). The lowest MIC value of *E. fetida* extracts was 3250 µg/mL, and it was detected in *S. aureus*-18. The highest ABTS radical scavenging activity was determined as 78% from the methanol extract of *E. fetida*. However, the highest DPPH radical scavenging activity was obtained from the ethanol extract of *E. fetida* and was determined as 55%. As a result, it is suggested that *Eisenia fetida* extracts have antibacterial activity against mastitis pathogens and can be used in the fight against these pathogens. In addition, it was determined that *E. fetida* extracts had high antioxidant activity.

Key Words: *Eisenia fetida, mastitis patogens, antibacterial activity, MIC, DPPH, ABTS*

Eisenia fetida (Savigny, 1826)' nın Mastitis Patojenlerine Karşı Antibakteriyel ve Antioksidan Aktivitelerinin Belirlenmesi

Özet

Yüksek çevresel adaptasyon ve üreme kapasitesine sahip olan *Eisenia fetida* (Savigny, 1826) taksonu, aynı zamanda organik kirleticilere karşı yüksek tolerans ve direnç gösterebilme yeteneğine de sahiptir. Ürettikleri yapışkan salgıları ve topraktaki organik maddeleri dönüştürmesi sayesinde bu toprak solucanları mikrobiyal aktiviteyi ve organik maddelerin besin mevcudiyetini artırabilmektedir. *E. fetida*, "vermikompost" olarak adlandırılan ve tarımsal sürdürülebilirlik bakımından önemli organik bir toprak düzenleyicisi olan solucan gübresinin üretiminde en çok kullanılan türdür. Bu çalışmada *Eisenia fetida* türünden elde edilen farklı ekstrelerin mastitis patojenlerine karşı antibakteriyel aktivitesi ve ayrıca enzimatik-olmayan antioksidan aktivitelerinin belirlenmesi amaçlanmıştır. Bu çalışmada, *E. fetida* örnekleri 150 adet olup, Nevşehir Hacı Bektaş Veli Üniversitesi Biyoloji Araştırma Laboratuvarından sağlanmıştır. Çalışmada kullanılan mastitis patojenleri Muğla Sıtkı Koçman Üniversitesi Mikrobiyal Biyoteknoloji Araştırma Laboratuvarından temin edilmiştir. Bu çalışmada soksalet cihazı ile *E. fetida'* nın farklı ekstreleri (etanol, metanol, su) elde edilmiştir. Antibakteriyel aktivite çalışmaları disk difüzyon ve Minimum İnhibitör Konsantrasyon (MİK) yöntemleri ile saptanmıştır. Enzimatik-olmayan antioksidan aktivite çalışmaları 2,2′-azino-bis(3-etilbenzotiazolin-6-sulfonik asit) (ABTS*) ve 2,2-difenil-1-pikrilhidrazil (DPPH*) radikalleri kullanılarak belirlenmiştir. Bu çalışmada, en yüksek antibakteriyel aktivite metanol ekstresinden *Staphylococcus aureus*-18' e karşı 9 mm olarak belirlenirken, Koagulaz negatif *Staphylococcus*-36'ya (CNS-36) karşı etanol ekstresinden 9 mm inhibisyon zon çapı olarak saptanmıştır. *E. fetida* ekstrelerinin en düşük MİK değeri 3250 µg/mL olup, *S. aureus*-18' de saptanmıştır. En yüksek ABTS radikal süpürme aktivitesi *E. fetida'* nın metanol ekstresinden %78 olarak tespit edilmiştir. Ancak en yüksek DPPH radikal süpürme aktivitesi *E. fetida'* nın etanol ekstresinden elde edilmiş ve %55 olarak saptanmıştır. Sonuç olarak, *E. fetida* ekstrelerinin mastitis patojenlerine karşı antibakteriyel aktiviteye sahip olduğu ve bu patojenlerle mücadelede kullanılabileceği önerilmiştir. Ayrıca *E. fetida* ekstrelerinin yüksek antioksidan aktiviteye sahip olduğu belirlenmiştir.

Anahtar Kelimeler: Eisenia fetida, mastitis patojenleri, antibakteriyel aktivite, MİK, DPPH, ABTS

ID:462

Research on The Bio-Ecology and Biological Control Process of *Eurytoma amygdali*, Enderlein (Hymenoptera: Eurytomidae)

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Abstract

Eurytoma amygdali, Enderlein (Hymenoptera: Eurytomidae), known as almond borer, is an important pest of almond trees in different countries located in Southeast Europe and the Middle East, including Turkey. While *E. amygdali* causes significant damage to almond orchards in Turkey, it is seen in all areas where almonds are grown. It is known that the chemical control of *E. amygdali*, which is widely applied by almond producers in Turkey, is mostly unsuccessful. The main reason for this is that the pest has differences in terms of biological, ecological and damage. In this context, the main purpose and content of the study is about the biological control process against *E. amygdali* (almond heartworm), within the scope of analyzing the bio-ecology of the organism to get the data obtained from the observations and examinations carried out during 2022 in two different almond orchards in Nevşehir province Avanos district Köy Bağı Mevkii and Yukarı Mahalle Mevkii.

Key Words: *Eurytoma amygdali, Almond, Parasite, Bio-ecology, Biocontrol, Nevşehir*

Eurytoma amygdalı, Enderleın (Hymenoptera: Eurytomıdae)' Nın Biyo-Ekolojisi Ve Biyolojik Mücadele Süreci Üzerine Araştırma

Özet

Badem içkurdu olarak bilinen, *Eurytoma amygdali,* Enderlein (Hymenoptera: Eurytomidae), türü ; Türkiyenin de içinde bulunduğu Güneydoğu Avrupa ve Ortadoğu' da konumlanan farklı ülkelerde badem ağaçlarında görülen önemli bir zararlıdır. *E. amygdali*, Türkiye'de badem bahçelerinde önemli zarar oluştururken badem yetiştirilen tüm alanlarda görülmektedir. Türkiye'de badem üreticilerinin yaygın olarak uyguladıkları *E. Amygdali*'nin kimyasal mücadelesinde çoğunlukla başarısız olduğu bilinmektedir.. Bunun temel nedeni, zararlının biyolojik, ekolojik ve zarar verme bakımından farklılıklara sahip olmasıdır. Bu bağlamda çalışmaın temel amaç ve içeriğini; *E. amygdali*, (badem iç kurdu) ile biyolojik mücadele sürecinde öncelikle canlının biyo-ekolojisinin analiz edilmesi kapsamında; Nevşehir ili Avanos ilçesi Köy Bağı Mevkii ve Yukarı Mahalle Mevkii'lerinde bulunan iki farklı badem bahçesinde 2022 yılı süresince gerçekleştirilen gözlem ve incelemelerden elde edilen veriler oluşturmaktadır.

Anahtar Kelimeler: *Eurytoma amygdali, Badem, Parazit, Biyo-ekoloji, Biyokontrol, Nevşehir*

Giriş

Böcekler, Hayvanlar alemi içerisinde nitel ve nicel biyoçeşitliliği yüksek canlılardır. Ekosistemin dengeli işleyişinde kaynak poatansiyel taşırlar. Bunlar içerisinde Hymenoptera takımı yeryüzünün çok farklı habitatlarında varolabilen, ekolojik ve ekonomik etkisi önemli böcek takımlarındandır (Kekillioğlu; A., 2019).

Dünyada badem üretimi çoğunlukla Akdeniz'e kıyısı olan ülkelerde yoğunlaşmıştır. Dünya badem dikim alanlarının %61.63'ü Akdeniz'e kıyısı olan ülkelerde bulunmaktadır.Dünyada en fazla badem dikimi yapan ülkeler ise İspanya (544.518 ha), ABD (380.405 ha), Tunus (184.500 ha) ve Fas (165.817 ha) 'tır. Bu ülkeleri 33 bin hektar ile Türkiye 7. sırada takip etmektedir . Badem İçkurdu, Türkiye'nin her yerinde yılda tek döl veren (univoltine) monofag bir zararlıdır.Kışı, yere düşen bulaşık badem meyveleri içerisinde veya ağacın üzerinde mumyalaşmış bulaşık badem meyvelerinin içerisinde olgun larva döneminde geçirir. (Çağlar ve Işıkber , 2021)

Türkiye'de bulaşık meyve içerisindeki kışı geçiren olgun larvalar baharda pupa olmaya başlarken bulaşık meyvelerden erginlerin çıkışı delik açarak bahar ortasında (Nisan) başlayıp erken baharın sonlarına (Mayıs) kadar devam ettiği görülmektedir. Ergin dişiler, ovipozitörlerini kullanarak genç badem meyvelerinin (çağla) ekzo ve mezokarpı (meyve eti) delerek endokarpın iç kısmına yumurta bırakırlar. Her dişinin 80 yumurta bıraktığı bilinmektedir. Meyve etinin içerisindeki yumurtadan çıkan larva meyve özüne (embriyo) inerek meyvenin içini tamamen tahrip eder. Meyve özünü tamamen yiyen larvalar yazın sonunda olgun larva dönemine ulaştıktan sonra sonbaharda zarar görmüş meyve içerisinde kışı geçirmek üzere diyapoza girerler. (Barut, 2007; Çağlar ve Işıkber, 2021). Zarar görmüş meyveler ağaç üzerinde kalarak sağlam meyvelerden daha erken sararmakta, sonbahar ve kışın ağaç üzerinde kalarak siyahlaşır. Badem İçkurdu'nun mücadelesine yönelik bir strateji geliştirilmesi, zararlının biyonomisi (biyolojisi ve ekolojisi) hakkında bilgi sağlayarak başarılabilir. Bu zararlının gelişmesi ve hayatta kalması çevresel faktörlerle özellikle sıcaklıkla yakından ilişkilidir. Sıcaklık özellikle birinci ve ikinci (son) diyapoz larva dönemlerinin tamamlanması veya sonlandırılmasında önemli bir etkiye sahiptir. Bu bağlamda bulaşık meyvelerdeki olgun larvaların diyapozu tamamlanarak ergin çıkış zamanlarının belirlenmesi kimyasal mücadelenin başarısında büyük öneme sahiptir.

Materyal ve Yöntem

Bu çalışma nisan 2020 ile mayıs 2022 arasında yürütülmüştür.Çalışma iki farklı badem bahçesinde gerçekleştirilmiştir. Çalışmada araştırma sahası ve çevresinde yaygın olarak uygulanan mücadele yöntemi incelenmiştir.

Nevşehir ilinin Avanos ilçesi Köy Bağı mevkiinde *nounpreial* (yumuşak kabuklu badem) ve *teksas* (sert kabuklu badem) 10 yaşında, 120 adet badem ağacından oluşmaktadır. Tüm ağaçlar sulama sistemi ile sulanmaktadır. Nevşehir ilinin Avanos ilçesi Yukarı Mahalle mevkiinde bir *nounperial* bir *teksas* badem ağacı vardır. Bu iki ağaç 25 yaşında olup yağmur suyu ile sulanmaktadır.

Ergin bireyler yumuşak kabuklu nounperial bademleri delebildiği için onların içine yumurta bırakırlar.Badem İçkurdu'nun ergin çıkışlarını takip etmek amacıyla 15X15X15cm ve 30X30X30 (en - yükseklik - boy) boyutlarında alt tarafı sunta, etrafı sinek teliyle kafesler kullanılmıştır. Ağaçların güney-batı yönünün ergin çıkış zamanına ve pupa gelişimine etkisini belirlemek için badem ağacının dalların kafesler asılmıştır.

Uygulama sürecinde en önemli faktör, ergin çıkış zamanının belirlenmesidir. Buna bağlı olarak da verimli ürün alabilmenin koşulu olarak uygulanan ilaçlama zamanının belirlenmesidir.

Aynı sene hasta bademler toplanarak gözlem kulelerine yerleştirilmiştir. Gözlem kuleleri güney batı yönünde üç noktaya 20 nisan 2020 de asılmıştır. 12 mayıs 2020 bademlerden çıkan ergin böcekler görülmüştür. Aynı gün *Lance* isimli ilaç ile 100 litreye 60 gr şeklinde ilaçlama yapılmış don sebeyle ürün alınamamıştır.

Bir sonraki yıl 8 mayıs 2021 günü zararlının uçtuğunu görülmüştür. Yine aynı gün ilaçlama yapılmıştır. Bu kez Ninja 5EC isimli ilaç 100 litreye 60 gr dozunda kullanılmıştır. Ürün alınmıştır.

Sonraki yıl ise 10 mayıs 2022 günü zararlının uçtuğunu görülmüş, ilaçlama işlemi üreticinin kişisel sebeplerinden dolayı yapılamamış. Don sebebi ve ilaçlama yapılamaması ile ürün alınamamıştır. Ağaçlarda daha önce hiç görülmemiş olan şirin oluşmuştur.

Çalışma esnasında Nevşehir /Avanos Köy bağı mevkiinde badem iç kurdunun 8-12 mayıs zaman aralığında ilk erginlerinin görüldüğü tespit edilmiştir. Bu dönem çıkan ergin badem iç kurdu, ağaçlardaki yeni ürünlere yumurta bırakmak üzere devamlılığını sağlamıştır. Erginler badem üzerinde küçük yara izi bıraktığı belirlenmiştir. Yumurta bırakılan ürünlerin bir süre sonra kuruduğu, renginde sararma olduğu, bazılarının da ağaçtan döküldüğü gözlenmiştir. Badem içinde, 3-4 haftada yumurtadan çıktığı tespit edilmiştir. Bunu müteakip 12 günde de bademin içini tamamen boşalttığı izlenmiştir.

Çalışmanın böcek materyali Badem İçkurdu (*Eurytoma amygdali* Enderlein)'nun erginlerinden ve diğer dönemlerini (diyapozdaki larva, beyaz krem pupa (erken dönem pupa) ve siyah pupa (geç dönem pupa) içeren bir yıl önceden (2021) kalan bulaşık badem meyvelerinden oluşmuştur.

Bulaşık mumyalaşmış badem meyveleri Nevşehir ilinin Avanos ilçesi Yukarı Mahalle mevkii ve Köy Bağı mevkii badem bahçelerinde hasattan sonra ağacın üzerinden veya toprak yüzeyinden toplanmıştır. (Büken A., 2022)[1]. Badem İçkurdu'nun ergin bireyleri ve pupaları önceki yılın badem meyvelerinden elde edilmiştir.

Bulgular ve Tartışma

Taksonomi

Üst âlem:	Eukaryota
Âlem:	Animalia
Alt âlem:	Eumetazoa
Şube:	Arthropoda
Alt şube:	Hexapoda
Sınıf:	Insecta
Takım:	Hymenoptera
Alt takım:	Apocrita
Üst familya:	Chalcidoidea
Familya:	Eurytomidae
Alt familya:	Eurytominae
Cins:	Eurytoma
Tür:	***Eurytom. amygdali***

[1] Çalışma kapsamında, bahçe sahibi A. Büken'in görüş ve uygulamalarından yöntemsel olarak yaraalanılmıştır.

Biyo – Morfoloji

Ergin: Ergini siyah renkli bir arıcık olup, dış görünüşü ile tamamen kanatlı bir karıncayı andırır. Ön kanatlar hemen hemen üçgen şeklinde, saydam, renksiz, petrol parıltılı ve ortası hafif kahverengimsidir. Arka kanatlar böbrek şeklindedir. Dişileri erkeklere göre iri vücutlu olup karın nihayetinde belirgin bir yumurta koyma borusu taşırlar. Siyah renkte, sadece femur ve tibialarının uçları ile tarsi sarı renkte; kanatlar saydam ve madeni pırıltılı, başta integument nokta şeklinde çukurcuklar içerir, antenler 10 segmentli; abdomen erkekte yumurta şeklinde, dişide uca doğru sivrileşir, ovipozitör (yumurta koyma borusu) iyice belirgindir. Dişi 7-7.5; erkek 5.5–6 mm boyundadır.

Yumurta: Yumurtalar gayet küçük oval yapılı ve süt beyazı renginde olup biri kısa, diğeri uzun olan iki uzantıya sahiptirler.

Larva: Larvaları beyaz renkli ve bacaksızdır. Boyları normal duruşlarında (kıvrık) 4–5 mm, açılmış olarak 7–8 mm dir. Üzerleri vücut renginde seyrek kıllarla kaplıdır. Olgun larva beyaz renkte, bacaksız hafif kıvrıktır; boyu 6.0- 8.0 mm kadardır.
Pupa: Pupa başlangıçta beyaz renktedir. Zamanla kirli sarı bir renk alır, renk gitgide koyulaşır ve siyah olana kadar devam eder. Mevcut biyomorfolojik tanımlamalarımız; incelenen literatürlerden özellikle (Özbek vd., 1998; Barut 2007;Yeşilyaprak, 2015; Şimşek 2016) ile paralellik göstermektedir.

Biyo – Ekoloji

Dişi yumurtalarını her meyveye bir tane olmak üzere kabuk altına yerleştirir. Bir dişi 80 kadar yumurta yapar. Yumurtalar 3-4 haftada açılır, çıkan larvalar 12 gün içinde meyvede beslenir ve çekirdek evini tamamen tahrip eder. Kurtlu meyveler renk değiştirir, sararır sağlamlara oranla daha erken kurur. Sonbahar ve kış aylarında genelde, ağaçta kalan bu meyvelerin yüzeyi siyahlaşır. Badem içkurdu kışı ağaç üzerinde kalmış ya da yere dökülmüş badem meyvesi içinde olgun larva döneminde geçirir ve meyve içinde pupa olur. Larvalar ilkbaharda pupa olur, birkaç hafta sonra da erginler yaklaşık 2 mm çapında bir delikten dışarı çıkarlar. Doğada ilk erginlerin görünme zamanları Nisan ayı ortalarından Haziranın ilk haftasına kadar değişiklik gösterir. Doğu ve Güneydoğu Anadolu'da Mayıs başından itibaren başlamakta olup, daha sıcak bölgelerde çıkış biraz daha erken (Nisan) olmaktadır.Larvalar olgun hale geldikten sonra, ertesi ilkbahara, bazen de daha sonraki ilkbahara kadar kuru meyvelerde bekleyebilirler.

Konakçıları: Ana konakçı *badem* olsa da *erik* ve *kayısı* ağaçlarında da bulunurlar.

Zararı: Ergini, yumurtasını meyvenin içine koyarken, meyve üzerinde çok küçük yara izi oluşturmaktadır. Ancak meyve gelişimiyle birlikte iz belli olur. Asıl önemli zararı larvalar yapar. Larva saldırısına uğramış bademler sağlamlardan daha çabuk kuruyarak renk değiştirir. Üst kabuktaki açık yeşil renk kaybolur. Kış aylarında ise üst kabuk rengi tamamen esmerleşir. Beslenme ilerledikçe zamanla iç kısmını tamamen yiyerek boşaltırlar ve sadece meyve içinin kabuğu kalır. Erginin çıkış yaptığı meyvelerin kabuk kısmında yaklaşık 2 mm çapında çıkış deliği görülür. (Özbek vd., 1998)

Düşmanları (Larva Parazitoidleri):

Adontomerus amygdali (Torymidae; Hymenoptera)
Aprostocetus bucculentus (Eulophidae; Hymenoptera)

Avcıları
Chrysoperla carnae (Chrysopidae; Neuroptera)
Coccinella semptempunctata (Coccinellidae; Coleoptera)
Scymnus pallipediformis (Coccinellidae; Coleoptera)
Propylaea quatuordecimpunctata (Coccinellidae; Coleoptera)
Oenopia (Synharmania) conglobata (Coccinellidae; Coleoptera)
Syrphus spp. (Syrphidae; Diptera)
Orius spp. (Anthocoridae; Heteroptera)
Nabis spp. (Nabidae; Heteroptera)

Ülkemizde Uygulanan Mücadele Süreçleri;

Kültürel Mücadele: Badem ağaçlarında çeşitlere göre meyvenin kurtlanma oranında farklılıklar olduğu bilinmektedir. Eğer bu kurtlanmayan çeşitler pomolojik özellikleri uygunsa, yeni tesis edilecek bademliklerde bu çeşitler tercih edilmelidir. (Türkiye'de en çok kurtlanan badem çeşitleri: Nonpareil ve Picantily)(Günaydın ve Ekici, 1969)

Mekanik mücadele: Badem içkurdu ile bulaşık tüm bahçelerde hasat sırasında veya kış aylarında ağaçlar üzerindeki ve yere dökülen kurtlu bademleri toplayarak yakmak veya çok derin şekilde toprağa gömmek zararlıya karşı en etkin mücadele yöntemidir. (Nîzamlıoğlu, 1962)

Kimyasal mücadele: Kullanılacak ilaçlar ve dozları hakkında en yakın il veya ilçe müdürlüklerine başvurulmalıdır.Araştırma yaptığımız Avanos Bölgesi'nde bu yöntem geleneksel olarak kullanılmaktadır. (Büken A., 2022)

Sonuç

Sonuç olarak bu çalışmada Nevşehir ilinin Avanos ilçesi Yukarı Mahalle mevkii ve Köy Bağı mevkiinde farklı lokasyondaki badem bahçelerindeki ilk ergin çıkışlarının badem meyvesinin mercimek iriliğinde olduğu *8-12 Mayıs* tarihlerinde olduğu belirlenmiştir.Bu tarihlerde bölgede yaygın olarak kullanılan mücadele yöntemi, ilaçlama ile ekonomik zararın büyük oranda önüne geçildiği tespit edilmiştir.İlaçlamanın olmadığı ya da gözlem düzgün yapılmadığından geç ilaçlama yapıldığı zaman, sadece badem iç kurduna bağlı ekonomik kaybın %50'nin üzerine ulaştığı görülmüştür. Bölgede zaman zaman nisan/mayıs aylarında görülen don olayları; erken çiçeklenen badem bitkisini verim yönünden oldukça etkilediği bilinmektedir. Bununla birlikte badem iç kurduna karşı kimyasal mücadele de yapılmazsa verim kayıplarının %100'e ulaştığı da bilinmektedir.

Teşekkür

Bu çalışmada emeğini esirgemeyen çalışkan babam Abbas Büken ' e teşekür ediyorum (ÜY).

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ID:463

Challenges of Scientific Research in Molecular Biotechnology in Yemen

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Abstract

Research is achieved for the sake of contribution towards science and getting information systematically, starting from the collection, passing through interpretation and final evaluation of data and all that, in an organized manner which is called scientific research. Biotechnology includes the application both of older biological knowledge, which is based on structures, functioning, and development of animals and plants in their ecological setting, and of newer approaches, which are based on an understanding of genetics and on the cellular and subcellular processes. The development of biotechnology has given society an awesome new power and an equally awesome responsibility to use it wisely. Biotechnology is being applied in different areas of science such as agriculture, health, the environment, and many other aspects of science and industry. Most of these applications and developments are centered in the developed countries and the research is established by these notions. Currently, it has been obvious that biotechnology is crucial for notion's economic growth and sustainable development. Yemen, as one of the most developing countries, is suffering to emerge molecular biotechnology research in universities and research units. This is because of many issues that affect the soceity, goverment, and ultimatly the entire country, including society, human resources, facilities, infrastructure and environment resources, and stability. To conclude, the researchers in Yemen are surrounding by many challenges, which are starting in society and ending up in the laboratory. The research has very low priority on a long listbof priorities such as food, stability, security, and healthcare. All the challenges can be solved, but it will need a more educated society and serious government policy toward research as a tool to build a strong society.

Key Words: *Challenges, Biotechnology, Research, Researcher, Yemen.*

ID:464

Alkali Extraction Of Phenolic Compounds From Tomato Peel: Optimization Of Extraction Conditions And Investigation Of Phenolic Profile By Lc-Ms/Ms

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Abstract

With the increasing world population, the food need of humanity is increasing proportionally. Agricultural wastes constitute an important potential for the global economy as they contain components that are less preferred to be consumed as food due to their low bioavailability due to their indigestion in the human body or due to their sensory properties, but that may be beneficial to human health such as antioxidant substances and antimicrobial agents. The benefits of using these wastes in terms of economy and reducing environmental pollution are obvious. Tomato, which is one of the most used agricultural products in our country and in the world, is processed by removing its skins in the processing of many products. Tomato skins cause serious environmental problems and economic losses unless they are valorized. In this regard, this study aims to optimize the extraction efficiency, the antioxidant capacity and total phenolic content of the tomato peel extract according to the independent variables of temperature and time, while the alkaline extraction process applied to tomato skins is cheap and industrially applicable. Using response surface methodology, highest extraction yield (28.77 g/100 g dry extract), total phenolic content (3819,32 mg GAE/100 g dry extract), and total antioxidant capacity (2737.82 µmol Trolox/100 g dry extract) were obtained under extraction conditions at 100°C for 5.26 hours. According to LC-MS/MS results, tomato skins treated with alkali contain various phenolic acids and some flavonoids. The phenolic component found in the highest amount in the tomato peel extract was determined as p-coumaric acid (429.99 ± 38,53 mg/100 g dry extract). Other important phenolic components are ferulic acid (12.44 ± 2.06); 4-hydroxy benzoic acid (7.13 ± 1.01) and vanillin (2.47 ± 0.22) mg/100 g dry extract.

Key Words: *Tomato Peel, Antioxidant Capacity, Optimization, Alkaline Extraction, Phenolic Profile*

Domates Kabuğunun Alkali Ekstraksiyon Yöntemiyle Fenolik Bileşiklerinin Ortaya Çikarilmasi: Ekstraksiyon Koşullarinin Optimizasyonu Ve Fenolik Profilin Lc-Ms/Ms İle İncelenmesi

Özet

Artan dünya nüfusu ile birlikte insanlığın gıda ihtiyacı da orantılı olarak artmaktadır. Tarımsal atıklar küresel ekonomi için önemli bir potansiyel oluşturmaktadır çünkü bu atıklar antioksidan maddeler ve antimikrobiyal maddeler gibi insan sağlığına faydalı olabilecek bileşenleri içermektedir. Ancak bu bileşenlerin insan vücudunda sindirilebilirliklerinin düşük olması veya duyusal özellikleri, tarımsal atıkların gıda olarak tüketimini daha az tercih edilir kılmaktadır. Bu atıkların ekonomiye kazandırılması ve çevre kirliliğinin azaltılması açısından faydaları ortadadır. Ülkemizde ve dünyada en çok kullanılan tarım ürünlerinden biri olan domates, birçok ürünün işlenmesinde kabuğu çıkarılarak işlenmektedir. Domates kabukları değerlendirilmediği takdirde ciddi çevre sorunlarına ve ekonomik kayıplara neden olmaktadır. Bu bağlamda, bu çalışma, domates kabuklarından ucuz ve endüstriyel olarak uygulanabilir bir teknik olan alkali ekstraksiyon işlemi ile elde edilen ekstraktın ekstraksiyon verimini, antioksidan kapasitesini ve toplam fenolik madde miktarını sıcaklık ve zaman bağımsız değişkenlerine göre optimize etmeyi amaçlamaktadır. Yanıt yüzey metodolojisi kullanılarak en yüksek ekstraksiyon verimi (28.77 g/100 g kuru ekstrakt), toplam fenolik madde (3819,32 mg GAE/100g kuru ekstrakt) ve toplam antioksidan kapasite (2737.82 µmol Trolox/100 g kuru ekstrakt) elde edilmiştir. 5.26 saat boyunca 100°C'de ekstraksiyon koşulları altında LC-MS/MS fenolik profil sonuçlarına göre alkali ile muamele edilen domates kabukları çeşitli fenolik asitler ve bazı flavonoidler içermektedir. Domates kabuğu ekstraktında en yüksek miktarda bulunan fenolik bileşen p-kumarik asit (429,99 ± 38,53 mg/100 g kuru ekstrakt) olarak belirlenmiştir. Diğer önemli fenolik bileşenler ise ferulik asit (12.44 ± 2.06); 4-hidroksi benzoik asit (7.13 ± 1.01) ve vanilin (2.47 ± 0.22) mg/100 g kuru ekstrakt.olarak tespit edilmiştir.

Anahtar Kelimeler: *Domates Kabuğu, Antioksidan Kapasite, Optimizasyon, Alkali Ekstraksiyon, Fenolik Profil*

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Vertical Axis Maglev wind Turbine having Various Designs

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Abstract
Renewable energy sources like turbines are gaining additional importance in recent years as apprehension of setting pollution has increased. Several developments have taken place to utilize star and wind energy. Wind is gift all over in the slightest degree time however wind turbines are present in few places to get power. An effort has been created to create use of wind even from tiny regions by developing paradigm of vertical axis wind turbine mistreatment railroading suspension to harness power. A new approach of getting placed the magnets (double finished arrangement) has been experimented during this work. The aim is to use straightforward material as turbine blade and generate power by magnetically levitated system. A brand new means of putting the ND magnet and coils were deployed on the wind turbine plates and experimented during this work. On rotation of the wind turbine the magnetic arrangement would produce axial flux whereas passing over copper coil arrangement.
Keywords: *turbine-Blades, Magnetic Levitation, Magnets, Wind Energy,*

Introduction

Presently a day, we will eventually have to look for inexhaustible or basically limitless fuel hotspots for the human turn of events to proceed. Environmentally friendly power is for the most part power provided from sources, for example, wind power, sunlight based force, geothermal energy, hydropower and some others. The requirement for the environmentally friendly power is high from most recent couple of a long time because of the weariness of regular power age strategies. The utilization of environmentally friendly power is the as it were thing that diminishes the reliance of human on petroleum products. Among the wide range of various environmentally friendly power sources Wind Energy is one of the quickest developing fuel sources which is developing at the pace of 30% yearly diagram.[2]

The breeze speeds in Asian nations is extremely low, particularly in the urban areas, and this much measure of wind speed isn't sufficient to begin the breeze factory. This undertaking presents structure and guideline of the proposed attractive levitation wind turbine for better use of wind energy. In Maglev Wind turbine there is no grating, and subsequently it can deal with low speed. The Maglev wind turbine configuration is a huge take off from customary propeller plans. Its fundamental preferences are that it utilizes frictionless orientation and an attractive levitation plan and it doesn't have to tremendous spaces needed by more regular breeze turbines. It additionally requires nearly nothing if any support. The Maglev wind turbine was first uncovered at the Wind Power Asia display in Beijing 2007. The exceptional working standard behind this plan is through attractive levitation. Attractive levitation is as far as anyone knows an incredibly proficient framework for wind energy. The vertically situated edges of the breeze turbine are suspended noticeable all around supplanting any requirement for metal rollers.(T G Sriganesh, G J Naveen, Vishnu P)

Wind power terminology:

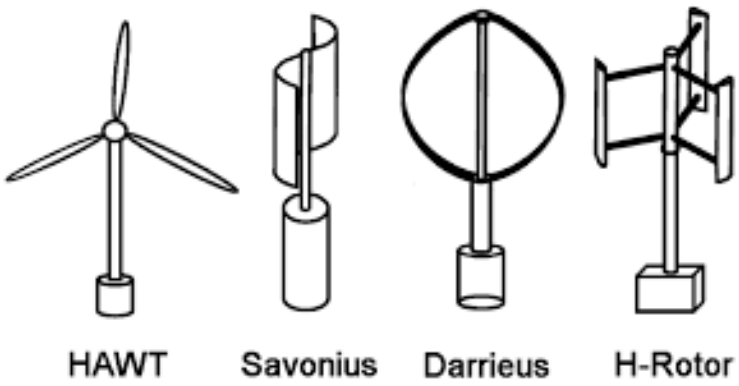

Figure 8 Maglev Vertical Axis Wind Turbine

Sujata R. Ingle, Ambika prasad O. Chaubey have shown the effectiveness of the breeze turbine is subject to wind availability, in the event that the measure of wind is adequate breeze turbine sharp edges are turning continuously. The wind is hits the cutting edges of the turbine, the force age by the cutting edges can be determined as,
Dynamic energy (K.E) = ½ mv2 Measure of Air cruising is given by,
m = ρ AV (1)
Subbing this estimation of the mass in articulation of K.E,
K.E = ρAv3 Watts (2)
To change control over to kilo watt a non-dimensional proportionality steady k is presented where,
k = 2.14 X 10-3
Along these lines, Force in KW (P) = 2.14 ρAv3 x10 (3)
Where,
m = Mass of air navigating
A = Area
Air Density (ρ) = 1.2 kg/m3
Cleared by the sharp edges of the turbine
Speed (V) = wind speed with condition over, the force being created can be determined, anyway one should take note of that it is preposterous to expect to change over all the intensity of the breeze into power. The turbine assimilates the breeze energy with their individual edge will move more slow that the breeze speed. The distinctive speed creates a drag power to drive the sharp edges. The drag power for following up on one sharp edge is determined as

$$Fw = \mathrm{Cd2A}\,\frac{Uw - Ub}{2}$$

Where,
A - Swept territory of the cutting edge
ρ - Air thickness (about 1.225 kg/m3 adrift level)
Uw - Wind speed
Cd - The drag coefficient (1.9 for rectangular structure)
Ub - The speed on the edge surface.

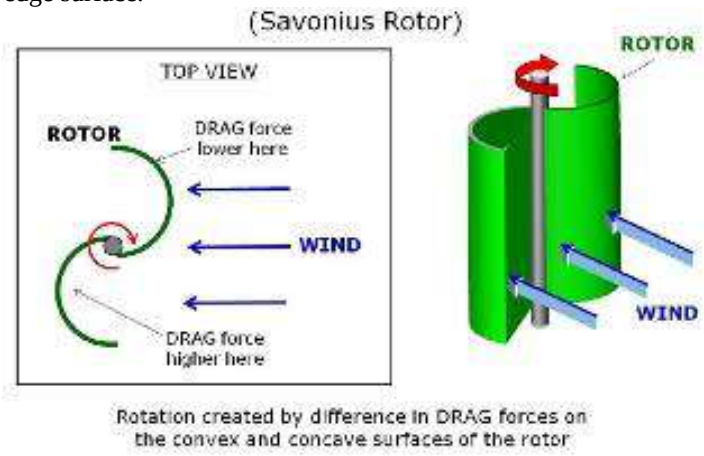

Figure 9 Drag- Based Wind Turbine Concept

Principle and types of magnetic suspension:
research on Magnetic suspension way that an item is suspended through magnetic enchantment and/or repulsion forces to reap non-touch guide and low-friction in motion.
Due to no mechanical contact in the attractive bearing, it has numerous points of interest, including no wear, no defilement, reasonable for long haul use in vacuum and destructive climate, no mechanical grinding, low commotion, low force misfortune and no need of grease or fixing. In this manner, attractive suspension innovation can be utilized for fast applications to kill mechanical issues identified with oil and force misfortune.
Attractive levitation is a technique wherein an article is suspended with no help other than attractive fields. The attractive power created is utilized to neutralize the impacts of gravitational power and lift up the item. By putting these two magnets on top of one another with like polarities confronting one another, the attractive shock will be solid enough to get both the magnets a good way off far from one another. There are numerous preferences for using attractive levitation that is to limit contact, make power estimation, plan, and engaging gadgets. As of late,

this development innovation is applied into transportation framework in which non-leading vehicle travel securely at extremely rapid while suspended, guided, and moved over a guide path by attractive fields. The idea of attractively suspended vehicle invigorated the turn of events of helpful application in different fields, for example, power age.

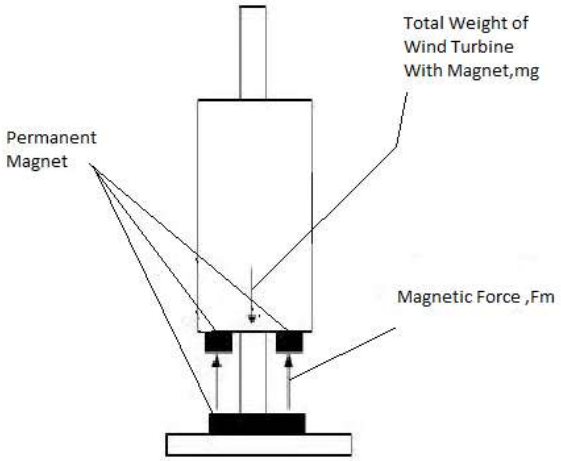

Figure 10 Free body diagram of magnetically levitated object

Working Principle:

This is the overall schematic graph of attractive levitation vertical hub wind turbine by which the force is created by utilizing Faraday's first law of acceptance which expresses that "Any place a conductor is put in a fluctuating attractive field, emf are instigated which is called incited emf, if the conductor circuit are shut, current are likewise actuated which is called initiated current." The breeze energy turns the breeze turbine cutting edges which are fixed to circle and to which magnets are fixed and attractive motion of these magnets joins with the loop which is put on the base of the maglev wind factory.[3]

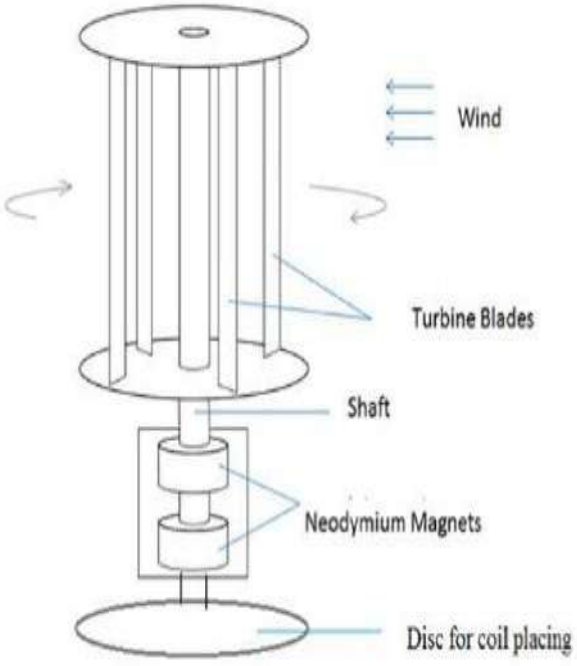

Figure 4 Sketch and components of maglev wind turbine

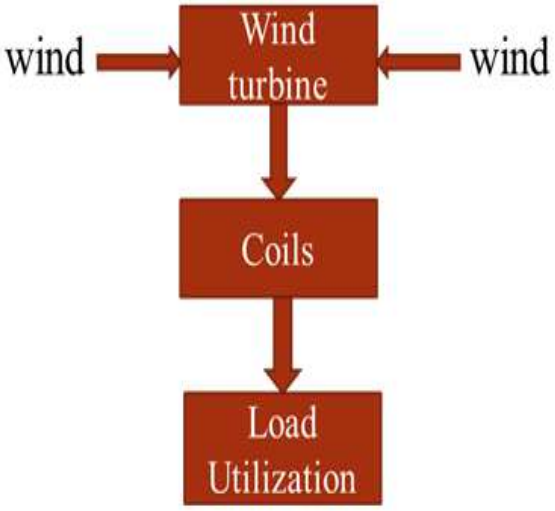

Figure 5 Block diagram of maglev wind turbine

Advantages:

- A monstrous pinnacle structure isn't needed, as VAWT's are mounted nearer to the ground.
- These are found nearer to the ground and subsequently simpler to keep up.
- No such oil requirements.
- Capable of creating power from wind speeds as low as 1.5 m/s and answered to work in breezes arriving at 40 m/s.
- Producing 20% more energy than a regular turbine, at once shrinking operational expenses by half over the customary draft turbine.
- Better response to quickly evolving winds.
- Lighter weight towers

Future Scope:

Future work could involve examination of the impact of following points of view talked about beneath on the presentation of the current rotor.

- By utilizing modernized cutting edges for Savonius rotor, the force of the rotor can be expanded to deliver more force at even low speeds.
- Design identified with self-flexible End Plates can be created to draw in more air to go through the cutting edges via programmed formation of weight differential across gulf and source.
- In this plan we can put Solar Plate and can get multiplied power with a similar spot being use

Conclusion

The idea of vertical hub wind turbine utilizing attractive levitation effectively worked. Contrasting with customary even wind turbines, single maglev wind turbine having enormous limit gives more yield. The turbine productivity is improved by usage of magnets assisting with turning with quick speed with insignificant grinding as it offsets the weight on the shaft of the turbine. The standard windmills having set of 1000 windmills powers 5 lakh homes while single maglev wind turbine is fit providing capacity to 7.5 lakh homes. The necessary zone for single maglev windmill is under 100 sections of land while field of 1000 windmills require in excess of 64000 sections of land. From this perception we can say that a solitary maglev wind turbine is conservative contrasted with traditional breeze turbine.

Regarding huge scope power creation, vertical hub wind turbines have not been known to be appropriate for these applications.. A mortgage holder would have the option to separate free clean energy subsequently encountering a decrease in their utility cost and furthermore add to the "Environmentally friendly power Energy" mindfulness that is progressively picking up ubiquity.

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Express Determination Of Ecotoxicantic Volume Substances In Waste Water Formed In The Process Of Hydrogen Purification Of Petroleum Oils

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Abstract

The hydrogen treatment plant for petroleum distillates and other oil distillates at the Heydar Aliyev Oil Refinery is considered to be more environmentally and economically efficient than the old classical technological plants.As it is known, so far the complete reduction of emissions has not been achieved during the technological processes of oil refining in the developed countries of the world oil industry

One of the main directions of our research is the initial assessment of the environmental impact of wastewater generated at the facility.The following analyzes were performed for this purpose.

Spectral analysis of volatile ecotoxicants in water samples taken from wastewater formed during the hydrogenation of Autol 8 and Autol 15 oil distillates as catalysts as the main raw material was carried out in the above-mentioned facility [1-3].

We use gas chromatography-mass spectrometry method for the analysis of aromatic hydrocarbons in polystyrene wastewater; optical emission spectrometry method for metals; spectrometry method for phenols, dyes and fluorine; nephelometry method for turbidity; gravimetry method for common suspended particles.

The results obtained during laboratory measurements by taking water samples from the general wastewater outlet of the facility in accordance with the known methods are shown below (Table 1).

As can be seen from the results obtained from the tables, the reasons for the formation of all volatile organic and inorganic substances with all ecotoxicant properties in the water sample taken from the plant of the refinery can be explained as follows:

- Chemical transformations of hydrogen gas with Autol 8 and Autol 15 distillates due to the presence of sulfur, nitrogen, oxygen, phosphorus organic compounds, various mixtures of hydrocarbons and metal salts and catalysts, pressure and temperature up to 280-310^{0}C. resulting in volatile ecotoxicants.
- Although the individual quantities of the refinery are less than normal, as can be seen from the table, their total amount is very high and toxic.

Table 1. Results of analysis of industrial wastewater

Assigned indicator	Amounts. mg/l
Polycyclic aromatic hydrocarbons	
Naphthalene	9.8
Acenaftilen	0.06
Acenaften	0.06
Fluoren	0.17
Fenantren	0.27
Anthracene	0.18
Fluorant	0.23
Pyrenees	0.36
Benz (a) anthracene	0.34
Krizen	0.53
Benz (b + j + k) fluorescent	0.30
Benz (a) pyrene	0.18
Inden (1,2,3-cd) pyrene	0.08
Benz (ghi) perilen	0.09
Dibenz (ah) anthracene	0.09
∑ 16 Polycyclic aromatic hydrocarbons	12.7

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Role of lactic acid bacteria in food preservation

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Abstract

Organic molecules are used as electron acceptors and/or donors to generate energy in food fermentation process. The preservation of food products by using lactic acid bacteria (LAB) has gained increasing interest since it is cheap and typically requires no or medium heat. LAB are Gram-positive, non-spore-forming, microaerophilic or anaerobic bacteria that produce lactic acid as the major end product of fermentation. LAB are typically catalase and cytochrome negative, fastidious, aerotolerant, and acid tolerant. LAB are classified into two groups as *homofermentative* and *heterofermentative bacteria*. While the homofermentative LAB (all species of Lactococcus, Pediococcus, lactic Streptococcus, and some species of Lactobacillus) convert most sugars to lactic acid quantitatively, the heterofermentative LAB (all species of Leuconostoc and some species of Lactobacillus) produce ethanol/acetic acid and carbon-dioxide in addition to lactic acid. Several food products including meat and fish, dairy, vegetables, cereals and fruits have gone through fermentation process where the existence of lactic acid bacteria due to their distinctive metabolic properties. The aim of this review is to discuss the importance of lactic acid bacteria in food preservation and give information about some significant fermented foods.

Keywords**:** *lactic acid bacteria, fermentation, food preservation*

Introduction

Food fermentation is the process of utilizing microorganisms to produce food or modify its properties. Production of fermented foods is one of the earliest methods on food processing techniques. Methods used for fermenting meats, milks, and vegetables have been documented since the beginning of civilization. The earliest records were dated to 6000 BC and the civilizations of the Fertile Crescent in the Middle East (Fox, 1993).

Fermentation was carried out coincidently which led to low efficiency and uncertain final product quality in the past. The traditions developed by processing and preserving specific raw materials in a particular way led to the formation of foods which has desirable and attractive properties organoleptically in addition to preserving the food quality. Nowadays, a few starting cultures are used in industrial production. On the other hand, traditional food products generally rely on the spontaneous fermentation (Leonard et al., 2021).

Not many fermented foods are safe to consume immediately since the occurrence of some biochemical changes. Due to the development of certain flavoring chemicals, such as carboxylic acids, diacetyl, aldehydes, ketones, and esters, the maturation process helps to food products to achieve stability and improve the sensory quality. These factors are useful on fermented foods to become more acceptable by consumers in addition to the health benefits and better sensory qualities of these foods (Admassie, 2018).

Preservatives are food additives, in accordance with Europian Union (EU) regulations, which protect the foods against the microorganisms (fungi and/or bacteria) and extend the shelf life of foods. Sodium chloride, also known as salt, is likely the oldest preservative which still in use today. Organic acids used as preservatives in foods have a low pH include acetic acid (E260), propanoic acid (E280), benzoic acid (E210), and sorbic acid (E200). Nitrates and nitrites are used to prevent *Clostridium* botulinum growth in foods containing raw meat, such as salamis, ham, bacon, and sausage. On the other hand, sulphur dioxide (E220) and sulphites (E221-E226 and 224-228) are frequently added to dry fruits, juices, and wines to inhibit the growth of microbes. Antibiotics like nisin (E234) and natamycin (E235) are also used to prevent the growth of bacteria and fungi in a variety of foods (Silva & Lidon, 2016).

Chemical preservatives can show an adverse effects on some food products ccording to the several studies. For instance, the EU's Scientific Committee for Food (Directive 2008/7/CE, 2008) reported (on September 22, 1995) that nitrates in meat products are transformed into nitrites (i.e. by heating). Voss (2002), claimed that sulfur dioxide may led to degradation of thiamine, and using this chemical might result with vitamin B_1 loss. In addition, sorbic acid and sorbates can lead to possible allergies and are typically defined as urticarial (Voss, 2002; Abdulmumeen et al., 2012).

The use of microorganisms and their metabolites in a biological way to preserve food, termed as biopreservation, has received a lot of attention in recent years as a result of consumers' growing knowledge of the risks of chemical preservatives to their health. Several characteristics are needed to be met by microorganisms for natural preservation such as safety, the production of non-toxic metabolites, retaining high activity during storage, and the lack of any detrimental effects on the product's sensory attributes (Muhialdin et al., 2020a).

The aim of this study is to provide information on the effectiveness of lactic acid fermentation in boosting food safety as well as the activity of LAB against pathogens such as bacteria, yeast, and filamentous fungi. The role of lactic acid bacteria in food preservation will be addressed, and some noteworthy fermented foods will be mentioned.

LAB

Lactic acid fermentation is used to acidify milk, which results in the creation of fermented dairy prodcuts including cheese, yogurt, butter, sour cream, etc (Muhialdin et al., 2020b). Additionally, the method is utilized to mature cold cuts and is responsible for the production and stabilization of vegetable silage and sourdough. Both homo- and heterofermentative LAB are involved in the fermentation process. The bacteria belonging to the genera Lactococus, Streptococcus, Lactobacillus, Leuconostoc, Pediococcus, Weisella, and Bifidobacterium are the most common cultures employed in the processes of lactic acid fermentation.

Some LAB strains perform homofermentation by converting disaccharides to nearly pure lactic acid. On the other hand, in heterofermentation process, ethyl alcohol, carbon dioxide, hydrogen peroxide, diacetyl, acetoin, and acetic aldehyde are produced in addition to lactic acid as a result of the breakdown of lactose compound (Mandha et al., 2021). The basic fermentation method is lactic acid fermentation. Due to the predominance of LAB, which can adapt to the low pH easily, the natural pH decrease during the fermentation process does not have a harmful effect on the effectiveness of biochemistry (Wang et al., 2007).

LAB show the specific characteristics as nonsporulating, Gram-positive, rods and cocci. Lactic acids are one of the main fermentation products. They can only phosphorylate substrates at the level of the molecule to produce energy since they lack cytochromes and porphyrins and are unable to perform electron transport phosphorylation. They belong to the group of obligatory or relative anaerobes and can survive in acidic pH values (Hurtado et al., 2012).

In addition to being used in the food industry and generally recognized as safe (GRAS), LAB also make up the natural microflora of human intestines. Even though they produce a variety of metabolites with antimicrobial action during the growth and fermentation processes, LAB are crucial in the context of biopreservation. These metabolites include lactic acid, hydrogen peroxide, acetic acid, low molecular weight substances (diacetyl, fatty acids, reuterin, and reutericyclin), antifungal compounds (phenyl lactate, propionate, and hydroxyphenyl lactate), and bacteriocins (Castellano et al., 2017).

Lactic acid bacteria's metabolic activity

Although lactic acid bacteria can grow at temperatures as low as 5°C and as high as 45°C, they are mostly classified as mesophilic. Similar to this, some strains are active at pH 9.6 and others are at pH 3.2, while the bulk of bacteria grow between pH 4.0-4.5. For the microbial growth, strains are typically lipolytic and proteolytic and needed preformed amino acids, purine and pyrimidine bases, as well as B vitamins (Stamer, 1976). Since none of the lactic acid bacteria have functional heme-linked electron transport chains or functioning Krebs cycle, they all create lactic acid from hexoses and get their energy through substrate level phosphorylation.

The lactic acid that is created can either be L (+), D (-), or a combination of these two. Since D (-) lactic acid cannot be metabolized by humans, it should not be given to infants or young children (World Health Organization, 1974).

Homofermentative and heterofermentative lactic acid bacteria are classified according to the mechanisms through which hexoses are metabolized:

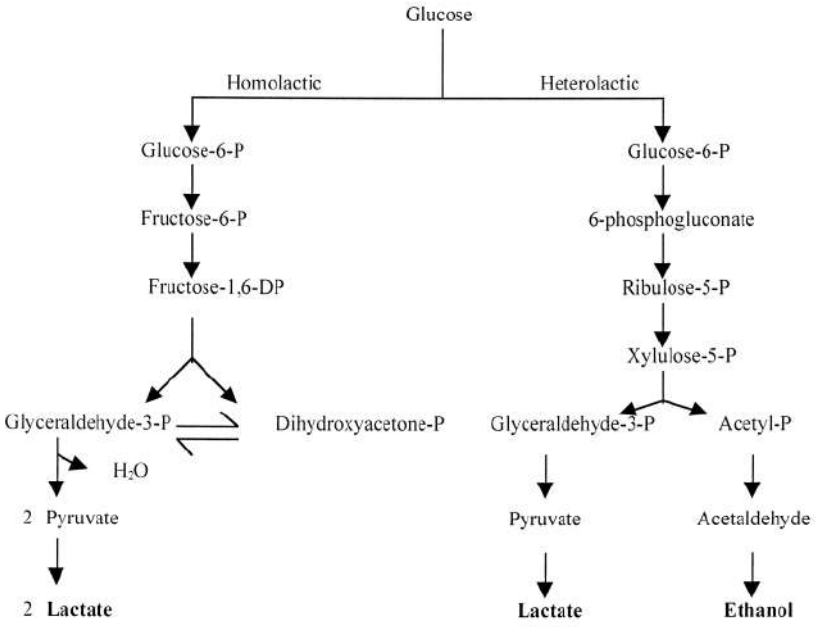

Fig 1. The scheme for lactic acid bacteria to ferment glucose (Caplice & Fitzgerald, 1999).

Mechanisms of lactic acid bacteria-mediated antibiosis

The production of organic acids, carbon dioxide, diacetyl, hydrogen peroxide, broad-spectrum antimicrobials like reuterin in addition to bacteriocins are only a few of the specific antimicrobial processes of lactic acid bacteria that are used in the biopreservation of food products (Vuyst & Vandamme, 1994a). These factors are believed to contribute to the inhibitory impact of Microguard. To prevent the growth of molds and gram-negative bacteria, Propionibacterium freudenreichii subsp. shermanii ferments skimmed milk. This product is then pasteurized and added as a generally recognized as safe (GRAS) food preservative to the most cottage cheese production in the United States.

Bacteriocins

The majority of the proteins in the bacteriocins group are generally thermostable and have antibacterial capabilities. Bacteriocins are considered to used by adhering to phosphate residues on the target cells' cell membranes, which opens pores and activates an enzyme called autolysin which breaks the bacterial cell walls (Papagianni & Anastasiadou, 2009). Bacteriocins are cationic and hydrophobic peptides that range in size from 20 to 60 amino acids. Furthermore, ribosomal machinery is the foundation of their synthesis. Operons in plasmids, chromosomes, and other genetic organelles are home of the bacteriocin-encoding genes (Hernández-González et al., 2021).

Bacteriocins' ability to combat bacteria, fungi, viruses, parasites, and other natural structures like biofilms is one of its most significant characteristics. The classification of bacteriocins produced by LAB based on three primary classes was proposed by Alvarez-Sieiro et al. (2016). Modified, heat-stable, and low-molecular-weight peptides consist of uncommon amino acids like lanthionine are included in class I. Unmodified thermostable, low molecular weight bacteriocins make up class II. And finally, only the last class contains high molecular weight and thermolabile compounds (Pérez-Ramos et al., 2021). Their actions can be bactericidal or bacteriostatic toward species connected to the strain . Bacteriocins are produced in response to environmental factors such as nutrient availability, bacterial cell density, acetic acid, and the presence of signal peptides. Their main structure serves as the foundation of their activity mechanism. Other bacteria's gene expression and protein synthesis can be effected by some bacteriocins when they enter their cytoplasm. However, some of them have the ability to act on the cytoplasmic membrane, causing the release of essential chemicals from sensitive microorganisms and resulting in cell lysis.

Additionally, a number of bacteriocins show synergistic effects with antibiotics, lowering the side effects and impairing the focus. It is widely known that they have synergistic effects on *Listeria monocytogenes* and *Staphylococcus aureus* when combined with other biomolecules like citric acid and nisin. However, it is crucial to note that the resistance of the aforementioned bacteria to bacteriocins is modest in comparison to that of the bacteria to conventional antibiotics (Soltani et al., 2021).

Organic acids and acetaldehyde

Organic acids such as lactic, acetic, and propionic, which may be formed by lactic acid bacterial fermentation of foods, have well-known antibacterial properties directly (Davidson et al., 2012). The impact of the acids on the bacterial cytoplasmic membrane, which interferes with the preservation of membrane potential and hinders active transport, is thought to be the cause of the antagonistic interaction (Cherrington et al., 1991). At a given molar concentration, not all of the acids exhibit the same antibacterial effect. Bacteria, yeasts, and molds can all be inhibited by acetic acid, which is more inhibitory than the lactic acid (Blom & Mørtvedt, 1991). Propionic acid, which is present in Microguard, inhibits bacteria and fungi and is also present in Bioprofit, a commercial product where the combination of a *Propionibacterium freudenreichii* strain and *Lactobacillus rhamnosus* increases the inhibitory activity against fungi and some gram-positive bacteria. Since the flavor threshold is significantly lower than the amounts to be required to enable microbe suppression, acetaldehyde's contribution to biopreservation is minimal (Frank & Marth, 1977).

Carbon dioxide

Some aerobic food microorganisms are poisoned by carbon dioxide, which is produced during heterolactic fermentation and can directly produce an anaerobic environment. It also has the ability to lower the internal and external pH, which has a negative impact on some aerobic food bacteria. Some bacteria may grow more rapidly when it is present in low concentrations (Vuyst & Vandamme, 1994b).

Hydrogen peroxide (H_2O_2)

True catalase, which is required to degrade the hydrogen peroxide produced in the presence of oxygen, is absent in lactic acid bacteria. According to some studies, H_2O_2 can build up and hinder some microorganisms. The high oxidizing action on cell proteins and membrane lipids mediates inhibition. By forming hypothiocyanate and other antimicrobials, hydrogen peroxide may also activate the lactoperoxidase system in fresh milk. It is unclear how much H_2O_2 contributes to antibacterial action in vivo because other enzyme systems, such flavoproteins and peroxidases, can break down the H_2O_2 (Nagy et al., 1991).

Fermented foods

Foods produced or preserved by the action of microorganisms include a variety of fermented foods. When used in this context, the term "fermentation" usually refers to the conversion of sugar to alcohol using yeast. However, other fermentation processes, including the production of foods like yogurt and sauerkraut, also require bacteria like lactobacillus. Today, people's diet includes several fermented foods. The primary raw materials used in the industrial production of most well-known fermented foods are listed as milk, meat, cucumber, and cabbage. These produce a vast array of yoghurt and fermented milk drinks, fermented sausages and salamis, pickles, and sauerkraut (Jay et al., 2008).

Table 1. Common fermented foods

Type	Main Ingredient	Microorganism(s)	Country	References
Yogurt	Milk	*Lactobacillus bulgaricus, Streptococcus thermophilus*	International	(Singh et al., 2021)
Kimchi	Cabbage, radish, salt	*Pediococcus, Weissella, Lactobacillus, Leuconostoc*	Korea	(Lee et al., 2015)
Cucumbers	Cucumbers, garlic, salt	*Enterobacter, Leuconostoc mesenteroides, Levilactobacillus brevis (Lactobacillus brevis), Lactiplantibacillus plantarum (Lactobasillus plantarum)*	International	(McFeeters & Pérez-Díaz, 2010)
Sauerkraut	Cabbage, salt	*Leuconostoc mesenteroides, Lactococcus lactis, Levilactobacillus brevis (Lactobacillus brevis), Lactiplantibacillus plantarum (Lactobacillus plantarum), Lactobacillus pentoaceticus*	International	(Snyder et al., 2020)
Villi	Milk	*Lactococcus lactis subsp. cremoris, Lactococcus lactis subsp. lactis, Leuconostoc mesenterie*	Nordic countries	(Luo & Deng, 2016)
Sourdough	Flour, water	*Enterococcus, Lactobacillus, Lactococcus, Leuconostoc, Pediococcus, Streptococcus, Weissella*	International	(Marco et al., 2017)
Kefir	Milk	*Lactobacillus, Lactococcus, Leuconostoc, Oenococcus, Pediococcus, Streptococcus*	International	(Gul et al., 2015)
Kenkey	Maize	Unknown	Ghana	(Halm et al., 2004)
Mahewu	Maize	*Lactobacilli*	South Africa	(Fadahunsi & Soremekun, 2017)
Ogi	Maize	*Lactic bacteria*	Nigeria, West Africa	(Onyekwere et al., 2004)
Olives	Green olives	*Ln. mesenteroides, Lb. plantarum*	Mediterranean	(Hurtado et al., 2012)
Nan	White wheat flour	*Saccharomyces cerevisiae,* Lactic acid bacteria	India	(Tamang et al., 2016)
Oncom	Peanut press cake	*Neurospora intermedia, or Rhizopus oligosporus*	Indonesia	(Sastraatmadja et al., 2002)
Gari	Cassava root	Lactic acid bacteria *(Lb. plantarum)*	West Africa	(Irtwange & Achimba, 2009)

Conclusion

In the placement of chemical and/or physical methods which are typically seen as harmful to the product's quality and consumer health in the food preservation, biopreservation may provide a biological alternative to these methods. Considering the capacity to enhance nutritional content of food products by producing some vitamins, organic acids, and other substances, biopreservation based on the utilization of LAB and their metabolites may be linked with an improvement in food safety as well as other advantages for human health. Many food products all over the world are benefited from lactic acid fermentation in terms of safetiness, nutritional content, shelf life, and

acceptability of food products. It can be described as useful technology since it combines economical household-level techniques to extend the shelf life, improve the sensory characteristics, increase the safety, and boost the nutritional content of foods. More research on technological advancement, technology transfer and socioeconomic effects of lactic acid fermentation are needed to maximize the potential of this technology.

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ID:471

Phosphate solubilizing bacteria (PSB) isolation from tomato rhizospheres at Koka district, Ethiopia.

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Abstract

Phosphorous is an essential macronutrient for plant growth and development. Most of the soil is deficient in plant available phosphorous and due to economic limitations majority of Ethiopian farmers applied inadequate fertilizers. It is essential to stabilize a mechanism to access P for plants with an efficient, cheap, and eco-friendly approach for enhanced crop growth and production. The main objective of this study was to screen efficient phosphate solubilizing bacteria from tomato rhizosphere soil. Using halo zone formation on PVK agar medium more than 400 PSB were isolated from 13 rhizosphere soil samples. By evaluating SI, texture in the culture-re-culturing process, liquid medium pH change efficiency, OD reading and CFU, upmost three promising PSB isolates (K-1-29, K-10-27, and K-10-41) were selected. Five days of incubation of isolates in PVK broth showed significant pH reduction. For instance, isolate K-10-41 showed significant pH reduction (4.02) which indicates organic acid production. Isolation and evaluation of efficient phosphate solubilizing bacteria maintain soil fertility, promote plant growth, induce plant response to pathogens, reduce agrochemical consumption and promote sustainable agriculture. Therefore, these selected PSB isolates need further detailed study for taxonomic identification, plant growth promotion, host range, and phytopathogen response. Local isolation improves environmental adaptation and indigenous competition.

***Keywords*:** *Koka, biofertilizers, phosphorous, PSB, tomato*

ID:472

Trend and Temporal Variation of Droughts in East Wollega Zone, Western Ethiopia

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Abstract
Drought is one of the most serious environmental, social, and economic issues facing the world today. This study looked at the pattern and temporal variation of drought in East Wollega Zone, Western Ethiopia, from 1981 to 2017. The daily rainfall data of seven stations for 37 years (1981-2017) was collected from National Meteorological Agency of Ethiopia. The study utilized multi-index approach drought indexes such as Standardized Precipitation Index (SPI), Standardized Precipitation Evapotranspiration Index (SPEI), Rainfall Anomaly Index (RAI), Palmer Drought Severity Index (PDSI), Deciles Index (DI), Reconnaissance Drought Index (RDI), Percent Normal Precipitation Index (PNI), Z-Score (ZSI) and Precipitation Concentration Index (PCI) using R and DrinC software. The result of the study revealed a declined trend of rainfall while the trend and frequency of drought increased. All of the drought indexes agreed that the years 1999-2005 were the worst hit by drought. The trend of annual rainfall deviation from normal was increased while it was decreased on seasonal basis. The temporal precipitation distribution of the area was moderate for 22 years (59.46%) and irregular rainfall distribution for 15 years (40.54%). The diminishing rainfall and increased trend and frequency of drought should be taken into account when making agricultural system decisions and planning adaptation in the area.
Keywords*: Drought, Trend, Rainfall, Variation, Drought indexes*

ID:473

Meat Quality Packaging by Application of Novel Edible Film and Coatings: A Review

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Abstract

Meat is an important component of modern diet and perishable food commodity. In 2021 all over the world 346.14 million tons meat was consumed and expecting to increase 453 million tons within 10 years. So it gain greater attention, proper processing and packaging practices are need to extend its shelf life and reduce the quality degradation of meat. In quality preservation, packaging is a supreme important factor but there is a need that packaging material should be environment friendly and non-toxic to human health. As consumer also demands for high quality, low cost, sustainable and natural food packaging. In this regard there is an increasing demand of organic and edible source based film and coatings that reduces the packaging waste. The organic compounds used in edible packaging are protein (milk, collagen and soy protein), polysaccharides (cellulose, pectin and starch) and lipids (essential oil and waxes). They act as barrier properties against water, light and gasses with excellent transparency, mechanical strength, sensory perceptions and extend the shelf life. The functionality of edible film and coating can be improved by adding the novel agents such as antioxidants (essential oils), antimicrobial (gallic acid and lactoperoxidase) and plasticizers (glycerol and sorbitol). Application of edible film and coatings in the meat industry by foaming, spraying, casting, brushing, wrapping and rolling. The purpose of study is to briefly explain the novel component of edible film and coatings; their formulation, application methods, research and developments of film wrapped or coated meat or meat products and their future trends.

Keywords: Meat, Packaging, Film and coatings.

ID:474

Assessment Of The Water Quality By River Pollution Index For Ergene River Basin: A Gis Based Stream Network Analysis

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Abstract
Ergene River is the most significant aquatic ecosystem of Thrace Region of Türkiye. But unfortunately, it is being exposed to an intensive pollution. In this research, water quality of Ergene River Basin was evaluated by using River Pollution Index (RPI). Surface water samples were taken from 25 stations selected on the watershed in summer season of 2020. Total of 4 variables including dissolved oxygen (DO), biological oxygen demand (BOD), suspended solids (SS) and ammonium (NH_3) were measured and RPI scores were calculated for all the investigated potamic habitats. Also, Geographic Information System (GIS) was used to provide a visual summary of the RPI results. According to detected data, 20% of the basin components were found as "Highly Polluted", 24% of the basin components were found as "Moderately Polluted", 28% of the basin components were found as "Less Polluted" and 28% of the basin components were found as "Unpolluted" in general.
***Keywords**: Ergene River Basin, Water quality, River Pollution Index*

Introduction

Water pollution is among the most important problems of the world especially in recent years. Especially freshwater habitats are significantly affected by developing technology and population growth. New methods are developed for the evaluation of the contamination levels on the water ecosystems. Also in especially recent years, the synergistic effects of different parameters are being evaluated using various indices. The River Pollution Index (RPI) is an effective water quality assessment tool and being widely used all over the world (Akın et al., 2010; Chen et al., 2012; Çiçek et al., 2013; Wang et al., 2014; Onur and Tokatlı, 2020; Köse et al., 2020; Tokatlı, 2021; 2022; Yüksel et al., 2022; Varol et al., 2022).

The Ergene River originates from the Yıldız Mountains on the Black Sea coast of the Marmara Region and merges with the Meriç River and discharges into the Aegean Sea. Safaalan, Çorlu, Ahmetbey, Köprüaltı, Ana, Hayrabolu, Büyükdere, Kuleli, Anadere, Hasanağa and Sazlıdere Streams constitute the most important tributaries. Meriç – Ergene River Basin is the most significant potamic habitat of the Thrace Region of Türkiye. But as in many aquatic habitats, it is being adversely affected from industrial and agricultural pollution (Tokatlı and Ustaoğlu, 2020; Tokatlı and Varol, 2021; Tokatlı et al., 2022; Varol and Tokatlı, 2022). The aim of this research was to evaluate the water quality of Ergene River Basin by using RPI.

Material And Methods

Sample Collection

In this study, water samples were collected from 25 stations located on the Ergene River Basin in the summer season of 2020. The topographic map of Ergene River Basin and selected stations on the watershed are given in Figure 1.

Chemical Analysis

Dissolved oxygen (DS) parameter was determined by using a multi – parameter device (Hach Lange – HQ40D) in the field studies; suspended solids (SS) parameter was determined by using a colorimeter device (Hach Lange – DR890) in the laboratory studies; ammonium (NH_3) parameter was determined by using a spectrophotometer device (Hach Lange – DR3900) in the laboratory studies; biological oxygen demand (BOD) parameter was determined by using a BOD device (Hach Lange – BOD Track) in the laboratory studies.

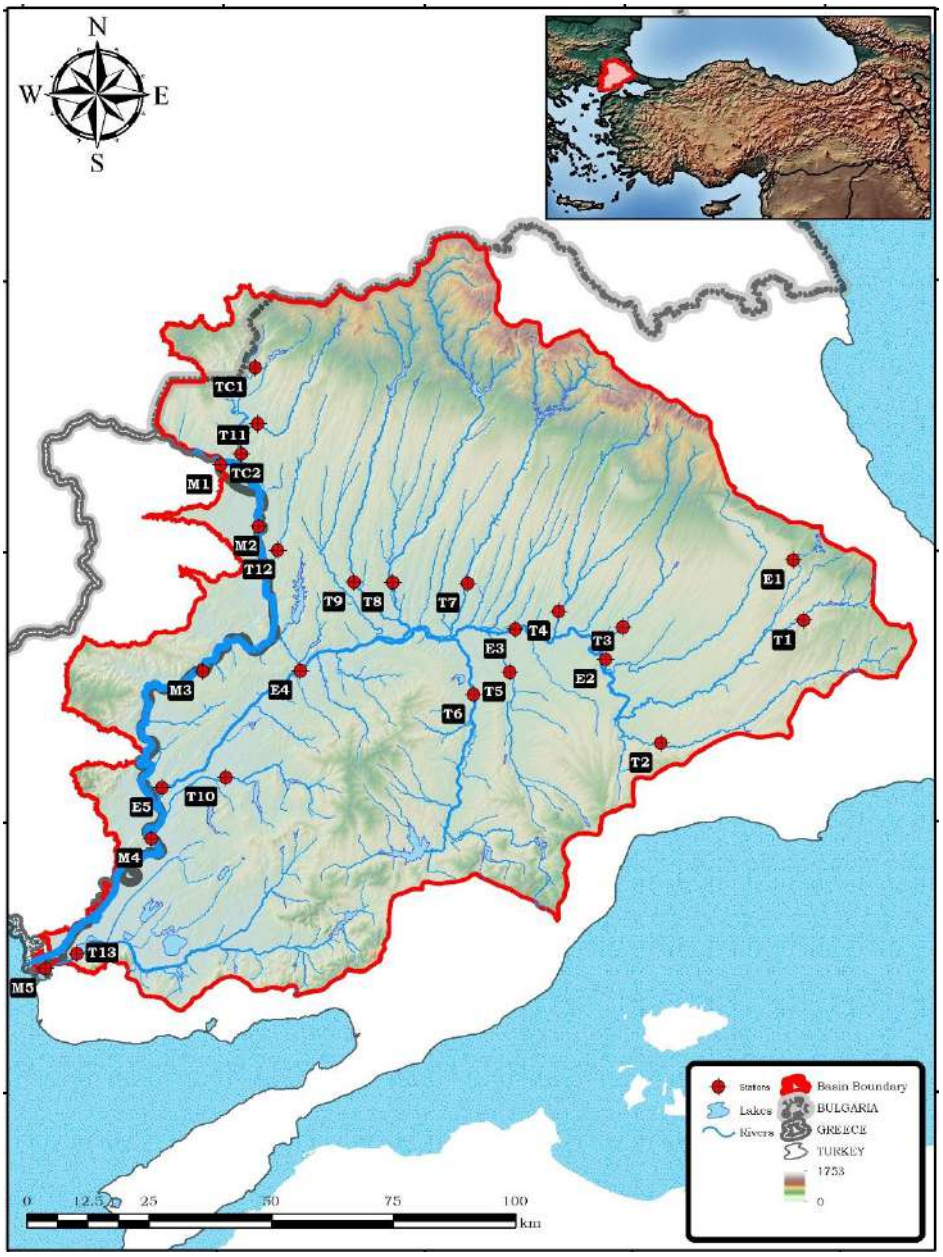

Figure 1. Ergene River Basin and selected stations

River Pollution Index (RPI)

The RPI is a simple method for assessing river water quality, which is calculated by using levels of 4 parameters; dissolved oxygen (DO), biological oxygen demand (BOD), suspended solids (SS) and ammonium (NH_3). Each parameter is converted into a four-state quality score given in Table 1, and the RPI is calculated by using the following equation (Liou et al., 2004; Chen et al., 2012);

$$RPI = 1/4 \sum_{i=1}^{4} Si$$

Table 1. River Pollution Index scores

Parameters	**Unpolluted**	**Less polluted**	**Moderately polluted**	**Highly polluted**
DO (ppm)	>6.5	4.5-6.5	2.0-4.5	<2.0
BOD (ppm)	<3	3-5	5-15	>15
SS (ppm)	20	20-50	50-100	>100
NH_3 (ppm)	0.5	0.5-0.9	0.9-3.0	>3.0
Index Score (Si)	1	3	6	10
Sub-index Score	<2	2-3	3-6	>6

GIS Based Analysis

Geographical Information System (GIS) was used in all phases of the collection, storage, analysis and assessment of surface water samples in the Ergene River Basin area. The spatial information of the stations, whose coordinates were gathered with the portable GPS device, was stored as feature layers in a geodatabase established specifically for this study using gis software. In addition, Stream Network data was produced according to Strahler order with 30 m resolution Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) digital elevation model. In the basin, thematic maps showing distribution on stream network according to the class limit values of river pollution index were prepared. However, RPI scores were mapped as bar column in each sampling location in the river basin.

Results And Discussion

Results of applied River Pollution Index (RPI) scores of investigated basin components selected on the Ergene River Basin are given in Figure 2 and Figure 3.

According to the results of monomial RPI, the risk ranking of the parameters investigated in terms of index scores is as follows: BOD > NH_3 > SS > DO (Figure 2). According to the results of multinomial RPI, the riskiest habitats among the basin components investigated in terms of index scores were determined as Çorlu Stream and Ergene River (Figure 3).

As a result of applied RPI, 20% of the basin components were found as "Highly Polluted", 24% of the basin components were found as "Moderately Polluted", 28% of the basin components were found as "Less Polluted" and 28% of the basin components were found as "Unpolluted" in general.

Ammonium occurs as a result of the breakdown of organic substances containing nitrogen in general. It is an intermediate product and not significantly toxic for most organisms. Organic matter degradation, organic fertilizer or chemical fertilization from inorganic ammonium, discharge of domestic and industrial wastewaters are important factors that increase the amount of ammonium (NH_4) in water. Another significant indicator of biological activity and organic matter content in freshwater habitats is the biological oxygen demand (BOD) parameter and it is clearly known that BOD parameter can reach quite high levels especially in regions where organic wastes are high. (Wetzel, 2001; Manahan, 2011; Tokatlı et al., 2022).

According to results of RPI, NH_4 and BOD parameters were found as the most critical parameters for the Ergene River Basin. It is thought that the intensive agricultural and industrial activities carried out in the watershed may be the reason of the detected quite high RPI scores of these parameters especially in the water Çorlu Stream and Ergene River.

Conclusions

In the present investigation, River Pollution Index (RPI) a widely used surface potamic water quality assessment index was used to evaluate the quality of Ergene River Basin by determining some significant limnologic parameters including dissolved oxygen, biological oxygen demand, suspended solids and ammonium. As a result of applied RPI, 20% of the basin components were found as "Highly Polluted", 24% of the basin components were found as "Moderately Polluted", 28% of the basin components were found as "Less Polluted" and 28% of the basin components were found as "Unpolluted" in general. It was also determined that BOD and NH_4 parameters were found as the most critical parameters for the basin among the investigated parameters and Çorlu Stream and Ergene River were found as the most critical fluvial habitats for the system among the investigated basin components.

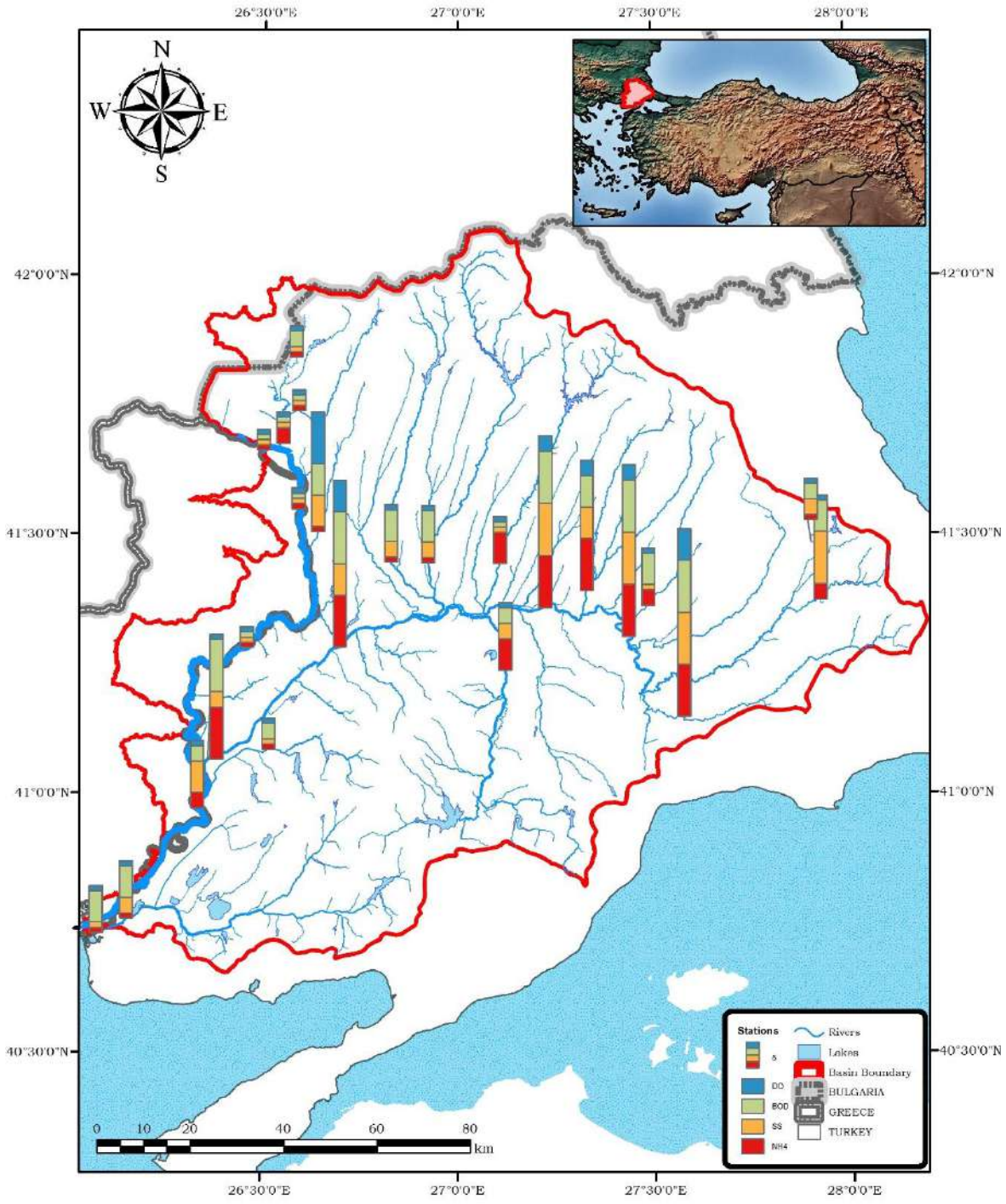

Figure 2. Monomial RPI scores of locations

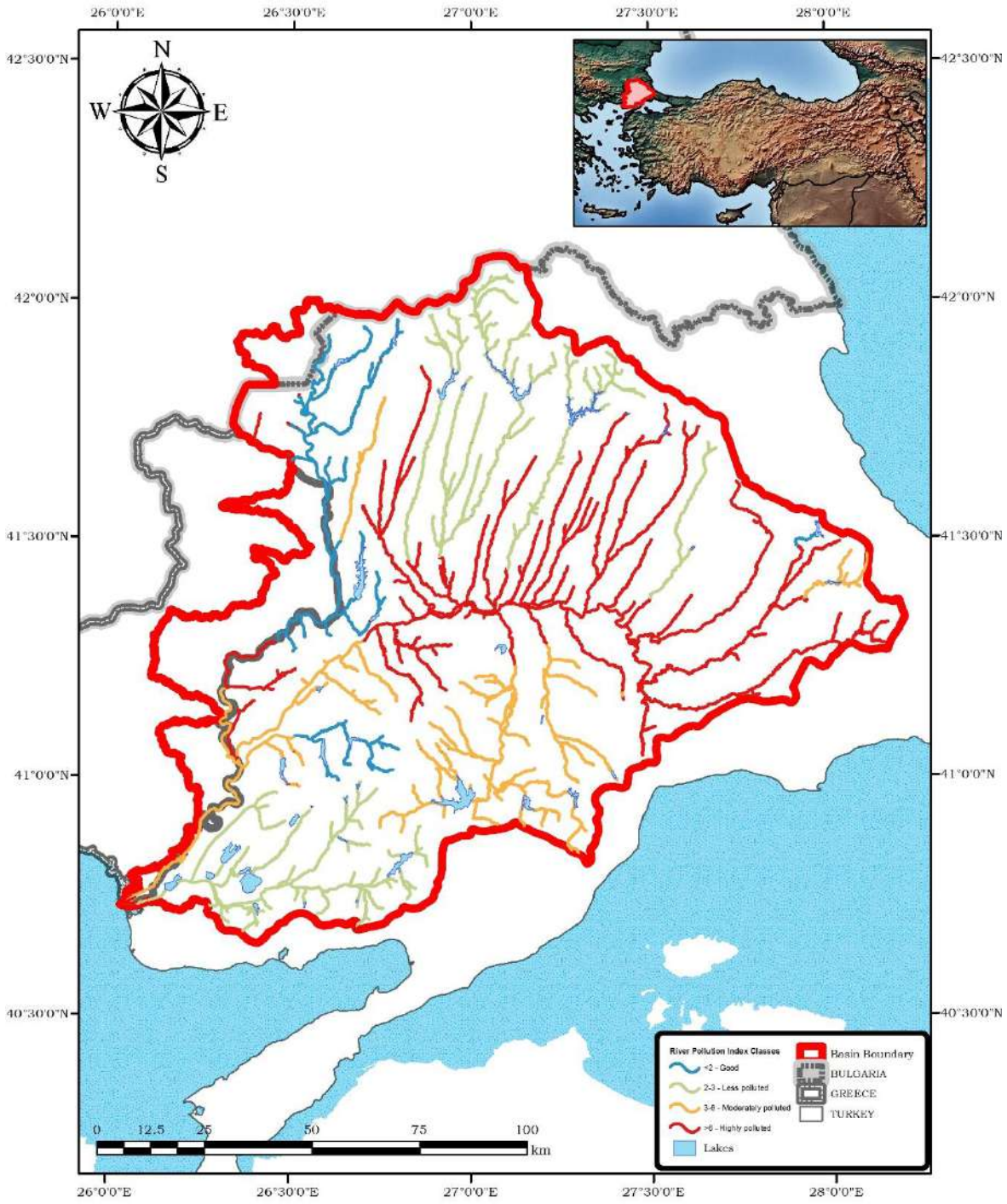

Figure 3. Multinomial RPI scores of locations

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Women Empowerment in Agricultural Activities and Its Impact on Farming Household Food Security: The Case of Anna Sorra District, Guji Zone, Oromia Regional State, Ethiopia.

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Abstract
Background: Food insecurity is widely recognized as a major concern throughout the world, notably in East Africa, including Ethiopia. Empowering women through agricultural activities is one key solution to improve food security, even though considerable gender inequities still exist. Hence, the objective of this study was to examine women's empowerment in agricultural activities and its impact on farming household food security among 336 randomly selected women households in Anna Sorra District, Guji zone, Oromia region of Ethiopia.
Methodology: Both quantitative and qualitative data were collected using a household survey, focus group discussion, and key informant interview data collection methods. Descriptive statistics (women empowerment in the agricultural index (WEAI), Household caloric acquisition), and econometric model (Binary logistic regression and Propensity Scores Matching) were used to analyze the data.
Result: The descriptive statistics result under women empowerment in the agricultural index showed that overall five domains of empowerment (5DE) of the study area were 73.7% and the 5DE result shows that 58.6% of the women in the sample were disempowered. The results of household caloric acquisition showed that out of 336 total respondents 53.9 % of the households were food in-secured, while the remaining 46.1% of the households are food secured. The regression result reveals that, except distant from the nearest market, other significant variables such as age, women being household head, educational level of women, Education of husband, annual household income, off/non-farm income, and ownership of the property had a positive effect on women empowerment. The result from Propensity Scores Matching revealed that empowered women households had higher food calorie intake per day per adult equivalent than those who did not. The average treatment effect on the treated (ATT) from empowered women's households was 560.89Kcal/AE/day.
Conclusion: The study concluded that empowering women in agricultural activities is one key valuable potential solution to ensure food security in the study area. As a result, it is suggested that the government `s and all other stakeholders should focus on empowering women and further research should be conducted for a more holistic understanding of the significance of women's empowerment.
Keywords: Women empowerment, Impact, Anna Sorra, food security, Agricultural index

Background of the study

Food insecurity is widely recognized as a key issue around the world. According to the most recent data, nearly 9.2% of the world's population is at risk of the most extreme type of food insecurity. The individuals suffering food inadequacy are about 1.04 billion from Asia; 676 million and 188 million from Africa & Latin America, respectively (FAO, et al., 2019).

Food insecurity is an enduring and significant issue in East African countries, particularly Ethiopia (Mohamed, 2017). The number of food-insecure people in the country increases from time to time; which was an estimated 3.2 million people in 2012, 4.5 million in,2015, 5.6 million people in the year 2017, needed emergency food support (FAO et al., 2017), 8.13 million people need food assistance in 2019 (FSIN, 2020) and 2020 about 12.1 million peoples in the acute food insecurity (WFP and FAO, 2021).

Globally, debates on food security include gender equality as a mechanism to foster economic balance and food security (Aziz et al., 2020). Significantly, several researchers for instance, (Quisumbing and Pandolfelli, 2010), have demonstrated strong ties between gender inequality and food insecurity, especially in the case of underprivileged and oppressed women who sometimes have access to essential resources. The FAO (2009) gender equality congress reported that, women's access to resources and opportunities is typically limited, and their output remains low in comparison to their potential (Gender Equality, 2009).

Ethiopia has one of the lowest gender equality performance indicators in the world. The reports revealed that, Ethiopia is ranked 82nd out of 153 countries in 2019, while in 2020 ranked 97st out of 156 countries (Global Gender Gap Report, 2020 and Global Gender Gap Report, 2021). UN Women (2018) asserted, in certain cases, women are at a disadvantage as compared to men. They are strongly excluded in the social, economic, and political spheres and face restrictions in making decisions about issues that concern their lives. In line with this, Mengistie, (2013) confirmed that, women's socioeconomic deprivation is marked by a lack of resources, services, and work opportunities.

The account given by Care (2020) prevailed that food security will not be achieved without gender equality and rural women's economic, social, and political empowerment (. Gender based discrimination, or the denial of women's human rights, is widely acknowledged as one of the leading causes of hunger and food insecurity (Van,

2021). According to, Visser, and Wangu (2021) empowering women through agricultural activities is one key solution to improve food security. If women had equitable access to productive resources, they could increase farm yields by 20–30 percent, agricultural output in developing countries could be raised by 2.5–4 %, and the number of hungry people in the world could be reduced by 12–17%. Accordingly, an empowered woman can have a significant impact on how resources, especially food, are distributed in the household, benefiting the entire family's health and wellbeing.

Although there are numerous technical, political, financial, and other barriers to equality, the literature evidence, for instance (CFS, 2017) show that social norms and systemic barriers to gender equality and women's empowerment in the food security sphere are the most important. Discriminatory social norms, traditions, and roles form the gendered distribution of paid and unpaid work; restrict women's access to assets, economic capital, and markets; and erode women's self-confidence and leadership capacity. In addition to normative attributes of women discrimination, other studies, for instance, Didana, (2019), has identified socioeconomic factors such as- age, family size, education level , household income, employment, ownership of property, and institutional factors including credit utilization, distance from the market, access of information, and participation of community affairs are among others determining women's level of empowerment in agricultural activities.

The impact of women's empowerment through agricultural activities has remain the focus of development research studies, (Lépine, and Strobl, 2013; Imai et al., 2014) arguing, is one of the most effective ways to increase food security. The fundamental reason has been well established by the study report, (Duflo, 2012), is the existence of variability in of resource, especially of income utilization preference among women and their counterparts asserted that, women invest significantly more resources in the well-being of their family members.

The above arguments (Lépine, and Strobl, 2013; Imai et al., 2014) that are not women empowerment as an effective solution in ensuring household food security are more of to the theoretical/ conceptual abstraction levels. Women empowerment, therefore, as it has been argued by Akter et al. (2017) would have been influenced by the contextual factors particularly, development policies and their implementation interventions. Thus, analyzing the relevance of empowerment for outcomes such as food security and nutrition requires addressing both the context-specificity as well as the multidimensionality of women empowerment in the development context. It is critical, asserted by Akter, et al. (2017), to recognize the specific settings in which certain policies are formed in order to construct relevant policies that address gender inequality.

To this end, several studies, for instance (Schutter, 2013; Sraboni et al. 2014), have shown a correlation between women's empowerment and household livelihood outcomes such as food security. Women choose to help and ensure household food security when they have leverage over assets and decision-making power (Schutter, 2013), and there is a positive relationship between women's empowerment and food security and calorie availability (Sraboni et al. 2014). Moreover, according to the findings of study conducted by (Aziz et al., 2020), women's rights in different domains, including leadership domain, agricultural production, resource ownership and time spent on farming lands have major positive effects on food security. However, since majority of these research studies has been focused on South Asia countries, there are few empirical evidences on the issue in Ethiopia.

Among recent studies, (Girma & Singh, 2019; Melese, 2019; Abera et al., 2020) in Ethiopia have focused on factors that affect women's empowerment. Even though, these studies, attempted to identify socio-demographic and institutional factors affecting women's empowerment, little attention has been given to economic factors such as assets ownership, off-farm and non-farm income, that are assumed pertinent to ensuring household food security. There are only few partial assessment studies among which, (Yimer & Tadesse, 2016 and Gebre et al. 2021) linking women empowerment in agriculture to household food security with in the agriculture-food security development pathways-framework. These studies are primarily concerned with the association between women's empowerment with children and women's nutritional status, thus, they have limited scope in integrating women's empowerment with overall household food security. In addition, it has been identified that, there is a methodological gap in the above reviewed studies. Have review, none of these studies; apply appropriate econometric models to evaluate the impact by using propensity score matching without considering unobserved factor covariates.

Therefore, this study believed, though empirically and systematic investigation that has established evidence based linkage of women's empowerment and farming household food security; has contributed new body of knowledge pertinent to planning and implementation of appropriate development interventions.

Methods and materials

Description of the study area

Geographical location: The research was conducted in Anna Sorra District, which is located in the Guji Zone of the Oromiya National Regional State. Anna Sora District Is situated in Oromia regional state at about 469km from Addis Ababa. It is bordered on the south by Arda Jila, on the west by Uraga, on the north Bore, and east by the Sidama people. The administration center of the District is Irba Muda. Astronomically, the district is situated at 60 15‟N to 70 N and 380 to 390 15‟E north of the equator.

Topography: The District has diverse topographic features that led it to experience a complex and diverse climatic condition. The District has a diverse agro-ecological zone which is the direct cause of experiencing the complex climatic condition. And attitudinally, district ranges from 1200-2800 meters above sea level.

The climate of the area: The district encompasses lowland, midland, and highland agro-ecological zones. It receives an estimated amount of 350-1830mm of rainfall annually and with an annual average temperature of 11.2-210 c,Anna sorra District Agricultural office (ASDAO, 2021). The district has two main rainy seasons, spring and autumn that are locally known as Ganna and Hagayya rains, respectively. Most of the area receives its maximum rainfall in spring and small rainfall in autumn. Expected to be 78 % of the total annual rainfall is received during the spring season which comes at the end of February to the May and autumn is the minor rainy season of the area where rains begin in September and ends in November.

Economic activity: Cereal crops like Barley, Wheat, Corn (maize), Teff, Horse been and Pea are important crops cultivated, Enset remain staple food, where coffee is grown in some parts of the district. Furthermore, livestock is the major economic activity in this District. Generally, their area was mostly agricultural-based (ASDAO, 2021).

Population and demographic characteristics: The 2006 national census reported CSA, (2006) total population for this District of 132,000 of whom 64,221were men and 67,779 women, 13,601 or 8.15%of its population was urban dwellers, which is less than the Zone average of 11.6%. With an estimated area of 1,196.88 square kilometers, Anna Sora has an estimated population density of 110.3 people per square kilometer, which is greater than the Zone average of 21.1

The five largest ethnic groups reported in Anna Sora were the Oromo (86.92%), the Amhara (4%), the Gedeo (3.81%), the Sidama (3.42%), and the Silte (0.99%); all other ethnic groups made up 0.86% of the population. Oromiffa was spoken as a first language by 86.41%, 5.57% spoke Amharic and 3.63% spoke Gedeo the remaining 4.39% spoke all other primary languages reported. The majority of the inhabitants were protestant with 41.22% of the population having reported they practiced that belief, were 19% Muslims, while 17.62% of the population said they practiced traditional beliefs, 8.47% professed Ethiopian Orthodox Christianity 4.29% was catholic and 1.33% was Protestants (CSA, 2006).

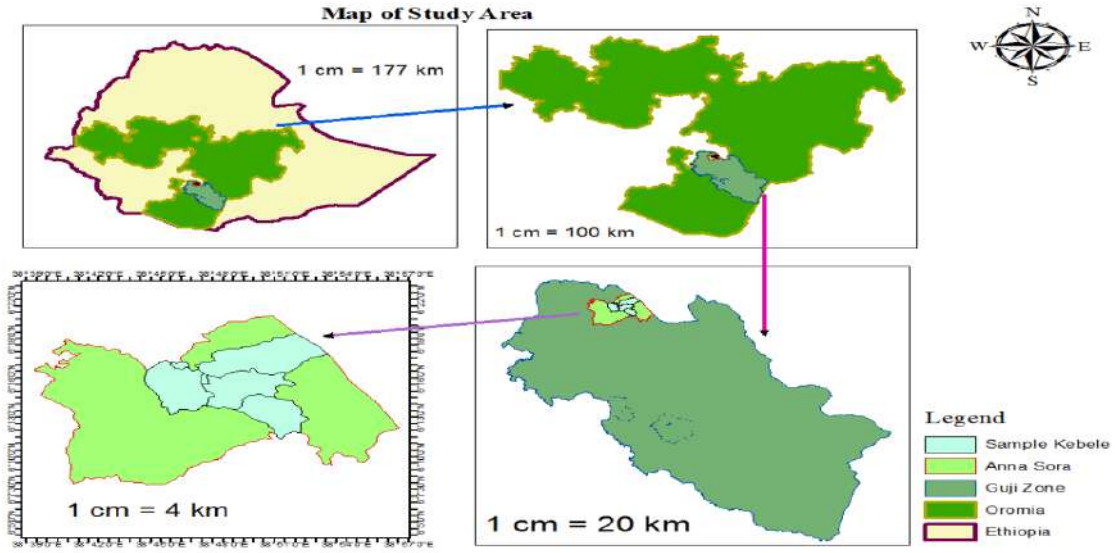

Fig 1: Map of the study area
Source: Extracted from ETHIO- Arc GIS (2021)

Research design

A cross-sectional survey design involving quantitative and qualitative methods was used in this study to analyze women's empowerment in agricultural activities and its impact on household food security in the study area.

Study population, Sampling Design and Sample size determination

A multi-stage sampling procedure was followed in this study. In the first stage, Anna Sorra District was selected purposively bearing in mind the fact that it is one of the most agricultural-based, the most populous. In the second stage, from the total of 20 kebeles[2], four kebeles were randomly selected. In the last stage, 336 samples of women households were selected by simple random sampling method. Since kebeles differ in terms of the total number of households they encompass, probability proportional to sample size-sampling technique was employed to determine the number of households from each kebeles.

To determine the number of sample respondents, the Yemane formula was used. By considering 5% levels of error and determine sample size as follows:

[2] Kebele is the smallest administrative unit in the study area

$n = N/1 + N (\alpha)^2$ …… …… (1)

Where;

n = Sample Size

N = Total number of targeted populations

α = level of precision (sampling error) at 5% significance level, the margin of error Level of confidence is 95 percent; this was chosen because the convenient method reduces the possibility of nonresponse drastically.

Accordingly, the sample size was determined from a total of four Kebele households out of 20 rural Kebeles of Anna Sorra District by the formula of Yamane as follows:

$n = 2,102/1+ (0.05^2)* 2,102= 336$. To distribute the sample size to each Kebele, the sample size determination formula of Israel (1992) was used. That is ns= (Nh/Ns)*n, Where: ns = sample size from each kebele, Nh = total population in each kebele, Ns = Total population of the sum of kebeles for the study, and n = Total sample size population from the study. Table 1 presents sample distribution across the selected kebeles.

Table 1: Study sample size distribution proportion to respective kebeles

Kebeles	**Sample of HH**	**ns= (Nh/Ns) *n**	**Proportion sample size from each kebeles**
Robale Debaye	504	504/2,102) *336	81
Kuku Seleto	634	(634/2,102) *336	101
Kochore Barsisa	512	(512/2,102) *336	82
Cicu Burasisa	452	(452/2,102) *336	72
Total	**2,102**	**(2,102/2,102) *336**	**336**

Source: Own computation from secondary data, 2021

Data type and sources

Qualitative and quantitative data were solicited from both primary and secondary sources to answer the research questions of the study. Primary data was collected from women respondents, on different issues such as household characteristics, all other variables hypothesized to empowerment, and domains that determine women empowerment. In addition to this, about food security condition in study area was asked. Further, the secondary data was also used to increase the additional information necessary to substantiate the study. It was collected from reports, journals, articles, books, bulletins, statistical reports, and government documents, published and unpublished documents (thesis), and from websites and records of development agents, agricultural Office, and women and children affairs officers of the District.

Methods of data collection

The data was collected through various data collection methods such as household surveys, focus group discussions, and key informants.

Household survey

To generate quantitative and qualitative information at the household level, a household survey was undertaken by developing a structured interview schedule. The interview schedule was designed based on the objectives of the study- level of women empowerment, factors affecting women empowerment, the status of household food security, and the impact of women empowerment on household food security that aimed to address. The survey addressed data on five domains (production, resource, income, leadership, and time) and ten indicators (input in productive decisions, relative autonomy in productive decisions, ownership of land and assets, purchase, sale, and transfer of assets, access to credit control over the use of income, group membership, speaking in public, workload, and leisure) related to the level of women empowerment. Furthermore, to examine factors of women empowerment, data were collected on socio-demographic characteristics, age of respondents, women being household head, educational status of women, education of husband, distance from the market, Annually household farm income, off/non-farm income of the household, owning property, farm size credit utilization and extension contact, the number of participation in social groups and Access to information channels.

To capture the daily calorie consumption of food by each of the sampled households in the Anna Sorra, sort of questions were included to investigate data on the type and amount of food consumed by each household for seven days was considered. For each food item, different units of local measurement were translated into a common measure. Four enumerators were selected based on their ability to speak the local language. Before data collection, all the enumerators were trained about the methods of data collection, the content of the survey schedule, and how they approach the interviewee. Thus, the survey was conducted by selecting one enumerator for each study site and awareness was given for populations before actual data collection and finally the administration of actual

fieldwork. The questionnaire was prepared in English language and translated into the local language (Afan Oromo), and Amharic, because most of the women were Afan Oromo speakers, and the others, is come from different regional states and zones, especially from SNNP particularly Gedeo and Sidama peoples.

Focus Group Discussion (FGD)

Group discussions are intended to foster collective and creative enthusiasm, which leads to the sharing of new ideas and concepts with an outsider who becomes acquainted with them (Chambers, 1992). One particular powerful strategy to properly employ FGDs is to bring participants together with a common background with the issue under discussion. Getting groups' opinions, attitudes, and views is a requirement to elaborate, clarify and cross-check ideas, experiences, and arguments obtained through other methods. Based on this argument and to have detailed information that has been useful to draw the right conclusion from the survey work, qualitative information was gathered from purposively selected respondent women, development agents, and community leaders using checklists. Collection of primary qualitative information was managed through discussing with the focused group to generate information on the background on women's participation in their agricultural activities and the level of their decision, the factors influencing women to become empowered. Moreover, they were asked questions related to the situation of food security and the impact of those empowered women on household food security.

A total 28 people in four (4) focus group discussions were conducted in the study area (one focus group discussion per kebeles). Seven people made up the focus groups. In each kebeles, one focus group was made up of women, while the other focus groups were made up of males who were thought to have a lot of knowledge about women's lives, what influences them as a community, and food security. The enumerators, with the guidance of the researcher, guided the discussions.

Key informant interview:

In-depth interviews with purposively selected key informants were undertaken. Key informant interviews likewise, enabled the study to draw important information on women empowerment history, factors that influence them for a long period of and the issue regarding household food security and matter concerned what if women empowered to household food security in the study area. This method was conducted in two ways. One is guided by a general interview guide (checklist questions), and the second is an informal conversational interview conducted spontaneously. The key informant interviews were including two experts of women and children affairs office, three agricultural office experts, four religious leaders, two elder females and two elder males, one development agents (DA), and 4 Kebele leaders at each kebeles were interviewed.

Methods of data analysis

The quantitative data collected from the survey households were edited, coded, entered, cleaned, and analyzed by employing SPSS 23version and STATA 15 software. Descriptive, inferential statistics and econometric models were used for this study. Descriptive statistics such as frequency and percentage were used for dummy variables and minimum-maximum, mean, and standard deviations were used for continuous variables to summarize and present the quantitative data. An Independent t-test for the continuous and chi-square test for dummy variables were employed to test the significance.

Measuring of women empowerment status

Women Empowerment in Agricultural Index (WEAI) is the most recent index established by Oxford Poverty & Human Development Initiative (OPHI) in 2012 as a direct measure of household and individual economic empowerment and gender equity (Alkire *et al*., 2012; 2013; and Yang & Stanley, 2012). Because empowerment is a dynamic and complex concept, a single indicator is insufficient to assess it. As a result, the WEAI was utilized to investigate women's empowerment; the five dimensions of empowerment like production, resource, income, leadership, and time with ten indicators (input in productive decisions, relative autonomy in productive decisions, ownership of land and assets, purchase, sale, and transfer of assets, access to credit, control over the use of income, group membership, speaking in public, workload, and leisure) were used and weighted according to their weight (Alkire *et al.,* 2012; Alkire *et al.,* 2013), with the 5 DE contributing for 90% of the measurement. WEAI aims to increase the understanding of the existent of the link between women's empowerment, food security, and agricultural growth (Malapit *et al.,* 2015). According to Alkire *et al.* (2012), and Alkire *et al.,* (2013), one has to achieve adequacy in more than 80% of the indicators to be empowered. A cut-off point for analysis is any combination of a number between 0 and 100% following the international standard set by Alkire *et al.* (2012); Alkire *et al.* (2013) cutoff point at 20% was used.

Coding the disempowerment indicators

Based on the idea of Alkire *et al.* (2012), the inadequacy score (Ci) of disempowerment indicators is the coded value of 1 for an individual who is inadequate in all 10 indicators and 0 for an individual who has no inadequacy on any indicator. The inadequacy score (Ci) is computed by:

$$(Ci) = W_1I_1 + W_2I_2 + \ldots\ldots\ldots\ldots\ldots + W_dI_d \quad (2)$$

Where I_d = inadequacy achievement of a person in the indicator "i"; Id = 1 for inadequacy and 0 otherwise.
Wd = weight attached to indicator I

Identification of the disempowered
A cutoff of point 0.20 (20%) is used to identify the disempowered (Alkier *et al.*, 2013). This cutoff point is the share-weighted disempowerment an individual must have to be considered as disempowered, which is denoted by (k). Hence, it is a way to compute the censored score. Ci (k) denotes a censored score and Ci is a non-censored score. If Ci>k, the Ci (k) = Ci, and if Ci<k, then Ci (k) = 0 where Ci (k) is the disempowerment score of the disempowered.

1st step: Disempowered headcount ratio (Hp): it is the incidence of the individuals (within a given population) whose share of weighted inadequacies is more than the cut-off k.
$H=\frac{q}{n}$ Where, H= Disempowered headcount ratio, q= number of disempowered individuals, and n is the total population.

2nd step: Intensity of disempowerment (Ae): it is the average inadequacy score of the disempowered individual.

$$A=\frac{\sum_{i=1}^{n}=Ci\ (k)}{q} \quad (3)$$

Where, *Ci (k*) = censored inadequacy score of individual i, and *q* is the number of disempowered individuals.

3rd step: Computing five domains of disempowerment
The disempowerment of an individual in five domains of empowerment is the product of disempowerment headcount and the average inadequacy score.

Symbolically: *M*0 = *Hp *Ae* (4)

Where, Mo= Disempowerment Index, Hp= Disempowered Headcount, and Ae= Average Inadequacy Score.

Finally, 5DE is easily obtained: 5DE = $1 - M_0 =$ He + Hp × Ae …… (5)

Breaking of disempowerment index by domain and indicators
This is important to see the disempowerment of women in different context via decomposing M0 into its component-censored indicators. The censored headcount in each of the indicators is calculated by adding up the number of disempowered people who are deprived of the indicator and dividing it by the total population. The censored headcount ratio for an indicator implies the proportion of deprived people in that indicator.
The overall M0 can be computed as:
M0t=wi1CHi1+wi2CHi1...+wi10CHi10 (6)

Where M0t= Total disempowerment index, *Chi* is the censored headcount ratio of the indicator "i" and *wi* is the weight attached to the indicator "i", the sum of each weight is equal to one.
The percentage contribution of each indicator to overall disempowerment is computed as follows:
% contribution of the indicator I to M0 = $\frac{\text{wiCHi}}{\text{M0}}$ (7)

The contributions of all indicators were sum up to 100%. And the percentage contribution of each domain to the overall disempowerment of women is the sum of the percentage contribution of each indicator in their respective domain.

Measuring food security status
Household food security was calculated using the household calorie acquisition method, which is based on the daily calorie consumption variable measured in Kcal/AE/day at the household level. To assess household food security in the study area, data on the type and amount of food consumed by each household for seven days was considered. For each food item, different units of local measurement were translated into a common measure. Then, using the calorie conversion factor Adult Equivalent (AE), the calorie content of food products eaten by sample households was determined. Each household's total kilocalorie intake was calculated and then translated to regular quantities. Finally, each household's overall daily food kilocalorie intake was divided by household AE, yielding daily household kilocalorie intake per AE. The results then are compared to the Ethiopian government's

daily minimum subsistence requirement of 2,200 Kcal per AE (MoFED, 2012). As a result, the value of the minimum subsistence requirement was used as a cut-off point for determining if a household is food secure or food insecure, with a household being considered food secure if it meets this requirement and insecure if it does not.

Binary logit model

Logit and Probit models are commonly used to establish the relationship between household characteristics and a dichotomous response variable, according to popular belief. The probabilities are bound between 0 and 1, which gives these models an advantage over the Linear Probability model. They also fit the nonlinear relationships between the response and the explanatory variables the best. The models define a functional relationship between empowerment probabilities and various explanatory variables. Gujarati (1995) also pointed out that the probit model and the logistic model are nearly identical in terms of the formulation; the main difference is that the logistic model has slightly flatter tails than the cumulative normal distribution, i.e. the probit curve approaches the axes faster than the logistic curve. As a result, the choice between the two is purely mathematical.

In this case, the logit model is preferred over the probit model. A similarly, hosmer *et al*., (1989) claimed that the logistic distribution has an advantage over the others in the analysis of dichotomous outcome variables because it is a mathematically flexible and easy-to-use model that yields meaningful interpretations. As a result, the binary logit model was used in this study, even though both models may produce similar results. According to Gujarati (1995), the binary logit model is defined as follows,

$$Pi=\in (Y=1/Xi) = \frac{1}{1+e^{-(\beta 0+ \beta 1xi)}} \quad (8)$$

Equation (1) can be expressed by:

$$Pi=\frac{1}{1+e^{-Zi}} \quad (9)$$

Where; Zi=β0+β1X¡

If Pi is the probability of being women empowered and the probability of disempowering 1- Pi, which is expressed, follows in equation 3.

$$1-Pi=\frac{1}{1+e^{Zi}} \quad (10)$$

Equation 4 is obtained by dividing the empowered to disempower:

$$\frac{Pi}{1-Pi}=\frac{1+e^{Zi}}{1+e^{-Zi}}=e^{Zi}. \quad (11)$$

Therefore;

The odds ratio (the ratio of the probability that an individual would choose an alternative). Pi is the probability of women empowered from 0 to 1.

Taking natural logarithms of $\frac{pi}{(1+pi)} = e^{zi}$

$$Li = Ln \frac{pi}{(1+pi)} = \beta_0+\beta_1X_1+\ldots\ldots\ldots\ldots\ldots+ \beta_kX_k+\mu i \quad (12)$$

$$Where; Zi = \beta_0+\beta_1X_1+ \beta_2X_2.....\beta_kX_k \quad (13)$$

Zi is a function of k-independent variables β0 = is the intercept or constant term
Xi = ith independent variable K = represents number of independent variables
Xk = Total number of independent variables.

Propensity score matching (PSM)

To generate statistically acceptable matched pairs between empowered and disempowered, the PSM probability model was used. The logic behind propensity score methods is that balance observed covariates through careful matching on a single score. This study was used propensity score matching techniques to build a matching pair for respondents that have similar observable characteristics between empowered and disempowered households based on p-score in absence of baseline data. The propensity score is defined as the probability of receiving treatment based on measured Covariates:

$$E(x) = P (D=1 \mid X) \quad (14)$$

Where E(x) is the abbreviation for propensity score, P a probability, D=1 a treatment indicator with values 0 for control (disempowered), and 1 for treatment (empowered). This matching process creates a balance between treated and untreated women respondents. It is also expected to create a balance on covariates that are used to estimate the propensity score. This balance property is a key aspect of the propensity score method because; a

balanced pre-test covariate cannot be a confounder anymore, each that cannot bias the treatment effect estimate (Thoemmes, 2012). According to Caliendo and Kopeinig (2008), some steps apply in PSM. These steps are predicted propensity scores; choosing matching algorism, restrict common support areas, testing matching quality or balancing tests, and sensitivity analysis.

Definition of variables and working hypothesis

Based on the review of empirical findings and observation concerning the existing conditions of the study area, the following variables were defined and hypothesized.

Outcome variable

In this study, the outcome variable is food security which is continuous and measured in the calorie acquisition method, the resulting average kcal consumed per adult equivalent per day was compared to the Ethiopian government's daily minimum subsistence requirement of 2,200 Kcal per AE (MoFED, 2012). As a result, the value of the minimum subsistence requirement was used as a cut-off point for determining if a household is food secure or food insecure, with a household being considered food secure if it meets this requirement and insecure if it does not.

Dependent variable

The dependent variable in this research was women's empowerment. The dependent variable is binary\dummy, 1 if the women are empowered, and 0, otherwise. According to Alkire *et al. (*2012) and Alkire *et al* (2013), to be empowered, one has to achieve adequacy in more than 80% of the indicators. A cut-off point for analysis is any combination of the number between 0 and 100% following the international standard set by (Alkire *et al.* 2012: 13) cutoff point of 20% was being used.

Independent variables

The independent or explanatory variables are variables that tend to explain and influence the dependent variable. The explanatory variables that were hypothesized to affect women's empowerment are presented below.

Age of women respondent (AGE): Age is a continuous variable measured in years and one of the factors of multi-dimensional empowerment of women has long been explored by many researchers and the findings differ in different studies. It plays an important role in the process of agricultural production. For example, according to research conducted by Asmare *et al.* (2017), the result revealed that age is significantly associated with the empowerment of women, i.e. the age characteristics of women are considered to contribute favorably if she increases because she can be actively involved in agricultural activities. This study was expected this variable to influence women empowerment positively.

Women headed household (HEAD): Household in which an adult female is the sole or main decision-maker. Is about whether or not the women headed household are divorced, widowed, or have a husband who is ill, and whether or not their husband is far away from their household owing to employment, and so on. This variable is a dummy variable taking the value of 1, if women are head of and 0, otherwise. As previously stated, being women headed household affect their empowerment positively. For example, empirical result by Moepeng and Tisdell (2008), and Machio *et al.,* (2020) revealed that being women household head increase women empowerment. Hence, this study was expected this variable to influence women's empowerment positively.

Education status of women respondent (EDUCWOMEN): Education status is another continuous variable that is measured in years of schooling. The literature reveals that education is a very important factor in increasing women's empowerment in agricultural activities. The level of education was a fundamental factor that influences the empowerment of women significantly and positively (Taye, 2014; Vishal, 2015; Asmare *et al.,* 2017; Machio *et al.,* 2020 and Dadina, 2019). On an individual basis, the more the women farmers are educated, the more they tend to contact information and technology agents and become the user and participant of new agricultural practices to search for better agricultural income (Aazami, 2011). Hence, it is hypothesized that the educational status of women influences women's empowerment positively.

Educational status of husband (EDUCHUSBAND): Educational status of the husband is another continuous variable that is measured in years of schooling and that affects women's empowerment. This variable asks women whether their husbands are educated or not by considering their year of schooling. The most important aspect of husband education is his wife's empowerment. According to Thandar *et al.,* (2020), the result of binary logistic regression on women's empowerment among married women aged 15 to 49 shows that education level of husband is statistically significant affect women empowerment and he concluded that women with educated husbands have a higher level of empowerment than women with illiterate husbands. Therefore, it is hypothesized that the educational status of the husband influences women's empowerment positively.

Family size (AE). It is a Continuous variable that measured the number of members in adult equivalent. Literature shows that family size was another factor that affects the empowerment of rural women. According to Ali (2014), there is a strongly positive and significant influence of household size over women's empowerment. Households with large family sizes (in the productive age group) have been reported as one of the most important contributing variables for increased agricultural production (Adekunle, 2013). As a result, as the number of adults in a household grows, so women become empowered. Thus, in this study, the variable is expected to positively influence the empowerment of women.

Land holding (LSIZE): Size of Landholding is a continuous variable that is measured by total land owned by the household in hectares. Research conducted by Tefera *et al.*, (2014), demonstrates that the household farm size is a direct determinant of women's empowerment. It was assumed that the larger the farm size the farmer has the better seek to information and contact extension agent and situated to be empowered and economically strong. Hence, this study variable has expected to positively influence the empowerment of women.

Farm Income (AHFARMINC): Household income is a continuous variable that is measured in terms of Ethiopian Birr (ETB) and it's the most important factor that determines women empowerment. According to Asmare *et al*, (2017); Taye, (2014); Haimanot, (2007) and Vishal, (2015) who applied descriptive studies to investigate the impact of microfinance services on the Empowerment of women household income has a statistically significant influence on the empowerment of women. Damisa and Yohana (2007) revealed that the annual farm income obtained from the sale of crops, livestock, and the sale of vegetables and other agricultural practices increases the farmers' financial capacity and increases the probability of investing and participating in new empowerment practices and technologies. Therefore, this variable has expected to positively influence the empowerment of women.

Income from non-farm activities (NON/OFF-FRMINC): This variable is a dummy variable taking the value of 1 if income earning from off-farm activities and 0 otherwise. (Kaba, 2009), indicated the significant influence of income towards women. Though these off/non-farm activities are diverse, income sources from handcrafts, selling labor, and petty trade are the most important for this variable. The incomes households seek from these sources are analyzed based on participation in these activities and earning cash income. Participating in different non/off-farm activities may increase the chance to be economically empowerment. As a result, Income from non-farm activities of women has been hypothesized to influence positively the empowerment of women.

Own property (OWNPROP): Having own property is a Dummy variable given value 1 if have owned, and 0 otherwise. Property ownership particularly land and Livestock are the most important asset and an index of wealth, prestige in rural communities. Gebrat (2013), consequently, he argues that accesses to the owned property for rural women have a strongly significant influence on the empowerment of women. Consequently, having the own property of women has been hypothesized to influence positively the empowerment of women.

Access to Credit (CREDIT): Access to Credit is a dummy variable taking a value of 1, if the woman has access to credit in the study period and 0, otherwise. According to Fletschner and Kenney (2011), rural farmers who have access to credit may overcome their financial constraints and therefore buy inputs and farm implements. That is the access to credit can relax the financial constraints of women farmers. As cited by Tefera, and Beyan (2014), the farmers without cash and no access to credit will find it very difficult to attain and adopt new technologies, access to inputs, and poor markets as top constraints to increasing productivity, a noteworthy gap (Ragasa *et al*., 2012). A household's access to credit has a significant contribution to agricultural production (Anaeto *et al.*, 2012 and Adekunle, 2013). Thus, Access to Credit for women households has been hypothesized to influence the empowerment of women positively.

Extension Service (EXTSERVICE): Extension service is dummy variable takes value1 if women household get access to extension service and 0 otherwise. The variable represents extension service as an important source of information, knowledge, and advice to smallholder farmers in Ethiopia. Empirical results revealed that extension service has a fundamental influence on farm households' adoption of new technology (Ali, 2014). He depicts that there is a strongly significant and positive influence on the empowerment of women. Hence, Contact with extension agents was hypothesized to positively affect women empowerment in this study.

Access to informational channels (ACSINFRMTNCH): Access to information channels is a dummy variable of whether households have access to information channels (=1, if yes; =0 otherwise). Access to informational channels, for instance, TV viewing, radio listening, printed materials, and public meeting were considered as the important factors to provide agricultural and relevant information, and informed farmers may play an important role in familiarizing women with basic information at their ease (Anila, 2009). At present, radio is a popular means of communication. Therefore, radio ownership is assumed to increase the probability of empowerment in rural activities. A study conducted by Almaz (2008) revealed that the effort to disseminate agricultural technologies is mainly successful if there is effective dissemination of information through mass media. If the information on technologies, programs, markets, etc. was more widely available and accessible; women would be better able to make their own choice out of a range of possible options. So, Access to informational channels was hypothesized to positively affect women's empowerment in this study.

Membership to social groups (SOCIALG): This is a continuous variable, measured in terms of the number of social groups in which the individual has a membership. It used to indicate the rural women's membership and involvement in a different social group. Abebe (2011) pointed that the more the woman farmer was participating in social groups, the more she will participate in the different activities of agriculture and be more empowered. Therefore, the number of social groups participating has been hypothesized to influence positively the empowerment of women.

Distance from the nearest market (DSFNRMKT): It is a continuous variable that measures in terms of Kms. If the market is far away from the households' residence, they may lack information regarding the market price and

quantity which makes them worse off. Hence women who are nearer to the nearest market towns are more likely to be empowered. The study conducted by Gebrat, (2013) reveals that the higher the demand for products and services, it is believed that the higher the empowerment of women. The households' residence was affected by their proximity to the market; they may lack information about the market price and quantity, making them worse off. As a result, women who live near a market are more likely to be empowered. Therefore, the distance from the nearest market of women's households has been hypothesized to influence negatively the empowerment of women.

Results And Discussion

Level of women empowerment

Because the comparison of empowered and disempowered women is the emphasis of the next explanation of continuous and categorical variables, this section begins with describing the level of women's empowerment. Tables 2 and 3, depict women's empowerment as determined by agricultural index measurement methodologies.

The Women empowerment in agricultural index for the study area is presented in Table 2. The WEAI for the study area is 0.737, which is the outcome of weighted 5DE (the value of five dimensions of empowerment). This outcome is less favorable than the Bangladesh pilot study carried out by Malapit et al., (2017) in the country's southern and southwestern regions. But, the result is higher than the 0.702 results obtained in Guatemala. However, it is lower than the result obtained in Uganda's pilot studies (Alkire *et al*, 2012).

Overall, 58.6 percent of women are disempowered, while 41.4 percent of them are empowered according to the headcount ratio. The percentage of disempowered women in the study area is higher than in Uganda (58 percent), Guatemala (56.7 percent) (Alkire *et al*, 2012; Alkire *et al.*, 2013), and Nepal (58 percent) (Cunningham et al., 2015). On the contrary, it is found to be lower than in Bangladesh (61 percent), Guatemala (71.3 percent) (Alkire *et al.*, 2013), in Pakistan (83 percent) (Ahmad & Khan, 2016). Moreover, different studies in Ethiopia on women empowerment reported different results. For instance, Yimer & Tadesse, (2015), Didana (2019), and Belete and Melak (2020) reported 69 percent; 65.58 percent; 79 percent, respectively.

Overall, 26.3% of women are disempowered in five domains of empowerment, which is higher than the comparable measure of disempowerment in Bangladesh (25.4%) and Uganda (21.1%) but lower than women's disempowerment index of Guatemala (31%) by (Alkire, et al., 2013) and in Amhara national regional state of Ethiopia (30.81%) by (Belete and Melak, 2020). On average, women who are not yet empowered have inadequate achievement in 45% of the domains. This infers that the disempowered woman had achieved adequacy in 55% of the 5DE indicators.

Table 2: Level of women empowerment

Indexes	**Index value**
Disempowered Headcount (Hp)	0.586
Empowered Headcount (1-Hp)	0.414
Average Inadequacy Score (Ae)	0.450
Average Adequacy Score (1- Ae)	0.550
Disempowerment Index (M0 = Hp x Ae or = 1-5DE)	0.263
5DE Index (1-M0)	0.737

Source: Own survey (2021).

The decomposition of 5DE (Table 3) the censored headcount ratio shows that the domains that contribute most to women's disempowerment are about 27% of women lack in a decision in production and 25% percent of women lack sole or jointly decision-making power over autonomy in productive decisions and the ability to make decisions about it. The results show that women receive fewer empowerment effects due to their lack of command over productive resources and control over output. The findings also reveal that about 35, 65 and 36 percent of women lack the ability solely or jointly make decisions about ownership of land and assets, purchase, sale, and transfer of assets as well as access to credit, respectively. These factors contribute to the constraints they face in terms of extra limits that prohibit them from fully using their land, cattle, and other assets, possible market decision-making, such as purchasing and selling input and output, and credit utilization. They rely extensively on others, particularly their husbands and male relatives, for labor, skills, and contributions. Likewise, 14 percent of women lack control over the use of income. This might be due to the fact that men control more income in the studied area.

According to the findings, 22% of these women are not members of a group, and 25% of the women in the study do not have access to public speech or the ability to make a public speech. Group participation and public speech, on the other hand, were associated with barriers to women's ability or willingness to advance in leadership positions, such as gender biases in social service institutions. As a result, 30% of women do not have a manageable workload that exceeds 10.5 hours per day, and 15% of rural women do not have adequate leisure time. This finding indicates that there was a difference in workloads and share of input production decision-making and that there

was a risk that the production process would further marginalize women. The outcome is in line with a preliminary empirical finding in southern Guatemala (Alkire et al., 2013) and (Malapit and Quisumbing, 2015).

Two old males' ages 67 and 51, and one female, age 49, from Denbobi Robale Kebale participated in a focus group discussion and key informant interview. They pointed that, '*'according to Robale Kebale, women face challenges in obtaining resources, and time poverty (high workloads and limited leisure time) is a major source of women's disempowerment''*. '*'Again they argue that women in this area invest their time on work at least 13 hours in a one day''*. However, they frequently describe women's workload as disempowering. This is possible since men's initial bargaining position under patriarchy was that they were the primary decision-makers in their families and Men think that women are not as good in management as men in the resource.

Econometric model analysis results of on factors affecting women empowerment

Before moving to econometric estimation and results demonstrate, multicollinearity was checked using variance inflation factor (VIF) and contingency coefficients (CC). The variance inflation factor (VIF) was used to determine whether or not continuous independent variables were multicollinearity. The term multicollinearity is the existence of a "perfect," or exact, linear relationship among some or all explanatory variables of a regression model and also refers to the case in which two or more explanatory variables in the regression model are highly correlated and also an indication for a linear relationship between independent variable is called multicollinearity. So multicollinearity occurs when the independent variables are not independent of each other. The presence of multicollinearity affects the least-squares estimators and renders them inefficient. The problem of multicollinearity must therefore be regarded as a 'block mark' that reduces the confidence in the conventional tests of least squares estimators. The method that is commonly used to detect the existence or absence of multicollinearity is the variance inflation factor. Based on this the researcher used the variance inflation factor and contingency coefficients test to check the presence or absence of multicollinearity in the data. A decision rule for the multicollinearity test for the model stated is a variable whose VIF value is greater than 10 indicates the existence of a multicollinearity problem. As it is observed there is no multicollinearity. The researcher concluded that there is no problem of multicollinearity between the explanatory variables.

Table 3: Women's disempowerment decomposed by domains and indicators

5DE	**Production**			**Resource**	
Statistics	Input in productive decisions	Relative autonomy in productive decisions	Ownership of land and assets	Purchase, sale and transfer of assets	Access to credit
Indicator Weight	0.1	0.1	0.067	0.067	0.067
Censored headcount	0.27	0.25	0.35	0.65	0.36
%Contribution	10.00%	9.60%	8.80%	16.60%	9.00%
Contribution	0.027	0.025	0.023	0.044	0.024
% Contr. By dimension	19.60%			34.40%	

5DE	**Income**	**Leadership**		**Time**	
Statistics	Control over use of income	Group membership	Speaking in public	Workload	Leisure
Indicator Weight	0.2	0.1	0.1	0.1	0.1
Censored headcount	0.14	0.22	0.25	0.3	0.15
%Contribution	10.60%	8.70%	9.60%	11.40%	5.70%
Contribution	0.028	0.022	0.025	0.03	0.015
% Contr. By dimension	10.60%	18.30%		17.00%	

Source: Own Survey (2021).

Factors influencing women empowerment

Tables 6 and 7 summarize the mean values and the t-test and χ^2 tests of the significance of factors influencing women's' empowerment.

Descriptive statistics for continuous variables

Table 6: Descriptive analysis of continuous variables factors affecting women empowerment

	Total (n=336)				Disempowered(n = 197)		Empowered(139)		
Variables	**Min**	**Max**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**t-value**
Age(years)	22	63	41.2	6.2	40.2	0.42	42.5	0.54	3.363*
Family size (AE)	1.5	9.75	5	1.8	5	0.125	5	0.16	-0.312
Education level of women(years)	0	13	5.6	2.58	5.3	0.18	6	0.23	2.784**
Education level of husband(years)	0	13	6	2.5	5.6	0.16	6.5	0.23	3.139 **
Distance from nearest market (Km)	1	12	5	2.6	5.3	0.19	4.65	0.17	-2.699***
Land holding (ha)	1	6	2.53	2.26	2.48	0.048	2.6	0.08	1.346
Annually Household farm income (Birr)	8,900	45,000	25046.33	6435.952	24218.81	389	26219.15	633	2.835 **
Membership to social groups (number)	0	4	1	0.49	0.96	0.066	1.26	0.09	2.753

Note: - ***, ** and* are represents of statistically significance at 1%, 5% and 10% level of significance
Source: Own survey, 2021

Table 7: Descriptive analysis result of dummy variables affecting women empowerment

Description of variables	Categories	Total sample Households(336)		Disempowered (197)		Empowered (139)		χ^2
		freq	%	freq	%	freq	%	
Women head of household	Yes	117	34.8	55	16.4	62	18.5	9.997***
	No	219	64.2	142	42.3	77	22.9	
The income from non/off-farm	Yes	191	56.8	98	29.2	93	27.7	9.783***
	No	145	43.2	99	29.5	46	13.7	
Ownership property	Yes	193	57.4	104	31	89	26.5	4.209 **
	No	143	42.6	93	27.7	50	14.9	
Access to credit	Users	192	57.1	105	31.3	87	25.9	2.872
	Non users	144	42.9	92	27.4	52	15.5	
Extension Service	Yes	187	44.3	101	30.1	86	25.6	3.711
	No	149	55.7	96	28.6	53	15.8	
Access to information	Yes	196	58.3	108	32.1	88	26.2	2.415
	No	140	41.7	89	26.5	51	15.2	

Note: - *** and ** are represented of statistical significance at 1% and 5% level of significance
Source: Own survey, 2021

Table 8: Logit model analysis results of on factors affecting women empowerment

Variables	**Coefficients**	**Std. Err.**	**z**	**P>z**	**Odds Ratio**
AGE	0.0661908	0.021164	3.13	0.002	1.068431
HEAD	0.617673	0.265007	2.33	0.02	1.854607
AE	0.024694	0.071125	0.35	0.728	1.025001
EDUCWOMEN	0.1343311	0.049979	2.69	0.007	1.143771
EDUCHUSBAND	0.0993829	0.054096	1.84	0.066	1.104489
DSFNRMKT	-0.158187	0.058465	-2.71	0.007	0.8536898
LSIZE	0.2318642	0.158832	1.46	0.144	1.260949
AHFARMINC	0.0345	0.00002	1.72	0.085	1.000034
NON/OFFFRMINC	0.6113713	0.264535	2.31	0.021	1.842957
OWNPPTY	0.5551596	0.258940	2.14	0.032	1.742219
CREDIT	0.4010523	0.253648	1.58	0.114	1.493395
EXTCONTACT	0.3317349	0.257228	1.29	0.197	1.393383
SOCIALG	0.1689182	0.129962	1.3	0.194	1.184023
ACSINFRMTN	0.3618025	0.264322	1.37	0.171	1.435915
_cons	-6.979971	1.379033	-5.06	0	0.0009303
Logistic regression		Number of obs = 336			
		LR chi2(14) = 71.04			
		Prob > chi2 = 0.0000			
Log likelihood = -192.34829		Pseudo R2 = 0.1559			

Source: Own survey, 2021

Age (AGE): Age of the respondents was hypothesized that it will have a positive relationship with the dependent variable. The result of the Binary logit regression model has shown that age has a positive influence on dependent variables and is statistically significant at the 1% level. The odds ratio in favor of women empowerment increases by a factor of 1.068 when the age of women increases by one year. Therefore, one can conclude that as the age of women increases, the probability of being empowered will also increase in the study area. This finding is in line with the results of studies done by Gebrat (2013); Ahamed (2013); Taye (2014); Asmare et al., (2017), and Didana (2019). But the result of this finding is contrary to the studies of Mengistie (2014); and Tefera, and Beyan (2014), which demonstrate that age is negatively and significantly, influenced the empowerment of women in agricultural activities.

From Focused Group Discussion Said "*As our culture in this community, women are more respected and empowered when their age becomes older," (Jarsa Biyya-aged-56, of Kochore Barsisa Kebele).*

Women head of household (HEAD): A woman being head of the household is statistically significant and positively affected women empowerment status at a 5% significance level. This variable has a 1.85 odds ratio in favor of women's empowerment. This means that if a woman is the head of the family, her chances of being empowered rise by 1.85. This is may be due to the fact that as women become head of household, their overall responsibilities to making discussion about the household become increase and their empowerment increase. This result is in line with Moepeng &Tisdell (2008) and Machio *et al.*, (2020), being having a husband reduces the chance of women's empowerment but being widowed increases the chance of women's empowerment relative to being single. But contradict with (Chant, 2004).

The educational level of women respondents (EDUCWOMEN): Education improves people's knowledge and abilities in a society, which is obvious. As a result, the more educated a society is, the more likely it is to become involved in various economic activities. As a result, Women's education is a recognized fundamental condition for women's empowerment because it allows them to have more access to and control over material and information resources, allowing them to improve their lives and resist discrimination and subordination ideas. Based on the result of the logit model, the education level of the women is found to be significantly and positively correlated with women empowerment at a 1% significance level. The result reveals that the odds ratio in favor of women empowerment increases by the factor of 1.144 when the number of years of schooling of women increases by an additional one year. This indicates that women's empowerment increased in parallel with their educational attainment. The result of this study is consistent with those of Alkire et al., (2012); Asmare et al., (2017); Achandi, (2019) and Dadina (2019), who found that empowerment and education were strongly associated. However, this study contradicts the findings of Ahmed, (2013) and Tefera et al., (2014), demonstrating that no definitive conclusion can be taken about the association between education and women's empowerment.

Education of husband (EDUHUSBAND): Based on the result of the logit model, the education level of the husband is found to be significantly and positively correlated with women's empowerment at a 10% significance level. The result reveals that the odds ratio in favor of women empowerment increases by the factor of 1.1 when the number of years of schooling of men increases by an additional one year. This implying that women whose husbands have been educated have a high empowerment level compared with women whose husbands are uneducated, controlling for other factors. This finding is consistent with the results of studies done in Myanmar by (Thandar, et al. 2020).

From my focus group discussion Lucho Gelchu 42 years old from kuku seleto kebele, argued that "*because of my house band is educated I am more advantageous in my life and I enjoyed it well*."

Distance from the nearest market (DSFNRMKT): Distance from the nearest market is found negatively related to women empowerment in the study area and statistically significant at a 1% probability level. The odds ratio in favor of women empowerment decreases by a factor of 0.854 when the distance to the nearest market increased by one kilometer. The findings show that women who live closer to the market are more likely to be empowered than those who live farther away. This could be because the women that are far away from the nearest market are less aware of their disempowerment (due to the availability of information through media, cross-cultural interactions, and general public awareness) while those nearest to market are aware of their disempowerment. This result is in line with the results of previous studies by (Achandi, 2019 and Didana, 2019). But the result of this finding is inconsistent with the results of Tefera, and Beyan (2014) which illustrates that there is no definite conclusion that can be drawn about the relationship between distance from the market center and empowerment of women. The findings of the focus groups and key informant interviews with two females aged 56 and 42 from the kochore Besrisa kebele further confirm the above assumption. From this, we can conclude that distance from the market affected the households' residence; they may lack information regarding the market price and quantity which makes them worse off. Hence women who are nearer to the market were more likely to be empowered.

Annual farm income (AHHFINCM): Different crops and livestock income sources, as well as other rural agricultural activities, are used by respondents to supplement their income. One of the most important aspects influencing people's empowerment in various development initiatives is their income. If respondents have a higher agricultural income, they are more likely to buy various farm inputs and implements, resulting in a higher profit/product from agriculture. As a result, it's been hypothesized that this variable has a positive and significant relationship with the dependent variable. The model output also supports the hypothesis and shows that farm income has affected the empowerment of women in agricultural activities positively and significantly at a 10% probability level. The odds ratio in favor of women empowerment increases by the factor of 1 when the household income rises by one birr. This could be because women from higher-income households have greater bargaining power in the home, the opportunity to participate more freely in the economic sector, and are more mobile in their communities. The finding of this study is consistent with the results of studies done by (Gebrat, 2013; Mengistie, 2013; Asmare et al., 2017 and Achandi, 2019).

The income from non/off farm (NON/OFFFRMINC): The result of the binary logit regression model has shown that non/off-farm income has a positive influence over the dependent variable and is statistically significant at a 5% probability level. The odds ratio in favor of women empowerment reveals that the income from non/off-farm increases the probability of the women being empowered by a factor of 1.84. This can be explained by the fact

that women who have non/off-farm income are more adequate in the decision on their income than those who solely depend on on-farm activities. The outcome is in line with what was expected. This finding is consistent with the results of studies done in Ethiopia by (Asmare et al., 2017 and Dadina, 2019), but not consistent with that of (Gebrat, 2013).

Ownership property (OWNPPTY): The result of the binary logit regression model has shown that having own property has positively related to women's empowerment and is statistically significant at a 5% level. The odds ratio for this variable in favor of women empowerment is 1.74. This indicates that the probability of women being empowered increases by 1.74 if a woman has their property. This is implying that in a rural society having their ownership especially land and livestock are the most valuable asset and an indicator of prosperity and reputation. As a result, one can conclude that rural women's access to owned property has a major influence on their empowerment. Other research, such as Dadina (2019) have found similar ownership property positively related to women empowerment. This is contradicting with (Thandar *et al.*, 2020) in the study; household ownership was not shown to be linked to overall levels of women's empowerment.

Food Security status of households

In this study, the household caloric acquisition method was used to measure household food security by physical consumption of food items. The amount of energy available for the household is compared with the minimum subsistence requirement per AE per day (i.e. 2,200 kcal) (MoFED, 2012). The survey indicates that the mean value of the energy available for food insecure and secure households were 2006.748 Kcal/AE/day and 2925.686 Kcal/AE/day, respectively. The minimum and maximum energy available for food insecure households was 843.4714 Kcal and 2199Kcal, respectively (Table 4). Whereas the minimum and maximum energy intakes of food secure households were 2202.1Kcal and 4867.775 Kcal, respectively. The mean energy intake of all sample households was 2430.663 kcal. The t value (19.2653) confirmed that there is a significant mean difference between food insecure and secure households.

Table 4: Food security status of household

Energy available/AE/day	**Food security status**			**T-value**
	Food secure (155)	Food insecure(181)	Total(336)	
Max	4867.775	2199	4867.775	19.2653***
Min	2202.1	843.4714	843.4714	
Mean	2925.686	2006.748	2430.663	
Std. Dev.	553.4525	300.7347	632.361	

Note: - *** is represented of statistical significance at a1% level
Source: Own survey, 2021

Classification and decomposition by empowerment and food status

Table 5 presents the food security status of households across women empowerment Status, which has been determined using descriptive analysis. Accordingly, the percentages of food insecure and secure households are found to be 53.9 % (42.3 from disempowered and 11.6 from empowered) and 46.1 % (16.40 from disempowered and 29.8 from empowered), respectively who fulfilled the minimum recommended daily calorie (2,200 Kcal/AE per day as mentioned in MoFED, 2012). The independent chi-square results reveal that empowering women is significantly different in terms of food security status, measured in terms of household food calorie intake/day per adult equivalent. To the extent that calorie intake is concerned, empowered women households tend to have higher calorie intake as compared to the disempowered ones.

Table 5: classification and decomposition by empowerment and food status

Empowerment status	**Food security status**						χ^2
	Food secured(155)		Food in secured(181)		Total (336)		
	No.	%	No.	%	No.	%	
Disempowered	55	16.40	142	42.30	197	41.4	63.56***
Empowered	100	29.8	39	11.6	139	58.6	
Total	155	46.1	181	53.9	366	100	

Note: - *** is represented of statistical significance at a1% level
Source: Own survey, 2021

Impact of women empowerment on households' food security

Determining common support region

The common support region should be imposed on the propensity score distribution of the treated with untreated after propensity score estimation. As shown in Table 9, the predicted scores used to match empowered with disempowered ranges from 0.0292167 to 0.910523. The propensity scores for disempowered vary between 0.097270 and 0.839983 and for empowered it varies between 0.02921 and 0.910523. Thus, the common support

region, where the values of propensity scores of both treatment and comparison groups found is between 0.0923964and 0.839983. As a result, 24 or 7.14% observations (7 from treated and 17 from untreated) were discarded from the study in the impact assessment procedure.

Table 9: Distribution of estimated propensity scores

Group	Obs	Mean	Std. Dev.	Min	Max
Total	336	0.413690	0.218553	0.029216	0.910523
Empowered	139	0.529082	0.206770	**0.092396**	0.910523
Disempowered	197	0.332271	0.188233	0.029216	**0.839983**

Source: Own survey, 2021

Table 10 below, describes the common support of the untreated and treated group for the outcome variables. From the total sampled household 312 observations (92.86%) are on support from both the treated and untreated groups. This result presents that 132 Empowered and 180 disempowered groups behave similar characteristics and matched. The decisions for the off and on support observations are based on the summarized p-scores in the treatment and untreated groups and count how many units are off support

Table 10: Common support region

Psmach2 treatment assignment	Off	On	Total
Untreated	17	180	197
Treated	7	132	139
Total	**24**	**312**	**336**

Source: Own survey, 2021

Using color codes, the diagram below distinguishes between the regions of common support. The upper green color shows the treated on support observations. The upper yellow color one indicates the treated off support, the lower blue color indicates the untreated off support and the lower red color represents untreated on support. As a result, the majority of the observations are concentrated in the region's common support region. This verified that there is enough overlap between the characteristics of treated and untreated components to find enough matches, according to Heckman (1997). As a result, the common support assumption is satisfied.

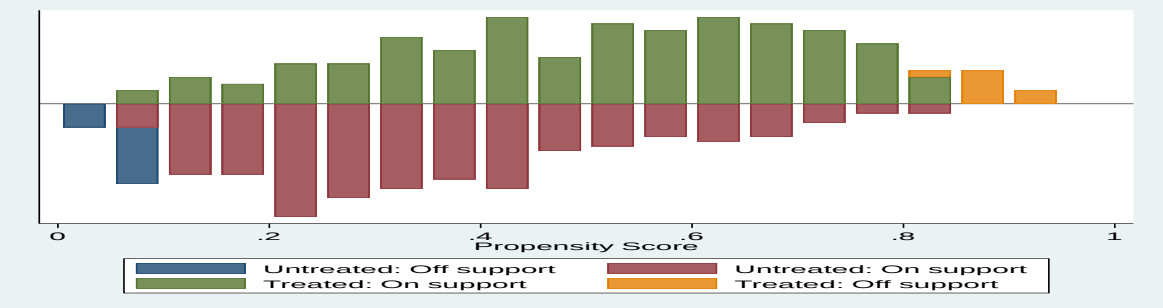

Figure 2: Common support for propensity score.
Source: Own survey, 2021

Testing the balance of propensity score and covariates

After choosing the best performing matching algorithm the next step is checking the balancing of propensity score and covariate using different procedures by applying the selected matching algorithm. To determine the estimations' balancing powers, different test methods, such as the reduction in mean standardized bias between matched and unmatched households, equality of means using t-test, and chi-square test for joint significance for the variables were used. The mean standardized bias before and after matching, as well as the total bias reduction achieved by the matching technique. The standardized difference in covariates before matching is in the range of -30.3% and 99.5% in absolute value. After matching, the remaining standardized differences of variables for all covariates are between –6.1% and 6.9%, which is lower than Rosenbaum and Rubin's (1985) indicated critical level of 20%. In every scenario, it is obvious that sample differences in the unmatched data significantly exceed those in the samples of matched cases. As a result of the matching process, the treatment and control samples have a high degree of covariate balance that is ready to utilize in the estimate phase. Similarly, the t-test demonstrated that after matching, all covariates became insignificant. As a result, the propensity score's matching quality or balance for all covariates has been recognized.

Propensity score matching: quality test

The standardized mean difference for overall variables utilized in the propensity score (30.4 % before matching) is decreased to about 4.1 % after matching, as shown in Table 11 below. Furthermore, the p-values of the likelihood ratio tests show that the joint significance of the covariates was always rejected after matching whereas it was never rejected before matching. The low pseudo R2, low standardized bias, high total bias reduction, and the insignificant p-values of the likelihood ratio test after matching suggest that the specification of the propensity is successful in terms of balancing the distribution of covariates between the treated and control groups.

Table 11: Propensity score matching: quality test

Sample	Ps R2	LR chi2	p>chi2	MeanBias	MedBias	B	R	%Var
Unmatched	0.155	70.78	0.000	30.4	30.2	99.5*	1.16	33
Matched	0.005	1.67	1.000	4.1	4.2	15.9	0.99	44

Source: Own survey, 2021

Estimating treatment effect on treated

The impact of empowering women on household food security in daily calorie consumption in kcal consumption per adult equivalent per day is analyzed. The Kernel Matching (KM) result reveals that supportive evidence of statistically significant impact of the empowered women's on the household daily calorie consumption in kcal/AE/day. Empowered women got an average of 560.89Kcal/AE/day than disempowered households (Table 15). This implies that the empowered women household had higher food calorie intake per day per adult equivalent than those who did not. Sraboni et al., (2014) in Bangladesh; Yimer and Tadesse (2016) in Ethiopia; Gitungwa (2018) in Tanzania; Sinharoy *et al.,* (2019) in Bangladesh and Aziz *et al.,* (2020) in rural areas of Azad Jammu & Kashmir, Pakistan as well as a qualitative survey of Galiè *et al*. (2019) in Tanzania all support this conclusion. In contrast with a quantitative study conducted in Tanzania by Galiè *et al.* (2019) which concluded no significant relationship between women's empowerment and household food security.

One 64-year-old man from Anna Sorra woreda, Kuku Selato Kebele, stated that '*'if they had greater control over their assets and could choose how much and what types of food to buy, they would be able to ensure that everyone in their family had enough and nutritious food to eat''*. ''*They also indicated that when women are empowered, however, the male household head may decrease the household food budget as a result of the women's contribution to the household income''.*

Table 12: The result of average treatment effect on the treated

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
HKcal	Unmatched	2757.9312	2199.7476	558.1837	63.15486	8.84
	ATT	2770.6415	2209.7483	560.8932	77.596143	7.23

Source: Own survey, 2021

Conclusions and Policy implications

Women were still disempowered with a 5 domain empowerment level of 26.3%, and important disempowering domains include lack of asset purchase, sale, and transfer, workload, and restricted control over the use of income. As a result, more work is needed to empower women in various ways. Improvements in each indicator's contribution to women's disempowerment with their relevance will diminish disempowerment and facilitate adequate empowerment in all aspects. As a result, the study's findings may inform policymakers on women's empowerment through agriculture in the Woreda, and may help in the formulation of constructive policies that would boost women's empowerment while also promoting the country's economic development.

In this study, the age of respondents had a significant and positive effect on empowerment, and the study shows that older women are more empowered than younger women. It would be preferable if Anna Sorra Woreda Women Affairs focused on educating young females about empowerment and the relevance it has for them and society as a whole. Because the majority of economic activity was in their hands, educating and training them in a way that they can positively understand the empowerment of women may be the best option for improving the empowerment of future generations.

The study shows there was a positive relationship between empowerment and the education level of respondents; this is because education improves the attitudes and self-confidence of women. So that, society should give priority to the education of the girl child with the hope that this will form the basis of empowerment women in the future. Furthermore, the Ministry of Education and the Ministry of Women & Children's Affairs should implement education programs for rural women more effectively.

The findings also revealed that non/off-farm income had a favorable and significant impact on women's empowerment. As a result, Anna Sorra woreda should establish more continuous and regular non-farm/off-farm operations, as well as train and support local women in job creation and raise income from those activities.

Furthermore, owning property has a significant and favorable impact on rural women's empowerment. This research supports the idea that for women to be empowered, they must accumulate wealth that belongs to them. As a result, women should accumulate wealth by engaging in more productive activities, and it is preferable to have advice and awareness for society to inherit property from their parents to increase wealth accumulation in their own hands.

The study showed that the distance from the nearest market to women was a significant and negative effect on their empowerment. This could be the women that are far away from the nearest market are less aware of their disempowerment, due to the availability of information through media cross cultural interactions and general public awareness. Women's empowerment is further hampered by a long distance from markets. Women can be empowered by the construction of roads and markets that allow them to reach markets. Thus, the intervention of governmental and non-governmental organizations in improving rural infrastructure particularly roads and other access either in form of establishing new or strengthening those already started ones and social media services is very important to allocate women empowerment.

Monitoring and evaluation measures should be developed to ensure that benefit women. For example, the focus groups revealed that heavy workloads are a key determinant of women's empowerment. As a result, project investments and related interventions should avoid the workload of women.

Impact evaluation of this study revealed that empowering women in agricultural activities has had a considerable beneficial influence on household food security. The households that empowered women in their agricultural pursuits would enjoy the greatest benefits. As a result, investing in women's empowerment in agricultural activities is critical for gender equality and food security, even though considerable gender inequities still exist in the study area. To overcome these inequities, bold, broad-based, and transformative methods are required. It drew on a large body of evidence to identify crucial factors that support or hinder women's empowerment, as well as policy recommendations. Accordingly, other research should be promoted and increased for a more holistic understanding of the significance of women empowerment.

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Characterization And Antimicrobial Potential Of Silver Nanoparticle Using *Carica papaya* Leaf Extracts.

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Abstract

Recently, the occurrence of resistant bacteria has led to the wide application of nano-technology whose structural components size ranges from 0.1 – 100nm. The biosynthesis of nanoparticles using plant extracts is of tremendous interest due to their numerous activities, accessibility, a wide spectrum of bioactive reducing agents and an excellent alternative for chemical and physical methods. Based on the important phytochemicals and biomedical applications of *Carica papaya*, this study aimed at the characterization and antimicrobial potential of biosynthesized silver nanoparticle using *Carica papaya* leaf extracts (CPL-AgNPs). The fresh leaves of *Carica papaya* extracted in aqueous, methanol and ethyl acetate and the phytochemical screening of the aqueous leaf extract was done. The CPL-AgNPs were characterized by UV-visible spectrophotometer, Fourier Transform Infrared spectroscopy (FTIR), Scanning electron microscope. The antimicrobial potential of the CPL-AgNPs was determined. The phytochemical analysis revealed that saponin, alkaloids and carbohydrates are strongly positive in the aqueous extract while glycosides and steroids were not detected in the aqueous extract. The methanol, ethyl acetate and aqueous extracts of the *Carica papaya* was able to bio-reduced the $AgNO^3$ to biosynthesized CPL-AgNPs by change in colour from colourless to dark brown. The UV-spectra of the aqueous, methanolic and acetyl ether leaf extract AgNPs has a sharp peak at 470 nm, 470 nm and 480 nm suggesting the formation of growing number of silver nanoparticles. These peak were conformed to the different functional groups and proven the presence of protein stabilizing agents. The scanning electron micrograph confirmed the shape of the biosynthesized CPL-AgNPs to be relatively spherical and the sizes ranging from 5-200 nm. The CPL-AgNPs had effective antimicrobial activity against the test bacterial pathogens with zones of inhibition ranging from 4 – 16 mm. All the test pathogens were susceptible to the nanoparticle except for the methanolic extract $AgNO_3$ that resisted *B. subtilis* and *K. pneumonia*. This findings revealed that CPL-AgNPs shape and size of nanoparticles and had effective bactericidal activity.

Key Words: Nanoparticles, *Carica papaya*, Phytochemical, Antimicrobial, Pathogens.

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Investigation of Spatial Analysis of Small Houses Built in Konya

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Abstract
Today, as a result of the changes in social, cultural and family life with globalization, the demands and needs of people have also changed. Due to reasons such as changes in lifestyle, shrinkage in the family, individualization and single-person living style, residences have been reduced spatially and the production of 'studio flat' residences, which are produced as 1+0, 1+1, 2+1, has increased today. Within the scope of this research, it is aimed to investigate the spatial harmony of small housing users with the houses they live in and their suitability for their lifestyles. For this purpose, 5 studio type residences with similar features in Selçuklu district of Konya, where the most studio flat stock is located, were examined. The close environment and spatial analyzes of these residences have been made, and they have been transferred within the framework of an analysis hierarchy from the general to the specific.These analyzes were handled in two stages, and in the first stage, the immediate environment analysis and architectural floor plan analyzes of the houses, and in the second stage, the residential plan types, spatial organization and interior analysis were transferred in tables and spatial determinations were made. As a result of the analyzes, the lifestyles of the small housing users were determined and the compatibility of this type of housing produced in Konya with the users was discussed.
Key Words: *Small House, Lifestyle, User, Spatial Analysis, Konya*

Konya'da Üretilen Küçük Konutların Mekansal Analizlerinin İncelenmesi

Özet
Günümüzde küreselleşmeyle beraber yaşanan toplumsal, kültürel ve aile hayatında yaşanan değişimler sonucu insanların talep ve ihtiyaçları da değişmiştir. Yaşam tarzındaki değişiklikler, ailedeki küçülme, bireyselleşme ve tek kişilik yaşama biçimi gibi nedenlerden dolayı konutlarda mekânsal olarak küçülmeye gidilmiş ve günümüzde 1+0, 1+1, 2+1 olarak üretilen küçük konut tiplerinden 'stüdyo daire' konutların üretimi artmıştır. Bu araştırma kapsamında küçük konut kullanıcılarının yaşadığı konutlar ile olan mekânsal uyumu ve yaşam biçimlerine uygunluğunun araştırılması hedeflenmiştir. Bu amaçla, Konya'nın en çok stüdyo daire stokunun yer aldığı Selçuklu ilçesindeki 5 adet benzer özelliğe sahip stüdyo tipi konut üzerine inceleme yapılmıştır. Bu konutların yakın çevresi ve mekânsal analizleri yapılarak genelden özele doğru detaylanan bir analiz hiyerarşisi çerçevesinde aktarımı yapılmıştır. Bu analizler iki aşamada ele alınmış olup ilk aşamada konutların yakın çevre analizi ve mimari kat plan analizleri, ikinci aşamada ise konut plan tipleri, mekânsal organizasyonu ve iç mekân analizleri tablolar halinde aktarılarak mekânsal tespitleri yapılmıştır. Yapılan analizler sonucu küçük konut kullanıcılarının yaşam biçimleri belirlenip, Konya'da üretilen bu tip konutların kullanıcıları ile olan uyumu tartışılmıştır.
Anahtar Kelimeler: *Küçük Konut, Yaşam Biçimi, Kullanıcı, Mekansal Analiz, Konya*

ID:482

Metaphorical Approach in Interior Architecture Education

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Abstract
Education in architecture and interior design has been rapidly evolving in response to global economic, social, cultural, environmental, and technological advancements. Design studios, that are at the heart of design-based disciplines, are at the frontline of these developments. The goals of design studios are to inspire creativity, foster the ability to create forms, and allow learners to integrate the formal, spatial, and structural skills they have acquired in other classes to produce design solutions. For this reason, the changes in our age have caused design approaches in studios to be constructed with new/innovative methods. New methods and techniques applied in studio lessons have played an important role in the process of creative thinking and transforming one's thinking into an idea, and their contributions to education and students have been revealed by many studies and research in the literature. In this study, the project studio, which is the foundation of interior design education, has been designed using the metaphor method, one of the intellectual methods applied in education. The metaphor method is a technique used to make difficult-to-understand abstract concepts concrete and helps design students develop their critical thinking and creative skills. In this context, designing, that is, the verbalization of abstract thought is limited to an object and the responsibility that this object brings with it. From this point of view, an experimental study was carried out with the metaphor method that constructs the object-space relationship in a 14-week design studio with the sophomore students of Selçuk University, Faculty of Architecture and Design, Department of Interior Architecture. The studio work aims to draw the boundaries of the interior architecture students in the process of searching for a solution to the design problem and to enable the students to come up with creative designs in making their function and form decisions. At this point, the metaphor method was used in the context of the object-space relationship as a guide in the form decisions of the students in the function solutions for the problem revealed in the interior architectural design process. After working in the studio, the students have developed a working doctrine that will guide their interior design studio projects using the designed method, allow them to create unique forms and shapes, enable them to translate abstract ideas into concrete space and make it possible for them to design at various scales, from equipment to space design. The method is at a level that will set an example for students, designers and academicians working in the design discipline.
Key Words: *Interior Architecture, Design, Education, Studio, Metaphor.*

İç Mimarlık Eğitiminde Metaforik Yaklaşım

Özet
Mimarlık ve içmimarlık eğitimi güncel olaylardan ve dünyada yaşanan ekonomik, sosyal, kültürel, çevresel ve teknolojik gelişmelere bağlı olarak hızla değişmekte ve gelişmektedir. Bu gelişmelerin başında, tasarım temelli disiplinlerin merkezinde olan tasarım stüdyoları gelmektedir. Tasarım stüdyolarının amacı, yaratıcılığın ortaya çıkarılması, form üretme yeteneğinin geliştirilmesi ve diğer derslerden elde edilen biçimsel, mekânsal ve strüktürel bilgilerin özümsenerek, tasarım çözümlerini oluşturmaktadır. Bu nedenle çağımızda yaşanan değişimler, stüdyolarda tasarım yaklaşımlarının yeni/yenilikçi yöntemlerle kurgulanmasına neden olmuştur. Stüdyo derslerinde uygulanan yeni yöntem ve metotlar yaratıcı düşünme ve düşündüğünü fikre dönüştürme sürecinde önemli bir rol üstlenmiş ve bunların eğitime ve öğrencilere olan katkıları literatürde birçok çalışma ve araştırma ile ortaya konulmuştur. Eğitimde uygulanan düşünsel metotlardan biri olan metafor yöntemi bu çalışma özelinde iç mimari tasarım eğitiminin bel kemiğini oluşturan proje stüdyosunda kurgulanmıştır. Metafor yöntemi tasarım öğrencilerinin düşünme yetilerini ve yaratıcılıklarını geliştiren, anlaşılması zor olan soyut kavramların somut hale getirilmesi için kullanılan bir yöntemdir. Bu bağlamda tasarlamak yani soyut düşüncenin söze dökülmesinin, bir nesne ve bu nesnenin beraberinde getirdiği sorumluluk ile sınırlıdır. Bu noktadan hareketle Selçuk Üniversitesi, Mimarlık ve Tasarım Fakültesi, İç Mimarlık Bölümü 2.sınıf öğrencileri ile beraber 14 haftalık bir tasarım stüdyosunda nesne-mekân ilişkisini kurgulayan metafor yöntemi ile deneysel bir çalışma yürütülmüştür. Stüdyo çalışmasının amacı, iç mimarlık öğrencilerinin tasarım problemine yönelik çözüm arama sürecinde sınırlarının çizilerek öğrencilerin işlev ve biçim kararlarını vermede yaratıcı tasarımların ortaya çıkmasını sağlamaktır. Bu noktada öğrencilerin iç mimari tasarım sürecinde ortaya konan probleme yönelik fonksiyon çözümlerinde form kararlarında yol gösterici olarak metafor yöntemi nesne-mekân ilişkisi bağlamında kullanılmıştır. Stüdyo deneyimi sonucunda öğrenciler kurgulanan yöntem ile iç mimari stüdyo çalışmalarına yön verecek, özgün biçim ve şekillerin oluşmasını sağlayacak, soyut kavramdan somut mekân elde etmesine imkân verecek ve donatıdan mekân tasarımına kadar farklı ölçeklerde tasarım yapabilecek bir çalışma öğretisi geliştirmişlerdir. Yöntem, öğrencilere, tasarımcılara ve tasarım disiplininde görev yapan akademisyenlere örnek teşkil edecek düzeydedir.
Anahtar Kelimeler: *İç Mimarlık, Tasarım, Eğitim, Stüdyo, Metafor.*

ID:483

Demographıc Study Of *Drosıcha Specıes* Fed On Dıfferent Hosts Under Laboratory Condıtıons In Skardu, Gılgıt Baltıstan

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Abstract

The life history parameters of mealybug, *Drosicha sp*, fed on willow (*Salix wilhelmsiana)* and apricot (*Prunus armeniaca* L.) hosts were studied under laboratory conditions at 25 ± 2 °C temperature and 60-65 relative humidity in the Integrated Pest Management Laboratory of Agriculture Directorate Skardu during 2019-2020. Survival, developmental and fecundity, data were analyzed using the age-stage, two-sex life table. The intrinsic rate of increase (*r*), finite rate of increase (λ), net reproductive rate (*Ro*) and mean generation time (*T*) of *Drosicha sp* reared on willow and apricot hosts were (0.081 ± 0.001, 0.076 ± 0.002) days, (1.085 ± 0.002, 1.079 ± 0.002) days, (147.66 ± 15.97, 120.9 ± 14.47) eggs/female and (60.96 ± 0.357, 62.45 ± 0.422) days respectively. The results further revealed that significant differences were observed in the developmental times, adult longevity and fecundity of *Drosicha sp* when reared on willow and apricot hosts. Male longevity was recorded longer on willow (64.46 ± 0.924 days) as compared to apricot (63.5 ± 1.27 days). Similarly, female longevity observed shorter on willow (67.80 ± 0.42) as compared to apricot (69.78 ± 0.48 days). *Drosicha sp* reared on apricot resulted in significantly decreased oviposition days (5.060 ± 0.113) and fecundity (219.81 ± 5.487 eggs) as compared to *Drosicha sp* reared on willow. The age stage specific survival rate (s_{xj}), age specific life expectancy (e_{xj}), age specific reproductive value (v_{xj}) was recorded significantly higher when *Drosicha sp* reared on willow as compared to apricot. The results revealed that the invasive mealybug, *Drosicha sp* can be considered as serious threats to willow, apricot and other ornamental plants in forests and fruits orchards. Therefore, understanding of the demographic study *Drosicha sp* is important for the success of its management program.

Key Words: *Apricot, Demographic, Mealybug, Willow, life table*

Introduction

Willows are deciduous trees or shrubs which belong to the Genus *Salix* having about 400 species distributed worldwide. *Salix wilhelmsiana* is the native and most common naturally growing willow species of Skardu- Gilgit Baltistan, Pakistan. Willows trees provide fuel, fodder and green cover to the beautiful land of Gilgit Baltistan. But presently, the survival of this species in the area is endangered due to severe insect pests attack and other infectious diseases. Major pests include mealybug, aphids, scales and leaf curl virus. Among these pests, mealybug pose serious threats to the willow forestation in the region (Alford, 2012). Besides willow trees, *Drosicha sp* has also been observed on apricot, mulberry and other horticultural crops as a secondary pest (Rizvi *et al.*, 2016). Apricot (*Prunus armeniaca* L.) is an important and essential fruit of Gilgit Baltistan. Due to high nutritional value and pleasant aroma, apricots are cultivated and consumed all over the world (Solis-Solis *et al.*, 2007). Apricots contain dietary fibers which play important role in diabetes, malfunctioning of the digestive tract, cancer and prevention of other diseases (Enomoto *et al.*, 2010; Waterhouse, 2009). Unfortunately, due to lack of facilities and other techniques, a major portion of the apricots are lost at the farm level. Further severe losses in apricot fruit occur mostly due to the birds and insects (mealybug) infestation which leads to the dropping of immature fruits, insects and fungal invasion (Kader and Hussein, 2009).

The mealybug, *Drosicha* specie (Homoptera: Margarodidae) is an invasive and polyphagous pest in Gilgit Baltistan, Pakistan. This pest was first recorded in 2005, as primary pest of the willow tree (*Salix*). Since then, it has become more common in Gilgit-Baltistan and is now a serious pest of forest trees and vegetables in Skardu, Pakistan and adjacent areas (Tanwar *et al.*, 2007). The mealybugs are soft-bodied insects that feed on phloem tissue, suck plant sap and causing distortion and yellowing of leaves. The nymphs and adult bugs suck sap from young leaves, shoots, inflorescence and even fruits. As a result, the flowers become shrunken and get dried. In case of severe infestation, the plants may die. These mealybugs also produce honeydew resulting further in sooty mold growth on the infested plant parts and interfere with the plant photosynthesis process (Venkatesha and Dinesh, 2011).

A mealybug secretes a certain type of fluid or wax that covers their body, therefore the name mealy has been given (Tanwar *et al.*, 2007). Female mealybug lays eggs only once in a year. These eggs are laid two to six inches below the tree or within the bark of the trees. These eggs are enclosed inside a cotton sack which protects these eggs from adverse climatic conditions. A female lays on average 300 to 500 eggs. These eggs hatched in the first week of April or May. The adult mealybugs appear in the first week of July to the end of June. Male and females are distinguished by their wings. Females are wingless while males are winged. Females and males of mealybug

(*Drosicha sp)* have two and three nymphal instars, respectively. They need one to four-month to complete their life cycle. Male mealybug dies within a week or two weeks after mating with the female. In late August, *Drosicha* species lay eggs in the soil and die in September (Hodgson *et al.*, 2008). Growers use different methods for the management of the *Drosicha sp*. These include cultural or chemicals. Gunny bags wrapping technique was not proved to be useful to stop the crawlers (Karar *et al.*, 2010; Solangi *et al.*, 2012). *Drosicha sp* is polyphagous in nature, different researchers have studied their biology on a different host (Rizvi *et al.*, 2016). Due to this variation in methodologies, efforts in estimating the true-life table parameters become complicated (Kumar *et al.*, 2013).

Understanding the population variations of pests at different stages of their life cycle necessitates the study of life table factors. It's a type of bookkeeping system that entomologists use to keep track of different insect pests' developmental stages and fatality rates. (Kakde *et al.*, 2014). The most essential analytical tool in ecological studies is the life table, which provides extensive information on population dynamics and allows for the generation of basic but more meaningful statistics. It also goes into great depth about survival, development, and life expectancy. Collecting data on insect survival at different temperatures is an important task for pest control in different environmental condition (Arshad and Rizvi, 2009). Life tables studies are important tools for both theoretical and applied population ecology because they provide full information on insect survival, population development, and death (Chi and Yang, 2003). Keeping in view the importance of life table theory, this study was design to study the life-history parameters of *Drosicha sp* fed on willow and apricot hosts.

Materials and Methods

The research regarding the life history parameters of mealybug, *Drosicha sp*, fed on willow and apricot hosts were carried out at 25 ± 2 °C temperature and 60-65 relative humidity in the Integrated Pest Management Laboratory of Agriculture Directorate Skardu during 2019-2020.

2.1. Rearing of the Mealybug Drosicha sp.

For this purpose, the initial culture of mealybug was collected during the first week of May 2020 from infested areas of District Skardu, Baltistan region. Collection of mealybugs was done using soft hand brushes in Petri dishes along with host leaves and cuttings was brought into the laboratory. The mealybug culture was reared in rearing cages (35×33.7cm) on willow and apricot leaves and cuttings for one generation. The cultures were maintained at 25 ± 2 °C temperature and 60-65 (R.H) in the laboratory. Fresh leaves were provided daily. When a sufficient number of mealybugs were reared, various studies were initiated.

2.2. Life table study of Mealybug on willow host

Age-specific life-tables study of *Drosicha sp* on willow tree leaves was studied in the Integrated Pest Management Laboratory (IPM) Skardu. Ten mated pairs of *Drosicha sp* were released in rearing cages on excised willow leaves and shoots cuttings, with the base of the leaves and cuttings dipped in a bottle of water to keep them fresh. Every two days, the leaves and cuttings were replaced. Approximately sixty freshly oviposited eggs of *Drosicha sp* was used for studying the life table parameter, each egg was considered as a replicate. The eggs were separated using a camel hairbrush. Each egg was transferred into a petri dish containing fresh leaves and shoots cuttings of willow tree. These Petri dishes were observed daily for egg hatching. After egg hatching, various nymphal instars duration was recorded daily. Different instars were confirmed by the presence of exuviae. Full-grown nymph along with willow tree cuttings were transferred into new Petri dishes containing soil for pupation. Adults were seen in these Petri dishes on a daily basis. The presence of wings on newly emerging adults was used to sex them (male have wings, female wingless). After sexing mated pairs were then moved to new Petri dishes for egg laying. The leaves and cuttings were change every two days. Eggs laying data per day per female were counted and recorded daily until the death of all females. The data was recorded on percent egg hatching, survival rate, development period of various stages, pre-pupal and pupal period, pre oviposition period, oviposition period and adult's longevity were measured.

2.3. Life table study of Mealybug on Apricot host

Age-specific lifetables of *Drosicha sp* on apricot tree leaves and shoots cuttings were studied in Integrated Pest Management laboratory Skardu. Ten mated pairs of *Drosicha sp* were released on excised apricot leaves and shoots cuttings in rearing cages. The leaves and cutting were kept fresh by dipping their bases in a bottle containing water and were replaced with new leaves and fresh cuttings every two days.

Approximately sixty freshly oviposited eggs of *Drosicha sp* were used for studying the life table parameters. Each egg was deemed as a replicate. The eggs were separated using a camel hairbrush. Each egg was transferred into a petri dish containing fresh leaves of apricot tree. These Petri dishes were observed daily for egg hatching. After egg hatching, various nymphal instars durations were recorded daily. Different instars were confirmed by the presence of exuviae. Full-grown nymph along with apricot tree leaves and fresh cuttings were transferred into new Petri dishes containing soil for pupation. Every day, these Petri dishes were checked for the appearance of adults. After sexing one male and one female, newly emerged adults were sexed by the presence of wings (males have wings, females wingless). The mated pairs were then put onto new Petri dishes for egg-laying. Every two days, the leaves and cuttings were replaced. Eggs laying data peer day per female was counted and recorded daily until

all the females died. Data on eggs hatching, various developmental durations (nymphs and adults) male and female longevity and reproduction period, Oviposition period were calculated. The intrinsic rate of increase (*r*), finite rate of increase (λ) and the net reproductive rate (R_0) were also calculated.

2.4. Statistical analysis

The data regarding the life history parameters of mealybug, *Drosicha sp* were analyzed by the computer program TWO SEX-MSChart using age-stage, two-sex life table method (Chi, 2018).

Results

3.1. Life table parameters

The total developmental time of *Drosicha sp* individually reared individually on willow and apricot hosts under laboratory condition are shown in Table 1. The data showed that non-significant difference was observed for egg developmental duration (*P*= 1.000) when reared on willow and apricot hosts. Further non-significant differences were recorded for nymphal stages (N1 and N2) with *P* values of 0.387 and 0.086 respectively. However, the 3rd nymphal stage of the *Drosicha sp* fed on apricot had significantly longer developmental duration (13.12 ± 0.216 days, *P*= 0.015) as compared to *Drosicha* sp reared on willow host (12.45 ± 0.176 days). There was non-significance difference in the doubling time duration of *Drosicha sp* reared on willow and apricot hosts (*P*= 0.065). *Drosicha sp* reared on willow had significantly lower preadult survival rate (54.88 % ± 0.354 days, *P*= 0.043), significantly lower female total longevity (67.80 days ± 0.424, *P*= 0.002) as compared to *Drosicha sp* reared on apricot host.

Table 1. Developmental time (means ± standard error) of different stages of *Drosicha sp* reared on willow and apricot hosts under laboratory condition.

Stage/Parameter	n *	Willow	n*	Apricot	*P*-value
Egg (days)	60	14.3 ± 0.089	60	14.3 ± 0.094	1.000
N1 (days)	60	13.26 ± 0.258	60	13.566 ± 0.222	0.387
N2 (days)	52	14.30 ± 0.270	47	14.87 ± 0.187	0.086
N3 (days)	51	12.45 ± 0.176	47	**13.12 ± 0.21	0.015
Doubling time (days)	60	8.459 ± 0.193	60	9.028 ± 0.244	0.065
Pre adult survival rate (%)	51	54.88 ± 0.354	47	**55.97 ± 0.41	0.043
Female total longevity (days)	36	67.80 ± 0.424	33	**69.78 ± 0.48	0.002
Male total Longevity (days)	15	64.46 ± 0.924	14	63.5 ± 1.278	0.535
Total longevity (days)	60	60.85 ± 1.893	60	59.36 ± 2.166	0.608

n* indicates number of replicates in each treatment, ** Specifies mean significance difference of different stages of *Drosicha sp* be reared individually on Willow and Apricot hosts using bootstrap technique with 100000 resampling.

The data presented in Table 2 showed that non significance difference was observed in the adult pre oviposition (APOP) of *Drosicha sp* when reared on either willow or apricot hosts (*P*= 0.210), while there was significance difference in the total pre oviposition days (TPOP) of *Drosicha sp* when reared on willow and apricot hosts (*P*= 0.003). The mean oviposition days of *Drosicha sp* when reared on willow and apricot hosts were 5.083 and 5.060 days respectively. The data further showed that *Drosicha sp* reared on willow host had resulted in significantly higher fecundity (246.11 ± 5.646 eggs) as compared to apricot with 219.81 ± 5.487 eggs (*P*= 0.001).

Table 2. Pre-oviposition period (APOP), total pre-oviposition period (TPOP), oviposition period and fecundity of *Drosicha sp* reared on willow and apricot hosts under laboratory conditions.

Stage/Parameter	n*	Willow	n*	Apricot	*P*-value
APOP (days)	33	4.277 ± 0.122	36	4.515 ± 0.144	0.210
TPOP (days)	36	58.83 ± 0.415	33	**60.60 ± 0.438	0.003
Oviposition day	36	5.083 ± 9.939	33	5.060 ± 0.113	0.887
Fecundity (egg)	36	**246.11 ± 5.64	33	219.81 ± 5.487	0.001

n* indicates number of replicates in each treatment, ** Specifies mean significance difference of different stages of *Drosicha sp* be reared individually on Willow and Apricot hosts using bootstrap technique with 100000 resampling.

3.2. Population Parameters

The population parameters of *Drosicha* sp reared on willow and apricot hosts under laboratory conditions are documented in Table 3. The data showed non-significant difference for the mean values of the intrinsic rate of increase (*r*) per day of *Drosicha* sp when reared on willow and apricot hosts (0.081 ± 0.001 and 0.076 ± 0.002) respectively. The results further demonstrated non significance difference for the mean values of finite rate of increase (λ) per day and net reproductive rate (R_0) of *Drosicha sp* as the values for these parameters in willow host were (1.085 ± 0.002 and 147.66 ± 15.97 offspring) per day and that of apricot host were (1.079 ± 0.002 and 120.9 ± 14.47) per day. The data further showed that significantly higher value of the mean generation time (*T*) in days

of *Drosicha sp* was recorded on apricot (62.45 ± 0.422) as compared to willow (60.96 ± 0.357 days) i-e. (*P*= 0.007). The gross reproductive rate (*GRR*) of *Drosicha sp* showed non-significant difference (*P*= 0.325) when reared on apricot (188.16 ± 13.56) and willow hosts (217.84 ± 24.81) respectively.

Table 3. Life table parameter of Mealybug (*Drosicha sp*) reared on willow and apricot hosts under laboratory conditions. Values are given as (mean ± standard error).

Parameter	**n***	**Willow**	**n***	**Apricot**	***P*-value**
The intrinsic rate of increase (*r*) per day	60	0.081 ± 0.001	60	0.076 ± 0.002	0.060
The finite rate of increase (λ) per day	60	1.085 ± 0.002	60	1.079 ± 0.002	0.060
The net reproductive rate (R_0)	60	147.66 ± 15.97	60	120.9 ± 14.47	0.215
The mean generation time (*T*) in days	60	60.96 ± 0.357	60	**62.45 ± 0.422	0.007
Gross reproductive rate(*GRR*)	60	217.84 ± 24.81	60	188.16 ± 13.56	0.325

n* indicates number of replicates in each treatment, ** Specifies mean significance difference of different stages of *Drosicha sp* be reared individually on Willow and Apricot hosts using bootstrap technique with 100000 resampling.

3.3. Age stage specific survival rates (s_{xj})

Age stage specific survival rates (s_{xj}) of *Drosicha sp* mealybug fed on willow and apricot hosts are shown in Fig. 1. The different curves showed that due to changed in the developmental time of the different stages, significant overlapping between the curves were observed. The age stage specific survival rate of *Drosicha sp* for egg reared on willow and apricot hosts were 14 and 15 days respectively. The curves regarding the different nymphal stages of *Drosicha sp* reared on willow were 19, 28, and 23 days for N1, N2 and N3 respectively while the age stage specific survival rate of nymphal stages (N1, N2, and N3) of *Drosicha sp* reared on apricot were 17, 23 and 23 days respectively. Similarly, the age stage specific survival rate curves for the male adult reared on willow and apricot were 25 and 23 days respectively while the age stage specific survival rate for the female adult reared on willow and apricot hosts were 21 and 23 days respectively.

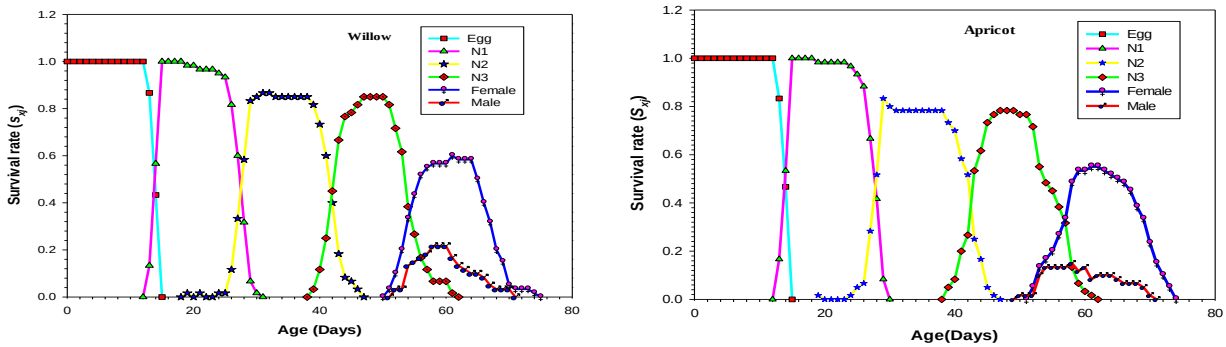

Fig. 1. Age stage specific survival rate of Drosicha sp reared on willow and apricot hosts under laboratory conditions

The different lines curves of the age specific survival rate (*lx*), age specific fecundity (*mx*), age-stage specific fecundity (*fx*) and age specific maternity (l*xmx*) of the *Drosicha sp* reared on willow and apricot hosts are shown in Fig. 2. The age specific survival rate (l_x) in *Drosicha sp* gradually dropped early when reared on apricot as compared to willow host. The age stage specific fecundity (f_x) value (41.029 offspring per day) was recorded on day 60 in willow which was higher than the peak value of *Drosicha sp* reared on apricot (35.909 offspring per day) on day 62. The curve for the age specific fecundity (m_x) showed greater value (5.361 offspring) reared on apricot at the time of emergence as compared to reared on willow (1.686 offspring). Similarly, the age specific maternity (l_xm_x) of *Drosicha sp* reared on willow host was (23.25 offspring) on day 60 which was greater than the age specific maternity (l_xm_x) (19.75 offspring) on day 62 of *Drosicha sp* reared on apricot host.

3.4. The age stage specific life expectancy (e_{xj})

The curves of the age stage specific life expectancy (e_{xj}) of *Drosicha sp* reared individually on willow and apricot hosts are shown in Fig. 3. The age stage specific life expectancy of newly hatched eggs of *Drosicha sp* reared on willow was 60.85 days while (e_{xj}) of newly hatched eggs of *Drosicha sp* reared on apricot was 59.36 days respectively. The curves regarding the male and female life expectancy showed that the life expectancy of male (12.17 days) and female was (16.80 days) recorded minimum on willow at the time of emergence. While the life expectancy of male (12.30 days) and female (17.78 days) were recorded maximum on apricot at the time of emergence.

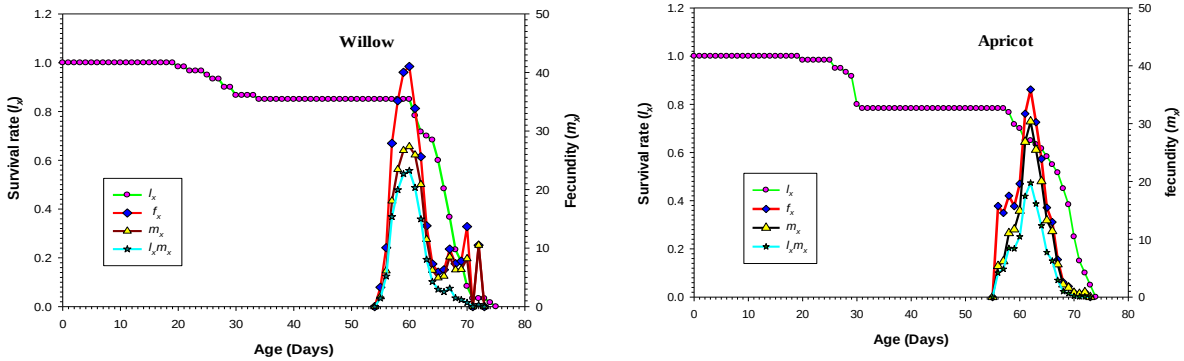

Fig. 2. Age specific survival rate (lx), female age specific fecundity (fxj) age specific fecundity of the total population (mx), and age-specific maternity (lxmx) of Drosicha sp reared on willow and apricot hosts under laboratory conditions

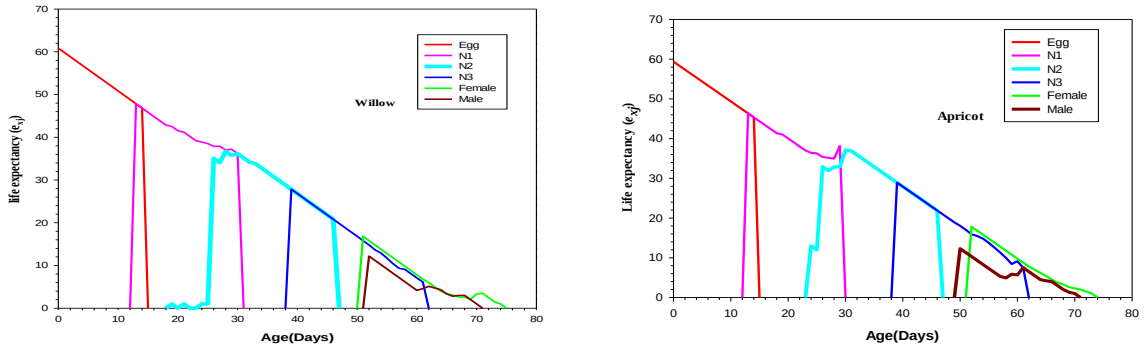

Fig. 3. Age stage specific life expectancy (e_{xj}) of *Drosicha sp* reared on willow and apricot hosts under laboratory conditions.

3.5. Age stage specific reproductive values (v_{xj})

Age stage specific reproductive values (v_{xj}) of *Drosicha sp* reared on willow and apricot hosts under laboratory conditions are shown in Fig. 4. The age stage specific reproductive rates (v_{xj}) of a new hatched eggs of *Drosicha sp* were recorded high (1.085 progeny) on willow as compared to the *Drosicha sp* reared on apricot host (1.079 progeny). Curve regarding the female reproductive value showed highest rates of (188.654 progeny) per day on day 58 when reared on willow which was higher than the reproductive rate of *Drosicha sp* when reared on apricot (160.64 progeny) on the day 56.

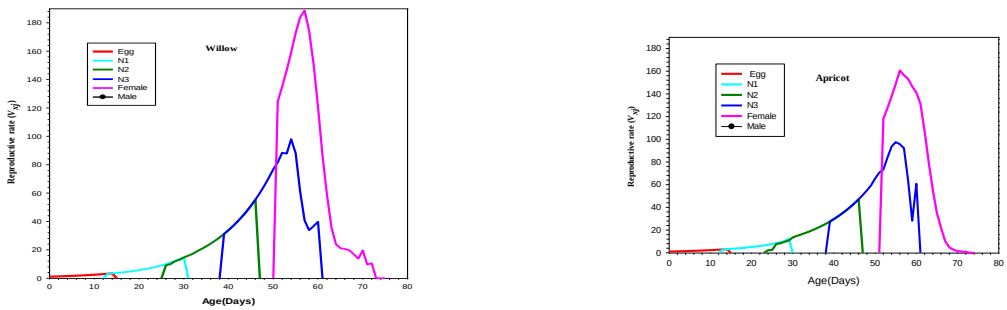

Fig. 4. Age stage specific reproductive values (vxj) of Drosicha sp reared on willow and apricot hosts under laboratory conditions.

Discussion

Understanding the population parameter of insect pests is essential for the development of integrated pest management techniques. These parameters provide the population growth rate of the current and next generation of insect pests (Frel et al., 2003). The present research was conducted on the life-tables parameters of *Drosicha sp* reared on willow and apricot tree leaves and shoots cuttings in the Integrated Pest Management Laboratory (IPM) Skardu Gilgit Baltistan. Ten mated pairs of *Drosicha sp* were released on excised willow and apricot leaves

in rearing cages. After oviposition sixty eggs were separated using a camel hairbrush. Each egg was transferred into a petri dish containing fresh leaves of willow and apricot trees. These Petri dishes were observed daily for egg hatching. After egg hatching, various nymphal instars duration was recorded daily. Different instars were confirmed by the presence of exuviae. There was significant difference occurred in different stages of *Drosicha sp* due to the availability and different function of their hosts. The mealy bug *Drosicha sp* preferred willow host for feeding as compared to apricot. Host plant cues plays an important role in controlling and deterring different pests population (Golizadeh et al., 2009; Tazerouni et al., 2016; Salim et al., 2021). Plants with antibiotic properties affect the biology and adult performance of the pests (Goldasteh *et al*., 2012; Reddy and Chi, 2015). Bellows *et al*. (1992) and Shahout *et al*. (2011) also reported different developmental time and reproduction rate of mealy bug when reared on different host plants. Musa and Ren (2005) studied the life history parameters of *Bemisia tabaci* on three different bean species and reported that insect select host that meets specific nutritional requirement not offered by others host. Similarly, Syed and Abro (2003) obtained variable growth pattern of diamond back moth when reared on different hosts and concluded that the difference in growth and development of the diamond back moth may be due to differences in nutrition levels of the host plants.

The current study found that *Drosicha sp* has a shorter life cycle and higher fecundity on willow than on another host. Although a variety of factors influence insect populations, there is a useful relationship between the appropriateness of host plants and their intrinsic growth rate (Soufbaf et al., 2012). The intrinsic growth rate (r) is an important indicator of population dynamics. External and internal factors such as plant volatiles, wax, leaf shape, and host plant nutritional quality, or a combination of these elements, have been found to have a significant impact on intrinsic growth rate (Soufbaf et al., 2012; Ahmad et al., 2016).

Our results indicate that the host plant can affect the intrinsic growth rate, finite rate and net reproduction rate of *Drasicha sp*. Goundoudaki et al. (2003) also studied the life history parameters of *Myzus persicae* on Oriental and Virginia tobacco varieties and reported that The intrinsic rate of increase and net reproduction rate are both the best indicators of insect population growth. They further concluded that both of these parameters are significantly affected by nutrients and changing ecological conditions on the hosts. The life table parameters of the *Drosicha sp* proved the relationship between the net reproduction rate (R_0) and the average female fertility rate (F). Chi (1988) has tested the life tables of both sexes. Since the life table of two sex by age stages takes into account the variable development rate between individuals, the overlap between the stages can be observed in the curves of (s_{xj}). However, if the same data were analyzed using the traditional age-specific female life table, such as the Lewis-Leslie matrix (1993), the differentiation by stages would not be revealed.

The age-specific survival rate (l_x) is the simplified version of the survival rate by age stages. Although the differentiation and overlap of stages could not be observed in the (l_x) curve, it was however constructed using the life table of two sex by age stages and could accurately explain the change in survival rate with age. Chi and Huang (2012) demonstrated that incorrect (l_x) curve would be obtained if the usual age-specific female were used. According to our findings, the net reproduction rate and mean generation time of *Drosicha sp* were much higher on willow than apricot, owing to the fact that willow cuttings are fresh and do not dry as quickly as apricot, allowing the *Drosicha sp* to feed on different days. However, there is no difference in the intrinsic rate of increase (r) per day and the finite rate of increase (λ) per day between the willow and apricot. However, no difference was observed in the *Drosicha sp* Gross reproductive rate (*GRR*) when reared willow and apricot hosts.

Rearing of the *Drosicha sp* on willow resulted in significantly lower total pre oviposition period (58.83 days) as compared to *Drosicha sp* reared on apricot (60.60 days). Conversely no difference was observed in the oviposition days of *Drosicha sp* when reared on apricot (5.06 days) and willow (5.0833 days). The statistical data also revealed that significantly maximum number of fecundity (eggs/female) of *Drosicha sp* was observed when reared on willow (246.11) as compared to apricot (219.81). Our results are in close conformity with the findings of Çalışkan et al. (2016) who studied the demographic parameters and biological features of *Phenacoccus solenopsis* on *Hibiscus rosa-sinensis*, *H. syriacus*, *Brugmansia aurea* and *Cestrum nocturnum* under laboratory conditions and reported that total pre-oviposition, oviposition, post-oviposition time, fecundity and longevity are affected by host plant species. Similarly different researchers have documented different estimates of female fecundity of mealy bugs ranging from 90.4 nymphs/female to 424.3 nymphs/female (Abbas et al., 2010; Rashid et al., 2012).

The population growth factors of *Drosicha sp* were much higher on willow than apricot, according to the findings. As a result, willow was a superior host for *Drosicha sp* growth and development than apricot. The difference in some of the findings of the present study with the other researchers may be due to the variation of plant hosts. It is evidence that modification in the developmental time of insect on the base of nutritional needs that reproduce alterations in food intake and feeding behavior (Browne, 1995).

The main purpose of this research work was to examine the overall suitability of *Drosicha sp* life cycle fed on different host. The results revealed that the invasive mealybug, *Drosicha sp* can be considered as serious threats to willow and other ornamental plants in forests and fruits orchards. If the ecological conditions are suitable, the mealybug population will increase rapidly in a short time and will result in significant damage to the forests and fruit orchards. Further, this study provides a pathway to the farmers for selecting the most suitable biocontrol

agents of *Drosicha sp*, to achieve efficient biological control. Therefore, understanding of the demographic study *Drosicha sp* is important for the success of its management program.

Conclusion

The current study concluded that the mealy bug (*Drosicha sp*) effectively feeds on both willow and apricot hosts and hence can be used for mass rearing of *Drosicha sp* and its associated natural enemies under laboratory conditions.

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Non-Carcinogenic Health Risk Assessment Of Fluoride In Drinking Waters Of Northern And Southern Villages Of Edirne Province Of Türkiye

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Abstract
Fluoride is a naturally occurring mineral found in water in varying amounts and intake of inadequate or excessive fluoride may cause adverse effects in especially children. Süloğlu and Enez Districts are in the northern – southern parts of Edirne a major agricultural land in Thrace Region of Turkey. The aim of this study was to assess and compare the non-carcinogenic health risks of fluoride via daily human intake in drinking waters of the Enez and Süloğlu Districts. For this purpose, 22 drinking water samples (11 of them were in villages of Enez and 11 of them were in villages of Süloğu) were collected during the winter season of 2019. Fluoride levels in drinking water were determined with spectrophotometric method and Estimated Daily Intake (EDI) and Hazard Quotient (HQ) of fluoride were calculated. The mean EDI data in infants, children, teenagers and adults were recorded as 0.00209, 0.01478, 0.01043 and 0.00836 ppm, respectively. All the calculated HQ values for all the investigated age groups were less than the critical limit of 1 with a mean of 0.03478 for infants, 0.24633 for children, 0.17388 for teenagers and 0.13933 for adults. The non-carcinogenic health risks of fluoride in drinking water of investigated settlements were found as follows: Süloğlu District > Enes District in general.
Keywords: *Enez District, Süloğlu District, Fluoride, Health Risk Assessment*

Introduction

Fluoride may enter to human body in various ways, but drinking water is known as the most significant source of fluoride. Intake of inadequate or excessive fluoride may cause several adverse effects on human. It is known that about 65% of dental fluorosis is caused by excessive fluoride exposure in drinking water, while inadequate intake cause to increase the risks of dental caries in especially children (Rasool et al., 2017; Aslani et al., 2019).
Health risk assessment indices are useful tools in estimating non-carcinogenic hazards, which may occur when people are exposed to various toxicants (Ustaoğlu and Aydın, 2020; Tokatlı and Ustaoğlu, 2020; Tokatlı and Varol, 2021a; 2021b; Varol and Tokatlı, 2022).
Enez District is located on the southwest corner of Edirne City. Enez District is in the Marmara Type area of the Mediterranean climate and semi-humid in terms of precipitation. The economy of the district is predominantly agricultural and animal husbandry. Fishing is also significant in the central and coastal villages. Süloğlu is located on the northern half of Edirne City. Süloğlu District is in the area of Thrace Passage Type climate (connected to Mediterranean climate) and semi-moist in terms of precipitation. The main livelihood of the district is agriculture (Anonymous, 2016; http://www.edirnekulturturizm.gov.tr).
The aim of the current study was to evaluate and compare the non-carcinogenic health risks of fluoride via daily human intake in 22 drinking water samples collected from villages of the Süloğlu and Enez Districts.

Material And Method

Sample Collection

Drinking water samples were collected from 22 stations (11 of them were in villages of Enez and 11 of them were in villages of Süloğu) located in the Süloğlu and Enez Districts in winter season of 2019 in polyethylene bottles. Coordinate information of the villages investigated are given in Table 1 and map of settlements with the map of Edirne Province are given in Figure 1.

Chemical Analysis

Fluoride was determined by using spectrophotometric method (wavelength range 320 – 1100 nm) with a "Hach Lange DR 3900 Spectrophotometer" device. Hach Lange LCK 323 Cuvette Test was used in spectrophotometer (https://tr.hach.com/).

Non-Carcinogenic Health Risk Assessment of Fluoride

In this research, population was divided into four age groups based on their physiological and behavioural differences as follow: infants (< 2 years old), children (2 – 6 years old), teenagers (6 – 16 years old) and adults (> 16 years old). The daily exposure to fluoride was calculated in these four different groups by using the equation 1.

Hazard Quotient (HQ) describes the non-carcinogenic risk of fluoride and it was calculated by using the equation 2 (Yousefi et al., 2018). A lower value of HQ than one reflects a negligible risk of non-carcinogenic effects and a higher value of HQ than one reflects an important health risk and a significant risk of severe fluorosis may be present.

$$EDI = \frac{Cf \; x \; Cd}{Bw} \quad (1)$$

$$HQ = \frac{EDI}{RfD} \quad (2)$$

EDI: Estimation of fluoride consumption – daily (mg/kg/day)
C_f: Fluoride level in the investigated drinking water samples (mg/L)
C_d: Mean daily water intake (L/day) (the mean water consumption rates in infants, children, teenagers and adults were 0.08, 0.85, 2 and 2.5 L/day, respectively)
B_w: Body weight (kg) (body weights of investigated groups were considered 10, 15, 50 and 78 kg, respectively)
RfD: Reference dose (mg/kg/day) (the reference dose for fluoride is 0.06 mg/kg/day (EPA, 1992).

Table 1. Location properties of villages

Enez District			**Süloğlu District**		
Location	**Coordinate**		**Location**	**Coordinate**	
	North	**East**		**North**	**East**
Yenice Village	40.700	26.149	Domurcalı Village	41.816	26.819
Çavuşköy Village	40.688	26.171	Sülecik Village	41.814	26.850
Büyükevren Village	40.651	26.228	Tatarlar Village	41.835	26.886
Abdürrahim Village	40.641	26.258	Taşlısekban Village	41.802	26.877
Hasköy Village	40.665	26.317	Yağcılı Village	41.784	26.829
Kocaali Village	40.666	26.345	Geçkinli Village	41.731	26.848
Şehitler Village	40.692	26.293	Küküler Village	41.715	26.896
Işıklı Village	40.719	26.309	Akardere Village	41.681	26.930
Çeribaşı Village	40.664	26.256	Büyükgerdelli Village	41.735	26.951
Karaincirli Village	40.627	26.297	Keramettin Village	41.787	26.977
Vakıf Village	40.616	26.258	Süloğlu District	41.767	26.911

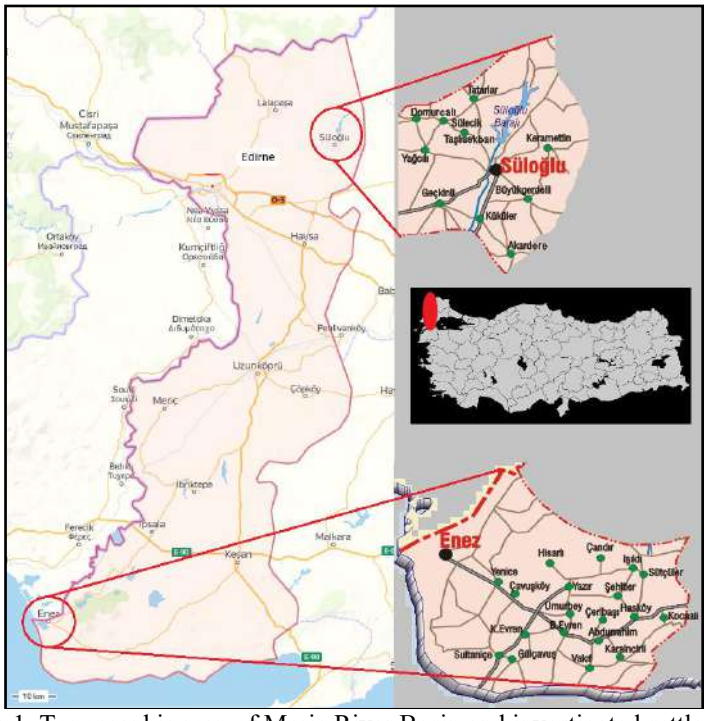

Figure 1. Topographic map of Meriç River Basin and investigated settlements

Result And Discussion

EDI and HQ values for exposure to fluoride in drinking water for infant, child, teenager and adult groups can be seen in Figure 2. Also, the spatial distribution map showing the mean HQ values of different age groups is given in Figure 3.

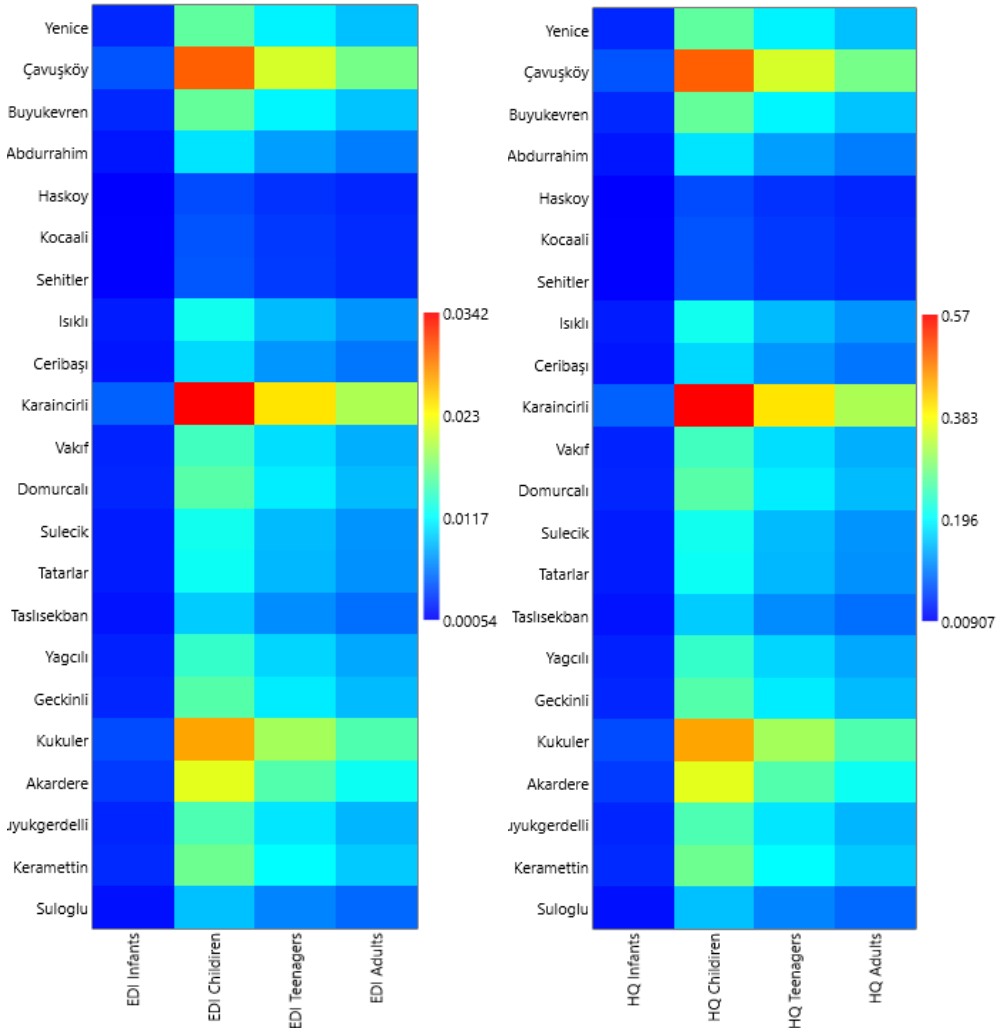

Figure 3. EDI (left) and HQ (right) values of different age groups

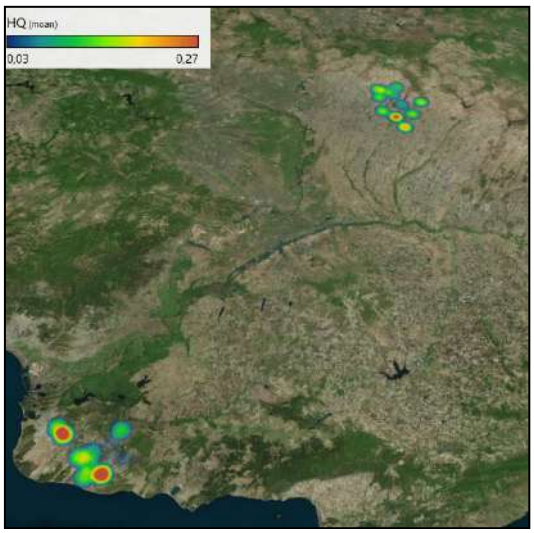

Figure 3. Distribution map of mean HQ values

The EDI data for fluoride in infants, children, teenagers and adults were varied from 0.00054 – 0.00482, 0.00385 – 0.03417, 0.00272 – 0.02412 and 0.00218 – 0.01933 ppm, respectively. The HQ values for fluoride in infants, children, teenagers and adults were varied from 0.00907 – 0.08040, 0.06422 – 0.56950, 0.04533 – 0.40200 and 0.03632 – 0.32212, respectively. The EDI and HQ risk rankings among the investigated different age groups were found as follows: children > teenagers > adults > infants in general. It was also determined that the non-carcinogenic health risks of fluoride in drinking water of investigated villages were found as follows: Süloğlu District > Enes District in general.

The main source of fluoride exposure is known as drinking water. Fluoride may have quite adverse health effects on human health depending on the content and consumption (Ayoob and Gupta, 2006). Optimal levels of fluoride in drinking water have a significant preventive effect on especially dental caries. However, if high amounts of fluoride are ingested through drinking water, it may be adversely effective on the human health mainly on teeth (Güner et al., 2016; Tokatlı and Güner, 2018; 2020; Onur et al., 2019; Onur and Tokatlı, 2020).

In many researches conducted in many different countries on the assessment of health risks of fluoride confirmed that the children are at the chronic health risk due to the intake of fluoride in drinking water (Gao et al., 2013; Narsimha et al., 2018; Dehghani et al., 2019; Qasemi et al., 2020). In the current investigation, group of children were found as the riskiest age group for the health risk due to the intake of fluoride in drinking water in Enez and Süloğlu Districts.

Conlusions

In this research, the non-carcinogenic health risks of fluoride via daily human intake in drinking waters of the Enez and Süloğlu Districts by using the methods of Estimated Daily Intake (EDI) and Hazard Quotient (HQ) and by dividing the population into four age groups based on their physiological and behavioural differences were investigated. As a result of this research, the mean EDI values were recorded as 0.00209 ppm for infants, 0.01478 ppm for children, 0.01043 ppm for teenagers and 0.00836 ppm for adults. The HQ values of all age groups were found as less than the critical limit of 1 and the risk rankings among the investigated different age groups were found as follows: children > teenagers > adults > infants in general. The health risks of fluoride in water of investigated villages were also found as follows: Süloğlu District > Enes District in general.

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Toxicity Of Various Insecticides Against Trichogramma Chilonis (Ishii) (Hymenoptera: Trichogrammatidae) Under Controlled Laboratory Conditions

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Abstract

The research studies were conducted to investigate the toxicity of Neem oil and an insecticide (Spinetoram) on the fitness of *Trichogramma chilonis* (Ishii) under controlled laboratory conditions at Agriculture Research Institute (ARI) Tarnab, Peshawar, during March to August 2019. Completely Randomized Design (CRD) was used for all under observed parameters. The experiment consisted of four treatments and each treatment having 10 replications. Field recommended dose of chemical insecticide Spinetoram (8ml/100 litter water) and Neem oil (2% and 3%) concentrations were tested against the life parameters *viz* insecticide effects on adult emergence, parasitoid parasitism, persistence toxicity of tested toxicants, female fecundity, developmental time of parasitoid, sex ratio and adult longevity of *T. chilonis* under the recommended guidelines of International Organization For Biological Control (IOBC). Results regarding the harmful effects of tested insecticides on adult emergence confirmed that Neem oil 2% concentration was found ''harmless'' while Spinetoram and Neem oil 3% was showed ''slightly harmful'' impacts on parasitoid emergence. Throughout the parasitism experiment lowest parasitism was noticed in Spinetoram, therefore compound was classified in category of ''Slightly harmful'' whereas, Neem oil product (2%, 3%) concentrations were labeled as ''Harmless'' in term of *T. chilonis* parasitism. The persistence toxicity revealed that different concentrations (2% and 3%) of Neem oil were found ''harmless'' and showed ''short lived'' persistency while, Spinetoram showed persistency >30 days in term of parasitoid adult mortality. Reduction in fecundity per female parasitism rate test showed that Spinetoram was moderately toxic (RP >90%) on parasitoid fecundity. There was significant difference recorded among the treatments and control (water) in developmental time of *T. chilonis*, while in case of adult longevity Spinetoram showed severely effects on parasitoid when parasitoids were treated in pupal stage in side host eggs. Insecticide effects on sex ratio of *T. chilonis* revealed that Neem oil positively affect the female percentage which comparatively similar to Spinetoram while significantly difference from control treatment. Our studies results revealed that Neem oil concentrations are relatively nontoxic for biological control organisms and environmental friendly mean easily degradable. While Spinetoram proved highly toxic to life parameters except of developmental time of parasitoids.

Key words: *Toxicity, Trichogramma chilonis, Neem oil, Spinetoram, Fitness*

Introduction

Current agricultural systems include the use of million tons of fertilizers and chemicals. Due to rapid revolution in agricultural fields a large number of contaminations are eliminated and discharge especially chemical fertilizer and pesticides are causing environmental problems and making health hazardous (Trivedi *et al.*, 1986). Pesticides used are one of the major approaches for controlling agriculture and urban pests population all over the world (Musser *et al.*, 2006). Pesticides are considered to be the most efficacious means of protecting crops from pests in all stages; they provide immediate control of entire pest population (Carpenter *et al.*, 2001). In spite of its advantages, the agriculture chemicals cause environmental problems. These pesticides not only disturb terrestrial environment it's also spread the marine environment through leaching and some through overflow from land application. Environmental damage is a serious problem due to unnecessary and widespread use of pesticides. The complex chemistry of pesticides, persistence in the environment, and toxicity to animals, human beings and bioaccumulation-risks make chemical pollution a critical problem (Peterson *et al.*, 2001). The harmful effects of chemical insecticide on biological control agents have highlighted the need of research and creation of pest control strategies besides pesticides, including bio-control practices (Jervis, 2005). Now a day's crop protection policy has suggested reduction in the application of non-selective pesticides for protecting crop against insects. Therefore, it's extremely necessary to study their side effects and to exclude those insecticides which have the injurious effects on the natural enemies. Mostly crops are affected by various pests, some but not all of them may be controlled through bio-control organism that is predator, parasitoid and pathogen. Most of biological control organism that is predators, parasites, parasitoids, at works without human interference for excellent regulation of much agriculture and in urban pest population. But1 for successful and agreeable control of complexes of pests, selective pesticides are more essential. In fact, that is necessary for integrate pest management. The chemical and bio-control organism integration is often critical to the success of an integrated pest management program for pest complex (Shenhmar *et al*., 2003).

Natural enemies have the potential for increasing the benefits of naturally occurring biological control agents by eliminating and reduction of pesticides. Biological control is almost safe, long last effecting, economic, ecological and sociable pest control approach. Most of bio-control agents are feeding on a few number of related species, in

short some bio-agents are host specific is unlikely to be infected the non-target species. Among the various natural enemies, egg parasitoids belong to Trichogrammatidae family are very effective against many lepidopteran pest (Takada *et al*., 2001).

Trichogramma chilonis (Ishii) is an important and commonly available lepidopteran eggs parasitoid and economically viable enterprise (Hassan, 1993). *T. chilonis* species is widely use against lepidopteran pests in Pakistan (Sattar *et al*., 2011). *Trichogramma* species are minute wasps that naturally occur anywhere (terrestrial habitat and some aquatic habitat). About 80 genera from the Trichogrammatidae family with 800 species of *Trichogramma* are used as a biological control around the world (Sumers, 2009). Approximately 200 species of Trichogrammatidae have been identified of which about 25 common species are used for pest management in 34 crops nearly in 30 countries (Parra and Zucchi, 2004). Moura *et al*. 2004 concluded that among the several parasitoids successfully used in the integrate pest management strategies the Trichogrammatidea is one of the most important groups of bio agent for the suppression of lepidopteran pests. Now a day's among the Trichogrammatidae nine species are rearing and commercially produce in the world. Common species of *Trichogramma* for management of pests on numerous crops, which is vegetable, cotton, sugar cane and orchard trees etc. (Hassan, 1993). *Trichogramma* as a feasible biological control organism against *Helicoverpa armigera*, brinjal shoot borer, *Plutella xylostelle, Chilo partellus* and *Sitotroga cerealella* etc.

All living things have 3 kinds of ability to uptake the insecticides from their environment i.e. 1) residual toxicity, 2) direct toxicity, 3) via food up taking and transfer (Croft, 1990). All Trichogrammatidae species are influenced by all three kinds of uptake of pesticides from their environment. Chemicals pesticides contamination can increase the lethal effects on *Trichogramma* that is toxic due to residual effect of pesticides (Hewa *et al*., 2003). Lethal effects of pesticides on parasitic wasps may cause inside the host eggs in juvenile stage or in adult stage. In case of sub-lethal effects on parasitoid include reduction in parasitism, efficiency in developmental time and sex ratio (Brar *et al.*, 1991).

There is great describing value of the pesticide that has impacts on biological control agents as well as on *Trichogramma* specie. Due to the above mentioned facts, it is necessary to find out the toxicity of pesticides against parasitic wasps (*Trichogramma)*, based on pesticides used with the parasitoid (*Trichogramma*) and as a result of a required concentration of insecticides that has been examined to be harmless for beneficial organisms (predator, parasite and parasitoid), especially *T. chilonis* (Tiwari and Khan, 2001) in order to effectively integrate chemical control with *Trichogramma* for successfully control measures of pests. The present research study was design to study the direct and indirect impacts of Neem oil and Radiant against *Trichogramma chilonis* under laboratory conditions.

Materials and Methods

To study the toxicity of Neem oil (2% and 3%) and Radiant (Spinetoram) against *Trichogramma chilonis* (Lepidopterous eggs parasitoid), the experiments were conducted under laboratory conditions (R.H 70-80% and Temperature 25-30ºC) at Entomology section, Agriculture Research Institute (ARI) Tarnab, Peshawar from March to August, 2019. The Trichocards having *Trichogramma* pupal stage prepared in the laboratory of Agriculture Research Institute. The *Trichogramma* eggs cards (size: 4×4*cm*^{2}***)*** containing approximately100 numbers of fresh eggs per card of *Sitotroga cerealella* parasitize eggs were used in laboratory experiment. Radiant 120 SC (Spinetoram, 80ml/100 litters of water) and Neem oil (2% and 3% concentration) was tested on the *Trichogramma* parasitized eggs card along with a control (distilled water).

Completely Randomized Design was used in all experimental work having four treatments with ten replications.

3.1 Rearing of host (*Sitotroga cerealella*) (Olivier) for egg parasitoids on wheat grains

S. cerealella eggs were released using trays size (30×25×4 cm) having two basic parts, its upper rectangular size (37×37×5 cm) part of mass rearing chamber made up of tin sheets, having about 5 kg sterilized wheat grains for *S. cerealella* (larval and adult) adults collecting box was attached with lower tapering downward with an opening size (3×3 cm). In upper part of mass rearing chamber hatching larvae were feed on wheat grains, then pupated and adults were emerged within 3-4 weeks and directly come into adult collecting box. The adults collecting box was changed on daily basis with new ones. Collected adults were place in plastic rearing jar having starch for feeding purpose. Adults laid eggs were collected by sieving starch with mesh size no. 70 and 50. The collected host eggs incubate for further experimental purpose in same conditions following the procedure of Saljoqi *et al*., (2012).

3.2 Rearing of parasitoid (*Trichogramma chilonis*) on host eggs

For maintenance of *T. chilonis* culture, *S. cerealella* eggs were used in the laboratory experiments. Approximately100 fresh 24<hrs host eggs were uniformly sprinkled on paper cards (size 4×4 cm²) by using a common 50 ml plastic bottle with lid of 30-45 mesh size. These Trichocards were placed at room temperature to dry for 1 to 2 hours. The dried Trichocards were put in glass jars (5×12 cm²) having approximately 40-50 (mixed gender adults) of *T. chilonis* at least for 24 hrs for parasitism. The glass jars were placed under tube light for good parasitism of parasitoid. The mass rearing jar was closely covered with nylon cloth to stop outflow of adult parasitoids. Subsequently, the parasitized Trichocards were transferred to another empty rearing jar of the same size and the jar were incubated at (Temperature 25-30ºC and 60-70% R.H) conditions till parasitoids emergence

from host eggs. Numerous parasitized Trichocards were collect in the same method on daily basis and incubate at same environments for maintenance of *Trichogramma* culture and further use it for experimental purpose.

3.3 Toxicants

Two types of toxicant i.e. Neem oil with different concentration (2% and 3%) and chemical insecticides including Radiant 120SC (Spinetoram) was purchased from local market Peshawar. Similarly, Neem oil ready to use was arranged from the local market (Sheikh Pansari, Shaheen Town, Peshawar).

Bıoassays

3.4.1 Effect on Pupal stage of *T. chilonis* (percent adult emergence)

The parasitized egg cards were cut into small size (1 cm^2) having three days old; hundred parasitized eggs (appearing black in color) were treated with recommended rate of tested toxicants. For the control treatment, only distilled water was sprayed using hand atomizer. All the chemical substances were sprayed following procedure of Badshah *et al.* (2016), the used of a hand atomizer of 1ml of the teste toxicant in such a way that all pupae treated with equal amount of concentration of the solution. The treated Trichocards were dried at room temperature for 20 minutes and then were kept inside a test tube (5ml) covered with nylon fabric. Each treatment was replicated ten times. The emerged parasitoid from each treatment was counted on daily base for percent emergence, for the determination of percent emergence of *T. chilonis,* the following formula was used;

$$\text{Percentage Emergence} = \frac{\text{No. of emerged adults in treatment}}{\text{Total No. of eggs offered}} \text{X100}$$

While reduction in adult's emergence E (%) was determined by:

$$\boldsymbol{E\ (\%) = \frac{1 - Vt}{Vc} \times 100}$$

where E is effect of insecticide on adult emergence, Vc = emergence in control (water) and Vt adult emergence in treatment (Manzoni *et al*., 2007)

3.4.3 Effect of above mention insecticides on Parasitism of *T. chilonis*

Approximately 100 Fresh eggs were used to spread uniformly on sticky cards (size 4×4 cm^2) and the cards were placed at room temperature to completely dry for 1-2 hours. The dried Trichocards were put in small vials (15ml) and the fresh treated ten pairs of *Trichogramma* adults were released separately into each vial having Trichocards and covered with nylon cloth to prevent the outflow of adults. After 24 h parasitoid was removed following procedure of Saljoqi and Walayati, (2013) with some modification. On 3rd, 4th and 5th days parasitized eggs appeared black and plumpy were observed and the percent parasitism was determined by

$$\textit{Percent parasitism} = \frac{\text{No. of parasitized eggs in treatment}}{\text{Total No. of eggs offered}} \times 100$$

The reduction in parasitism (RP) was calculated by the following formula:

$$\boldsymbol{RP\% = \frac{1-f}{t} \times 100}$$

where RP = Parasitism reduction f = Parasitized eggs in treatment and t = Average parasitized eggs in control (water) (Hassan *et al*., 2000).

3.5 Residual toxicity of neem oil and radiant on *T. chilonis*

To find out the residual effects of Neem oil (2% and 3%) and radiant on percent mortality of *T. chilonis*, a blank Trichocard (4×4 cm^2) was separately treated with tested treatments Spinetoram and (Neem oil 2%, Neem oil 3%) and were kept under laboratory conditions for 24hrs, 48hrs, 72hrs and 5 days following procedure of Badshah *et al.,* (2017). The treated cards were kept in 15-ml flask separately, so that to make sure contact of these cards with parasitoids. Then one day old adults of *T. chilonis* (20/flask) were released in these flasks having sprayed cards. When the *T. chilonis* adults started moving inside the flasks, the adults were come in contact with the cards treated with tested toxicants. After 24 hours from the exposure of parasitoids to these cards the mortality rate of the parasitoids adults was recorded and then compared with the control (only water). Each treatment was replicated ten times.

To evaluate the effects of each toxicant on life parameters (fecundity and longevity) of *T. chilonis,* for surviving adult parasitoids the life-table method was conducted procedure followed by Bayram *et al.,* (2010) with a bit modification. Approximately 100 newly emerged adults (>4 hours after emergence) from already treated pupae with tested insecticides or distilled water for control of *T. chilonis* was introduced into a 15 ml flask, flask was covered with nylon cloth to stop adults flow and allow air circulation. The surviving female parasitoids after exposure to tested toxicants for 8 hours were transfer individually into a clean flask having honey products for food source, each treatment was replicated ten times. For each treatment, 30 numbers of treated adults were randomly collected from five replications to determine the fecundity and longevity of *T. chilonis* procedure followed by Bayram *et al.,* (2010). The egg card having 150-200 *S. cerealella* eggs were inserted into each vial. The egg cards were replaced with a new one after 24 hours and it was changed day-to-day till all individuals were died to assess the fecundity of treated *T. chilonis*. Survivals of female parasitoids were recorded daily for longevity of parasitoids. The egg cards were labeled and placed into glass tubes (5.5 cm and 1cm dia.) and incubated for 13 days under standard laboratory conditions to ensure a complete emergence of offspring from the initial parasitism and the number of parasitized eggs (black), percent of emergence was calculated for each treatment.
To determine sex ratio, the adults got from longevity was observed under stereomicroscope 10X by using identification key as well as morphological characters (Querino and Zucchi, 2011).
To find out the effects of tested insecticide on the developmental time of wasps, life table method was conducted procedure followed by Liu *et al.,* (2012) with slide modification. Approximately 100 fresh (old<3hrs) host (*S. Cerealella)* eggs were smoothly spread on sticky paper cards then placed at room temperature to completely dry for some hours. The dried Trichocards were separately sprayed by using hand automizer with tested insecticides at the above mentions rate for control treatment only water was used. These treated cards were kept into small vails size (5ml) and then, 5 pairs of *T. chilonis* (old<24 hours) adults were released into each vails and cover with nylon cloth to stop the outflow of parasitoids for 24 hours to insure parasitization. After 24 hours parasitoid was removed and observed the host eggs for parasitization. The host eggs that changed their color into black were considered as parasitized by parasitoids while the rest of other were counted as unparasitized. The unparasitized eggs were removed from each Trichocards before the larvae hatching. Each treatment was replicated ten times. The parasitized eggs were examined until the parasitoid adult emergence.

Statistical Analysis
The collected data for each parameter was separately subjected to ANOVA through a Completely Randomized Design (CRD). Means were separated using Least Significant Difference (LSD) at 5% level. Statistical tests were done by using Statistix 8.1 software (Steel and Torrie, 1980).

Results
The laboratory study was carried out in order to evaluate **‘‘**The toxicity of Neem oil concentrations (2% and 3%) and an insecticide Radiant (Spinetoram 0.08%) against *Trichogramma chilonis* under controlled laboratory conditions at Entomology section, Agriculture Research Institute (ARI) Tarnab, Peshawar, during March 2019.
The results of present investigation are discussed under the following headings.

4.1Effect of Neem oil and Radiant on Adult emergence (%) of *T. Chilonis* under laboratory conditions
The data regarding the effects of different concentrations of Neem oil (2%, 3%) and field recommended dose of Radiant (Spinetoram) on the adults emergence of *T. chilonis* (Table-4.1) showed different effectivity.
The mean data (Table-4.1) revealed that the significant difference was recorded in percent adult emergence of *T. chilonis*. The mean data showed that treatments Radiant and Neem oil (2%, 3%) significantly affected in term of percent adult emergence of *T. chilonis* after 24hrs, 48hrs and 72hrs when compared with control. After 24hrs the maximum percent adult emergence (74.0%) was recorded in control (water) which was found significantly superior in term of adult emergence as compared to other treatments followed by Neem oil 2% concentration (54.6%). Minimum percent adult emergence (30.8%) was noticed in Radiant having Spinetoram which was followed by Neem oil 3% concentration. Mean data regarding after 48hrs showed that there was significantly difference observed in all tested treatments. Maximum adult emergence (79.7 %) was recorded in control which was statistically higher than other treatments while, lowest percent adult emergence (34.2%) was founded in Radiant which was followed by Neem oil 3% concentration (56.4%). After 72hrs, the highest percent adult emergence (89.5%) was showed in control (water) treatment followed by Neem oil 3% (63.0%) and lowest percent adult emergence (36.0%) was recorded in Radiant treatment which was followed by Neem oil 3% (59.7%). Overall lowest adult emergence at 24 hours, 48 hours and 72 hours was founded in Radiant (Spinetoram) as compared to other treatments and control therefore, categorized as ‘‘slightly harmful’’ (class 2). Similarly Neem oil 3% concentration was significantly difference in terms of reducing adult emergence rates and it was also ranked as ‘‘slightly harmful’’ (class 2). But Neem oil 2% concentration exerted the minimal negative effect on the immature stage of parasitoids therefore, it was ranked as ‘harmless’ on the basis of adult emergence.

Table-4.1. Effect of Neem oil (2%, 3%) and Radiant on Adult Emergence (%) of *T. chilonis* under laboratory conditions.

TREATMENTS	*AE(%)24 HRS	* E (%)	*AE(%) 48 HRS	*E (%)	*AE(%) 72 HRS	*E (%)
RADIANT	30.8 d	58	34.2 d	57	36.0 d	60
NEEM OIL 3%	50.8 c	31	56.4 c	30	59.7 c	34
NEEM OIL 2%	54.6 b	26	59.3 b	25	63.1 b	29
CONTROL	74.0 a	-	79.7 a	-	89.5 a	-
LSD	**1.92**	**-**	**1.22**	**-**	**1.7**	**-**

Small letters after mean values indicate the significant differences (P≤0.05) within column among the treatments, *AE(%) = Percent Adult Emergence

$$E\ (\%) = \frac{1-Vt}{Vc} \times 100$$

where E is the effect of the pesticide on parasitoid emergence compared to the control Vt parasitoid adult emergence in tested treatment and Vc adult emergence in control (water).
IOBC classification Class 1). Harmless (E<30%)
Class 2). Slightly Harmful (E= 30-79%)
Class 3). Moderately harmful (E=80-99%)
Class 4). Harmful (E>99%).

4.2. Influence of Neem oil (2%, 3%) and Radiant on Percent Parasitism of *T. Chilonis* under laboratory conditions.

The mean data regarding percent parasitism presented in (**Table-4.2)** revealed that Radiant (Spinetoram) and two different concentration of Neem oil (2%, 3%) were significantly influenced the percent parasitism of *T. chilonis* as compared to control after 24hrs, 48hrs and 72hrs. The highest percent parasitism rate (90.60%) was recorded after 24hrs in control (water) which was followed by Neem oil 2% (80.90%). Minimum percent parasitism (41.10%) was showed in Radiant followed by Neem oil 3% (74.60%). With the passage of time the percent parasitism of *T. chilonis*was increased. After 48hrs, the lowest percent parasitism (42.10%) was noticed in Radiant treatment followed by Neem oil 3% with parasitism rate (76.30%) while, the maximum parasitism (93.60%) was recorded in control (water) which was followed by Neem oil 2% (83.0%). Similarly, the minimum percent parasitism (43.20%) after 72hrs was shown by applying Radiant treatment which was followed by Neem oil 3% with parasitism rate (78.20%). Maximum parasitism (93.60%) was observed in control (water) followed by Neem oil 2% (84.20%). Throughout the parasitism experiment the lowest percent parasitism was recorded in Radiant treatment that's why it was labeled as ''Slightly harmful'' (class 2). In case of percent parasitism all the tested treatment showed significant difference among the treatments

Table- 4.2. The toxic effect of chemical and botanical insecticides on percent parasitism of *T. Chilonis* under laboratory conditions.

TREATMENTS	Parasitism (%) 24 HRS	E (%)	Parasitism (%) 48 HRS	E (%)	Parasitism (%) 72 HRS	E (%)
RADIANT	41.10 d	55	42.10 d	55	43.20 d	54
NEEM OIL 3%	74.60 c	18	76.30 c	18	78.20 c	16
NEEM OIL 2%	80.90 b	11	83.00 b	11	84.20 b	10
CONTROL	90.60 a	-	93.60 a	-	93.60 a	-
LSD	**2.26**	**-**	**2.25**	**-**	**2.26**	**-**

Note: *Small letters after mean values indicate the significant differences at (P≤0.05) within column among the treatments.*

E = Reduction in parasitism

$$E\ (\%) = \frac{1-Vt}{Vc} \times 100$$

Class1)- harmless (*E* < 30%)
Class 2)- slightly harmful (30% < *E* < 79%)
Class 3)- moderately harmful (80%< *E* < 99%)
Class 4)- harmful (*E* < 99%).

4.3 Residual toxicity of Neem oil and Radiant on adult mortality of *T. chilonis*

Mean data regarding the residual effect of insecticides on *T. chilonis* adults **(Table-4.3)** showed that all the tested treatments were statistically noxious as compared to control (water). When adults were exposed to 24 hrs old treated cards. The highest toxicity in term of adult mortality (92.20%) was recorded in Radiant which was followed by Neem oil 3% with (43.00%) adult mortality. Minimum persistency (10.80%) was recorded in control (water) followed by neem oil 2% concentration (28.20%). When the parasitoid was exposed to 48hrs old insecticides residue maximum mortality (88.40%) was recorded in Radiant while, the lowest insecticide persistency (9.50%) was noticed in control (water) which was followed by Neem oil 2% with (24.70%) adult mortality. After 72hrs the insecticides persistency a little bit decreased, the minimum (6.20%) adult mortality was noticed in control (water). However maximum adult mortality (84.70%) was observed in Radiant treatment. Similarly, after 5 days the highest adult mortality (75.90%) was recorded in Radiant which was followed by Neem oil 3% with (27.60%) adult mortality. The lowest (5.20%) *T. chilonis* adult mortality was showed in control followed by Neem 2% (16.80%) when *T. chilonis* were exposed to 5 days old treated cards. In Radiant treatment about (92.00%) *T. chilonis* adult mortality was recorded dead when adults were exposed to 24hrs old treated cards therefore, compound was labeled as "harmful" while rest of treatment Neem oil (2%) was labeled as "harmless" in term of adult mortality.

Table- 4.3. Mortality (%) of *T. chilonis* adults after exposure to 24hrs, 48hrs, 72hrs and 5 days old insecticide residues for 24hrs under laboratory conditions.

TREATMENTS	Adult Mortality (%) of *T. Chilonis* Age of pesticide residues (Hours) 24 Hrs	48 Hrs	72 Hrs	120 Hrs
RADIANT	92.20 a	88.40 a	84.70 a	75.90 a
NEEM OIL 3%	43.00 b	40.40 b	35.20 b	27.60 b
NEEM OIL 2%	28.20 c	24.70 c	20.70 c	16.80 c
CONTROL	10.80 d	9.50 d	6.60 d	5.20 d
LSD	**2.34**	**1.99**	**1.58**	**1.75**

Small letters after mean value indicate significant difference at (P≤0.05) within column among the treatments. International Organization for Biological Control (IOBC) residual toxicity:
Class A) short live (<5)
Class B) slightly persistent (5-15 days)
Class C) moderately persistent 16-30 days)
Class D) persistent (>30 days) (Sterk et al., 1999).

4.4 Toxic effect of tested insecticides on the fecundity of *T. chilonis*

The data regarding the fecundity of *T. chilonis* adults was presented in **(Table-4.4).** Results of the fecundity rate after 24hrs exposure to host eggs (*S. cerealella)*, revealed that maximum rate of parasitization (9.90 eggs/female) was observed in control (water) followed by Neem oil 2% (6.60 eggs/female), whereas lowest (1.30 eggs/female) adults fecundity was recorded by applying Radiant treatment which was followed by Neem oil 3% (6.60 eggs/female). Data regarding the parasitization per female after 48hrs showed that minimum fecundity rate (0.70 eggs/female) was shown in chemical insecticide Radiant followed by Neem oil 3% with (4.60 eggs/female). The highest fecundity rate (9.0 eggs/female) was noticed in control followed by Neem oil 2% (5.60 eggs/female). With time interval the parasitization ability was decreased, After 72 hrs results was presented in Table-4.4 showed that uppermost parasitization (8.0 eggs/female) was noticed in control (water) which was followed by Neem oil 2% (4.0 eggs/female). Due to insecticide toxicity (0.60) egg lying by per female was recorded in Radiant treatment. According to the International Organization For Biological Control (IOBC) ranking of effectivity level for reduction the ovipositional capacity of biological control agents, Radiant was ranked as ''Moderately harmful'' while the rest of treatments were categorized as ''Slightly harmful''(class 2).

Table -4.4 Influence of tested toxicant on fecundity rate of *T. chilonis* under laboratory conditions

TREATMENTS	Parasitization female^{-1} 24 HRS	%RP	Parasitization female^{-1} 48 HRS	%RP	Parasitization female^{-1} 72 HRS	%RP
RADIANT	1.30 d	87	0.70 d	92	0.60 d	93
NEEM OIL 3%	4.90 c	50	4.60 c	49	3.00 c	63
NEEM OIL 2%	6.60 b	33	5.60 b	38	4.00 b	50
CONTROL	9.90 a	_	9.0 a	_	8.00 a	_
LSD	**0.57**	_	**0.58**	_	**0.64**	_

Small letters after mean value indicate significant difference at (p≤0.05) within column among the treatments.

$$RP\% = \frac{1 - f}{t} \times 100$$

Where RP is the reduction in parasitism, F average number of parasitized eggs in tested treatment and t average number of parasitized eggs in control (just water)
IOBC class wise ranking
Class 1, harmless (RP<30%)
Class 2, slightly harmful (30%<RP<79%)
Class 3, moderately harmful (80%<RP<90%)
Class 4, harmful (RP>90%).

4.5. Sub lethal impact of insecticides on Developmental time (days), Adult Longevity (days) and Sex Ratio (M:F) of *T. Chilonis*

After treatment with recommended concentration, the mean data **(Table-4.5)** longevity of treated *T. chilonis* were significantly at par from each other. Further mean data regarding the longevity of surviving parasitoid adult showed that among the tested toxicants, Radiant was the more toxic, it was statistically reduced (1.2 days) the longevity of *T. chilonis* followed by Neem oil 3% with mean value (3.8days), whereas longer (8.4 days) adult longevity was recorded in control (only water) which was followed by Neem oil 2% (5.6 days).
The data on the total development period of parasitoid emerged from the effected host eggs are presented in Table-4.5. However the developmental time of the survival parasitoids were not significantly different among the tested insecticides but in control (water) treatment parasitoid consumed more time (10.20 days) as compared to the other treatments. According to our experiment there were no toxic adverse was shown by insecticides.
Contrastive with these results, the sex ratio (female %) of F_1 offspring was not significantly different among treatments. Parasitoids exposed to Neem oil 3% concentration displayed higher female percentage (66.2%) of their F_1 offspring which was statistically difference from control (60.70%). However, parasitoids were exposed to Radiant showed (64.8%) it was significantly similar to the Neem oil 2% and 3% concentrations (66.10%, 66.20%) respectively. While in case of male ratio in control of F_1 offspring was significantly higher (39.30%) than rest of the insecticides treatments. When the parasitoids were exposed to radiant displayed (35.2%) male which was statistically similar to Neem oil 2% concentration (35.2%). Lowest (34.0%) male percentage was recoded in Neem oil 3% concentration.

Table-4.5. Adverse effect of insecticides on the life parameter of *T. chilonis* under laboratory conditions.

Treatments	Mean of Longevity (Days)	Developmental time (Days)	Mean of Sex ratio	
			Male (%)	Female (%)
Radiant	1.10 d	8.70 b	35.2 b	64.8 a
Neem oil 3%	3.80 c	8.80 b	34.0 c	66.2 a
Neem oil 2%	5.60 b	9.00 b	35.2 b	66.1 a
Control	8.40 a	10.20 a	39.3 a	60.7 b
LSD	**0.40**	**0.78**	**1.16**	**1.98**

Small letters after mean value indicate significant difference at ($p \leq 0.05$) within column among the treatments.

Discussion

There is limited scientist publications are available on the effect of many novel chemical and biochemical insecticides against *Trichogramma* species Khan *et al.,* (2015). International Organization of Biological Control (IOBC) has recommended the strategies for research experiments of direct effect of insecticides on biological organism Hassan *et al.,* (1991). Similarly finite number of information are available regarding the effects of insecticides on the immature stages of *T. chilonis*, because IOBC arranged successive scheme for evaluating the adverse effect of insecticide against the adult stage of parasitoids Sattar *et al*., (2011).
The present studies are helpful to growers for management of lepidopterous pest by using *T. chilonis* mass releases, since they can help in pesticides selection, selection of suitable time for pesticides application to control the pests and avoiding the adverse effects on beneficial organisms, as part of strategies to enhance both quality and productivity of natural organisms, specially *Trichogramma species* in Agri ecosystem and our environment.
The current studies were carried out to investigate the impact of Neem oil and an insecticide Radiant (Spinetoram) against *T. chilonis* under controlled laboratory conditions at Agriculture Research Institute (ARI) Tarnab, Peshawar. Four treatments i.e. Radiant with field recommended dose (0.08%), Neem oil (2%, 3%) concentration and control (only water) were tested for 1). Adult emergence from the host eggs (*S. cerealella*) which was treated in pupal, 2). Parasitism of treated F_1 offspring, 3). Residual toxicity of insecticides on adult parasitoid, 4) longevity and Fecundity of surviving Adult, 5). Sex ratio of F_1 treated generation.
The pesticide Radiant used in the present studies was comparatively novel chemistry and highly selective as compared to other pesticides while Neem was evaluated as have limited toxic impact on parasitoids survival,

emergence and parasitism. Overall results of our studies suggest that the Neem oil products may be effectively integrated with biological control in integrate pest management strategies, especially where *Trichogramma* and other same behavior parasitoids are important.

The results regarding the impact of Neem oil on adult emergence revealed that Neem oil @2% concentration proved not sub-lethal impact on the immature stage of *T. chilonis* in term of adult emergence from host parasitized treated eggs. Likewise Neem oil 3% concentration slightly reduced the adult emergence from the treated host eggs therefore labeled as 'slightly harmful. Somewhat similar trend was observed by Sattar *et al*., (2011) who investigated the influence of new insecticides on the *T. chilonis* under laboratory conditions they concluded that Neem oil was not significantly toxic to *T. chilonis* when parasitoid was treated in different developmental stages i.e. (Egg, larval and pupal) as compared to control. But on the basis of International Organization For Biological Control (IOBC) classification Neem oil cloud be labeled as 'slightly harmful' only for the larval stage of parasitoid. Our results about Neem oil completely in agreement with Lingathurai *et al.,* (2014) they conducted the experiment on Ecotoxicological performances and biochemical effect of selected pesticides on *T. chilonis* Ishii. Who reported that the highest *T. chilonis* adult emergence was recorded in Neem oil treatment and confirmed that Neem oil was harmless to *T .chilonis* in term of parasitoid adult emergence. We are strongly agreed with Mandi and Pramanik (2018) who tested the Bio-efficacy of botanical insecticides on the adult emergence of *T. chilonis* According to them, the highest adult emergence was recorded in Neem treatment. Further they determined that Neem oil was harmless to *T. chilonis* emergence when parasitoid was treated in immature stages. The results of current investigation are in line with earlier finding Rashid *et al*., (2013) who studied the residual effect of Neem oil on cotton mealybug they reported that Neem oil was harmless to *Trichogramma* in integrate pest management programmed (IPM). They also reported that the Neem oil at minimum concentration against Trichogrammatidae family can be used to avoid the chemical insecticides to better and safer for the control of spotted bollworm.

In current studied we observed that Neem oil (2% and 3%) significantly reduce the parasitism of host (*S. cerealella*) eggs by *T. chilonis* as compared to control. But according to the IOBC categorization it could be ranked as 'harmless'. These observations are partially in line with Rashid *et al*., (2013) they investigated that the *T. chilonis* parasitism ability was statistically decrease by applying Neem oil at 2% concentration and Neem seed extract with 3% concentration. Our results show conformity with El-Wakeil *et al*., (2006) they reported that Neem oil significantly decrease the parasitism of *T. pretiosum* and had some bit impact on *T. minutum.* Khattak and Rashid (2006) support the current finding, According to them Neem oil suppress the parasitization of spotted bollworm by *T. chilonis.*

A laboratory experiments were performed to examine the persistency impact of Neem oil on adult stage of parasitoid. According to our studies the residual toxicity of different concentration of Neem oil was significantly affected adults was exposed to treated blank cards. Badshah *et al.,* (2016) also reported that the persistency of Neem oil on adult parasitoid *Aenasius Bambawalei*. Somewhat similar trend was investigated by Thubru *et al.,* (2016) who reported that Neem formulation was comparatively more persistence due to oil-based formulation.

Results of the current studies indicated that the parasitoids fecundity were slightly affected by applying the Neem oil (3%). Similarly when parasitoids were exposed to lower concentration of Neem oil then %RP > 30% was occurred in term of parasitoid fecundity consequently, Neem oil was labeled as 'slightly harmful'. Identical results were obtained by Irigary *et al*., (2010) who noted that when European grape berry moth were exposed to Align having Azadirachtin the fecundity rate was decreased. Medina *et al.,* (2003) reported that the oviposition rate of *Chrysoperla carnea* was decreased when immature stage was treated with Neem products. Our results are strongly agree with Tang *et al*., (2002) they explained that Neemix 4.5% (commercial name of neem product) significantly affect the oviposition preference of citrus aphids. Khaire *et al*., (1992) also stated that Neem oil significantly reduced the fecundity of pulse beetle.

Results of our study revealed that Neem oil was comparatively impacted on *T. chilonis* on the basis of adult longevity. Similar observations were made by Fontes *et al*., (2018) who tested 21 some chemicals and biochemical insecticides including Neem oil for their compatibility with *Trichogramma s*pecie and concluded that to some extends Neem oil reduced the adult longevity. Somewhat similar trend was observed by Thubru *et al.,* (2016) they investigated that the emerged adult longevity also affected when pupal was exposed to Neem oil. Concurring opinion was recorded by Singhamuni *et al.,* (2015) that concluded Neem products relatively reduced the longevity of survived beneficial arthropods as compared to control. Badshah *et al.,* (2017) reported that the highest concentration neem oil (3%) was relatively reduced the adult longevity and percent emergence. We recorded the Neem oil have no negative effects on *T. chilonis* in term of developmental time because there was no significant difference among treatments and control. Similar results were recorded by Raguraman and Singh (1999) who indicated that inside the host eggs parasitoid remained unaffected by using Neem oil. Nevertheless earlier worker like Hamd *et al.,* (2005); Nathan *et al*., (2007) contrary to our finding they investigated when higher concentration of Neem oil were used on mealy bug then it needed maximum developmental time to reach adult stage. Somewhat similar conclusion was observed by Fontes *et al*., (2018) they described the Neem products have no adverse effect on the developmental time of parasitoids.

The current data concerning the sex ratio of *T. chilonis* significantly affected with increase the female number out of total collected adults as compared to control when parasitoids were treated with Neem oil 3% concentration. The finding of present study are in agreement with the earlier worker Fontes *et al*., (2018) who study the lethal and sub lethal effect of pesticides on *T. achaeae* they reported that Neem oil are slightly effect the sex ratio of parasitoid with an increase of in the female number in progeny. Somewhat similar trend was recorded by Narendra *et al*., (2013) the percentage female in the population of Neem product was found to be on par with control. Similar finding have been stated by Flavia *et al*., (2004) in research study the parasitoids adult emerged host eggs which was treated with neem seed oil solution had no effect on the sex ratio of parasitoid. The finding of current study are in line with earlier research work carried out by Thubru *et al*., (2016) who proposed that the percentage of female in population were highest in neem oil treatment as compared to control.

An experimental study was performed to study the negative impact of Spinetoram (spinosyn) against the *T. chilonis.* The finding proved that when parasitoid exposed to Spinetoram which was significantly impact the parasitoid adult emergence and parasitism capacity. The compound was categorized as "slightly harmful" (class 2). Similar results were obtained by Khan *et al.,* (2015) they study the toxicity of new commonly used pesticides to parasitism by *T. chilonis* who concluded that spinosyn act as slightly harmful to parasitoid in term of adult emergence. As somewhat similar observation was recorded by Sattar *et al*., (2011) they stated that Spinosad belong to same group of Spinosyn as Spinetoram was slightly effected the adult emergence of *T. chilonis*. The present study was strongly agreed with Hernandez *et al.,* (2011) they stated that Spinetoram had no more toxic effect to parasitoid compared to other treatment and control. In contrast of our results Hossain and Poehling (2006) found that Spinetoram strongly affects two leaf minor parasitoids immature stages. Somewhat similar observation was recorded by earlier worker Elzen (1990) they reported that Spinosad at 75 g a.i/ha had no adverse impact on *T. chilonis* as compared to insecticides. Also Ruberson (2003) found that Spinosad had no negative effect on the *T. pretosum.* Further report that Spinosad was completely compatible with *T. pretosum* for integrates pest management. Our results are in line with Liu and Zhang (2012) who study the side effect of Spinosad and indoxacarb they reported that the high concentration of Spinosad when applied to larval and pupal stages significantly reduced adult emergence and parasitization rate of parasitoids. Similar observation was made by Visnupriya and Muthukrishan (2015) who stated that Spinetoram 12SC at 36, 45 and 54g a.i/ha had bit adverse effect on the basis of parasitism rate and adult emergence of *T. chilonis* when treated at developmental stages. Similarly Gandhi *et al.,* (2005) who proposed that only 60% parasitism of host egg treated Neem oil 2% concentration.

Data concerning the persistency impacts of Spinetoram on the mature stage of parasitoid showed that when the *T. chilonis* adult were exposed to 24 old residue of insecticide so more than (90%) of the adult were founded dead, therefore the Spinetoram was categorized as ''Harmful'' (Class 4). Our finding was strongly in line with Sattar *et al.,* (2011) who proposed that the all the insecticides were poisonous to *T. chilonis* in term of adult mortality. Further they reported that 100% percent of *T. chilonis* were recorded killed when adult was exposed to 24hrs old residue of Spinosad. The current results are in line with finding of Liu and Zhang (2012) they reported that the highest rate 60-70% of adult mortality was recorded in three days old residue of Spinosad. Similar observation was noted by Williams *et al*., (2003). Who study the Spinosad residual effect in field conditions they have been stated that Spinosad persistency was quickly degraded in field with bit residue toxicity to some species of predator and some parasitoids.

The study was conducted to tested the effects of Spinetoram on the life parameter of *T. chilonis.* The results showed that there was no significant difference in term of developmental time was recorded in all treatments including control (only water) the possible reason was that parasitoids mostly complete their life cycle inside the host eggs they were worked as well-protected layer from the direct contact of pesticides, that's why tested insecticides showed not influenced on the developmental duration of *T. chilonis.* Similar observation was concluded by Liu and Zhang (2012) who study the Side effects of two reduced-risk insecticides, Indoxacarb and Spinosad, on life parameter of *Trichogramma*. They revealed that the developmental period of *T. brassicae* and *T. pretiosum* were not significantly different from control, developmental duration range 9.3 to 10.9 days. The present study was in agreement with Ruberson (2003) reported that spinosyn product having no adverse impacted on developmental time of *Trichogramma* species. Our present data regarding the influence of tested toxicant on adult longevity of parasitoid were significantly different among the treatments, the results showed that shortest longevity of emerged adults from the treated pupae was recorded in Spinetoram. Somewhat similar data was observed by Thubru *et al*., (2016) who evaluated the risks of pesticides targeting lepidopteran pests in cruciferous ecosystems to eggs parasitoid, *T. brassicae*. They stated that lowest adult longevity was recorded in Spinosad followed by Neem oil, when the parasitoids were treated in pupal stage. The current study showed conformity with (Schneider *et al*., 2003; Xu *et al*., 2004) who described some parasitoid could emerged from Spinosad treated pupae but directly died within hour. Shoeb, (2010) support current findings who confirmed that after emergence of *T. chilonis* was died within 6 to 12 hours when parasitoids were treated with Spinosad in pupal stage.

Our present finding revealed that all the experimental process Spinetoram was founded harmful on the fitness of *T. chilonis* except of the developmental time, while the Neem oil 3% concentration was also showed slightly

harmful impact on beneficial wasp. The Neem oil was found harmless on the life parameters of *T. chilonis* Further we conformed that *T. chilonis* was comparatively compatible with less concentration of Neem oil for integrate pest management program and environmentally friendly in term of easily degradable in environment.

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Protein Requirements of Buffalo

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Abstract
Proteins have an important place in terms of their physiological functions in the animal body. For example, 75% of body dry matter consists of proteins. They take part in the structure of enzymes and hormones in the cell, in antibodies from the body's defense mechanism, and in nucleoproteins, which are the main features of heredity. Protein demand of buffaloes is met with medium quality pasture and vegetable protein supplementary feeds. Early form of pastures, being rich in amide substances, adding excessive urea to the feed and not undergoing heat treatment of the feed, etc., facilitate the breakdown of protein in the rumen. Accordingly, increased ammonia concentration causes irritability, uterine inflammation, early embryonic death, hypomagnesamic tetany, and increased urea level in milk in buffaloes. Diets containing high levels of protein and low energy levels similarly lead to lubrication in the mammary glands, infertility, laminitis and ketone formation. In case of protein deficiency, it reduces the feed consumption of animals. It reduces the digestibility of cellulose and reduces its ability to be injured from feed. In various studies, there is information that protein supplementation in buffalo ration positively affects the performance of animals. In this review, the protein requirements of buffaloes and information on the importance of protein are discussed.
Key words: *Protein Requirements of Buffalo and importance of protein*

Mandaların Protein Gereksinimleri

Özet
Proteinler, hayvan vücudundaki fizyolojik fonksiyonları bakımından önemli bir yere sahiptir. Örneğin vücut kuru maddesinin %75'i proteinlerden oluşmuştur. Hücre içinde enzim ve hormonların yapısında, vücudun savunma mekanizmasından antikorların içerisinde ve kalıtımın temel özelliği olan nükleoproteinler içerisinde görev alırlar. Mandaların protein talebi, orta kalitete de mera ve bitkisel kaynaklı protein ek yemleri ile gerçekleştirilir. Meraların erken biçimi, amid maddelerince zengin olması, yeme aşırı üre katılması ve yemin ısıl işlem görmemesi vb işlemler proteinin rumende parçalanmasını kolaylaştırır. Buna bağlı olarak artan amonyak yoğunluğu mandalarda hırçınlaşma, uterus yangısı, erken embiriyonik ölüm, hipomagnesamik tetani ve sütteki üre düzeyinin yükselmesine neden olur. Yüksek düzeyde protein ve düşük düzeyde enerji içeren rasyonlar, benzer şekilde meme bezlerinde yağlanma, kısırlık, laminitis' ve keton oluşumuna yol açmaktadır. Protein yetersizliği durumunda hayvanların yem tüketimini azaltır. Selülozun sindirilme derecesini düşürerek yemden yaralanma yeteneğini düşürmektedir. Çeşitli çalışmalarda manda rasyonunda protein ilavesinin hayvanların performansını olumlu yönde etkilediğine dair bilgiler bulunmaktadır. Bu derlemede, mandaların protein gereksinimleri ve proteinin önemi üzerine bilgiler ele alınmıştır.
Anahtar Kelimeler: *Mandaların protein gereksinimi ve proteinin önemi.*

Giriş

Mandaların besin madde ihtiyaçları sığırlarla benzerlik gösterir (Paul, 2003). Bu nedenle süt sığırları için önerilen besin madde gereksinimleri mandalar için de önerilebilir. Çalışan mandaların canlı ağırlık kaybı olmadan hem büyüme hem de çeki gücü kapasitesi ihtiyaçlarını karşılayabilecek düzeyde yoğun yemle beslenmeleri gerekir. Bu nedenle, mandaların yaşadıkları bölgelerde beslenme ve yönetim koşullarının iyileştirerek hayvanların çeki gücü ve et potansiyeli önemli ölçüde artırabilmesi mümkündür. Asya'da, hayvanlar henüz gelişmelerini tamamlamadan çeki gücü için kullanılır. Çalışan hayvanların hareketli olmaları, terlemenin artması ve ısı artışı nedeniyle yaşama payı ihtiyaçları çalışmayan hayvanlara oranla %40' fazladır. Mandaların toplam besin madde gereksinimleri; yaşama payı, gelişme dönemi, gebelik dönemi ve süt ile salgıladıkları besin maddeleri göz önüne alınarak hesaplanmaktadır (Değirmencioğlu, 2020). Hayvanların ihtiyaçlarını çeşitli faktörler etkilemektedir. Bu faktörlerden bir kısmını, kısaca aşağıda belirtildiği biçimde özetlemek mümkündür.

Hayvan temelli faktörler; yaş, canlı ağırlık, fizyolojik durum (büyüme, gebelik, laktasyon vb.), sindirim sistemi özellikleri ve sağlık durumu.

Rasyon ile ilişkili faktörler; rasyonda kullanılan yemlerin oranları, yemin besin madde içerikleri, yemlere uygulanan işlemler ve yemin saklanma biçimi.

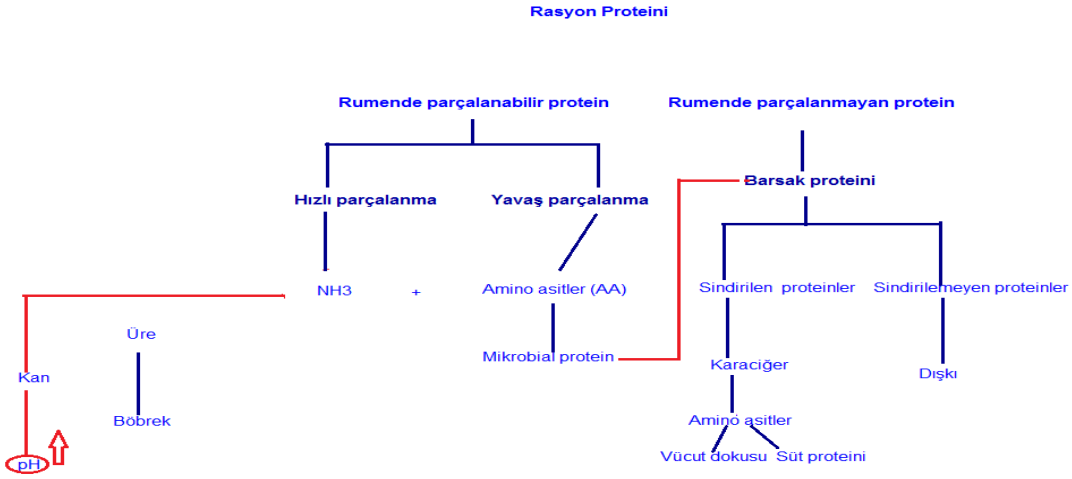
Çevresel faktörler; iklim, stres, yemleme sistemi ve barınak koşulları (Paul 2007). Türkiye de manda işletmelerinin küçük ölçekli olması ve manda yetiştiricilerinin eğitimlerinin yetersiz ve sermayelerinin kısıtlı olması nedeniyle, mandalar tek yönlü, beslenmekte, laktasyonun ilk aylarında beslenme bozuklukları meydana gelmekte ve süt verimi istenen düzeye ulaşamamaktadır (Degirmencioglu, 2016). Bu derlemede, mandaların protein gereksinimleri ve proteinin önemi üzerine bilgiler ele alınmıştır.

Materyal ve Yöntem

Bu derlemenin kaynak materyalini toplam (yurt içi ve yurt dışı) 22.kaynak oluşturmuştur. Derleme de proteinin genel metabolizması, mandaların dönemlere göre protein gereksinimi olmak üzere iki bölüme ayrılmış ve ilgili bölümlerde kaynaklara yer verilerek konuya açıklık getirilmeye çalışılmıştır. Sonuç kısmında ise mandalların protein gereksinimlerinin karşılanması için izlenmesi gereken yol haritası hakkında bilgi verilmiştir.

Proteinin Genel Metabolizması

Proteinlerin temel yapısal birimi amino asittir. Bütün amino asitler (a.a), aynı karbon atomuna bağlı bir karboksil (-COOH), bir amino (-NH2) grubu ile bir H atomu ve bir kök (R) içerirler. Proteinler, yağ ve karbonhidratta olduğu gibi temel elementler olarak C, H ve O_2'den oluşurlar Ancak diğerlerinden farklı olarak C, H ve O2'in yanısıra N içerirler. Proteinler ayrıca P, Fe, Cu, Zn ve manganez içerebilir. Proteinler amino grubunun N ile diğerinin karboksil grubunun yapılarından su açığa çıkararak oluşturdukları peptit bağları ile yüksek moleküllü organik bileşiklerdir. Organizmada bulunan bağışıklık maddelerinin tümü, hücre içinde yer alan enzim ve hormanlar, kalıtımın temel özelliği olan genler protein yapısındadır (Okuyan,1997).



Şekil 1. Protein Metabolizması

Mandaların protein talebi, orta kalitete mera ve bitkisel kaynaklı protein ek yemleri ile gerçekleştirilir. Yararlanılan başlıca protein kaynakları soya, pamuk, keten tohumu küspeleri, üre ve yavaş çözünen diğer protein olmayan nitrojen kaynakları ile karşılanabilmektedir. Rasyonun ham protein düzeyi yükseldiğinde, rumende parçalanarak mikrobiyal protein sentezinde kullanılır, geride kalan amonyak ise kana geçer, daha sonra karaciğerde üreye dönüşür. Ürenin bir kısmı idrarla dışarıya atılır. İdrardaki üre hızla amonyağa hidrolize edilir ve çevre kirliliğine neden olur (Muck, 1982). Üre oluşumu sırasında 3 molekül ATP kullanılır. Dolayısıyla gerek rumendeki amonyağın mikrobiyel proteine gerekse karaciğerdeki amonyağın üreye dönüşümü esnasında gereken enerji rasyonla desteklenmelidir. Rumen ortamında, mikrobiyal protein sentezi için belirli oranda hızla parçalanabilen amino asit kaynaklarına (a fraksiyonlarına) ihtiyaç vardır. Diğer yandan meraların erken biçimi, Mera yemlerinin amid maddelerince zengin olması ve bu yemleri tüketen mandalarda işkembede amonyak seviyesi hızla artmaktadır. Yeme ayrıca üre katılması ve yemin ısıl işlem görmemesi vb işlemler proteinin rumende parçalanmasını kolaylaştırır (Şekil 1). Buna bağlı olarak artan amonyak yoğunluğu mandalarda hırçınlaşma, uterus yangısı, erken embiriyonik ölüm, hipomagnesamik tetaniye neden olur. Esas itibariyle rumende NH3 ve karbonhidratların parçalanması sonucu açığa çıkan keto asitler rumendeki mikroorganizmalar tarafından amino asitlerin sentezlenmesinde kullanırlar. Rumende parçalanmaya dayanıklı karbonhidrat ile kolay parçalanabilen protein kaynaklarının birlikte kullanılmasıda rumende amonyak yoğunluğunu yükseltebilir (Di lella t, 1995). Örneğin rasyonda NPN kaynaklı bileşiklere ağırlık verilmesi durumunda sütün gerçek protein içeriği düşer.

Mikrobial proteinleri ise parçalanmış yem partikülleri ile birlikte abomasuma ve ince bağırsağa gelerek emilimi ince barsakta aktif- transport sistemiyle gerçekleşmektedir. Emilen amino asitler deaminasyona (keto asitler ve amonyak), transanimasyona (amino asitin amin kökü bir keto asite aktarılır) ve dekarboksilasyona (karboksil kökünü kaybeder ve primer amin ve karbondioksit) uğrarlar. İnce barsakta emilen amino asitler; vücut dokusu, süt, enzim ve hormon sentezinde kullanılır.

Dokularda protein depolanmasının bir üst sınırı vardır. Bu sınır aşılınca, amino asitleri α- keto asitleri ve amonyağa parçalanır. α- keto asitleri (piruvik asit) kreps siklusunda oksidasyona uğrayarak enerji kaynağı olarak kullanılır (glikoz, glikojenik amino asitler) ya da (yağ asitleri –ketojenik amino asitler) yağa dönüştürülerek depo edilir. Yüksek düzeyde protein ve düşük düzeyde enerji içeren rasyonlar, meme bezlerinde yağlanma, kısırlık ve laminitis' ve keton oluşumuna yol açmaktadır (Görgülü, 2019). Yüksek protein içerikli rasyonlar ve amino asitler

asetil CoA' ya dönüşerek vücutta keton oluşumunu hızlandırırlar. Keton parçalarından β-OH Butirk asit orta derecede kuvvetli asitler olduklarından, bu bileşiklerin idrarla atılma sırasında önemli miktarda katyon (Na) kaybına neden oldukları için bazende asidosis ortaya çıkar.
Protein yetersizliği durumunda hayvanların yem tüketimini azaltır. Selülozun sindirilme derecesini düşürerek yemden yaralanma yeteneğini düşürmektedir. Buffaloların protein yetersizliğine karşı gösterdiği reaksiyon şiddetlidir. Mandaların yetersiz proteinle beslenme durumunda hemen süt verimi düşmemektedir. Hayvan kendi vücut dokularından proteini mobilize ederek süt veriminin azalmasını engellemeye çalışmaktadır. Ancak protein yetersizliği devam etmesi durumunda hayvanda canlı ağırlık kayıpları artmakta ve hayvanın yaşamı tehlikeye girecektir.
Mandaların protein gereksinimi canlı ağırlık, canlı ağırlık artışı, gebelik ve laktasyon dönemi ve sütün içerdiği protein seviyesine göre büyük bir değişim göstermektedir.
Protein gereksinimi, ham protein (HP) ve/veya sindirilebilir ham protein (SHP)'e göre hesaplanabilir. Süt mandaların beslenmesinde genelde toplam protein ihtiyaçları üzerinde durulmaktadır (Bülbül, 2010). Zira rumen bakterileri sayesinde mikrobiyal proteinin biyolojik %80'e çıkabilmektedir.

Mandaların Yaşama Payı İhtiyacı
Hayvanın solunum, sindirim organlarının çalışması, dolaşım ve vücut sıcaklığı gibi kısaca yaşamsal olayların devamı için gerekli besin maddesi miktarıdır. Yaşama payı hesaplarken vücutta herhangi bir canlı ağırlık kazancı ya da kaybı veya verim payı gereksinimi dikkate alınmaz. Araştırıcılar tarafından manda ineklerinin yaşama payı protein ihtiyacını şöyle belirtilmiştir.
Yaşama payı protein ihtiyacı = 5.43 HP ve 3.14 SHP g/kg $CA^{0,75}$ Paul ve ark., (2002).
Yaşama payı protein gereksinimleri= 2.54-2.84 g sindirebilir protein (SP) /kg Canlı ağırlık $(CA)^{0.75}$ Ranjhan (1992)
YP protein gereksinimleri= 0.6 g SP/Kg CA Proto (1993)
Zicarelli (2001), 650 kg ağırlığında manda inekleri için
YP protein gereksinimi = 700 g Ham protein (HP)-400 g SP (gerçek protein) önermektedir.
Yaşama payı enerji ihtiyacı Toplam Sindirebilir Besin Maddeleri (TSBM)= 35.3 g/kg $CA^{0,75}$ Paul., (2002,2003)
Canlı ağırlık artışı (1kg) = 330 g HP ve 230 g SHP Paul ve ark., (2002).
Mandalarda yaşama payı olarak 100 kg canlı ağırlık için 0.51 kg nişasta birimi (NB) ve 50 gr sindirilebilir protein (SP) hesaplanması öngörülmektedir.

Mandalarin Üremesinde Proteinin Önemi
Manda yetiştiriciliğinde işletmenin karlılığını sürdürülebilmesi için üremenin belirli düzeyde gerçekleşmesi gerekmektedir. Döl veriminin üç temel amacı vardır. Bunlar;
Sürü büyüklüğün korunması
Verimli bir üretimim gerçekleştirilmei
Seleksiyon ve ayıklamanın etkin yapılabilmesidir.
Nehir mandası, damızlıkta yavaş hareket etmesi nedeniyle kötü bir üne sahiptir. Hayvan ayrıca barınak şartları oldukça kötü ve tek yönlü beslenmektedir. Ortam şartlarının bozuk olması üreme performanslarının düşmesine neden olmaktadır. Esas itibariyle hayvan yetiştiriciliğinin ana unsuru üremedir. Dişi mandaların besin madde ihtiyaçlarının karşılanmaması durumunda, gebelik süresinin uzamasına ya da malakların canlı ağırlıklarının kısalmasına neden olmaktadır. Döl tutma üzerinde protein, enerji, vitamin ve mineral maddelerin önemi bir payı vardır. Proteinler, hormanların yapısına girerek üreme olaylarının düzenlenmesini sağlamaktadır. Örneğin FSH ve LH hipofiz ön lobunun bazofil hücreleri tarafından sentezlenen glikoprotein yapısında bir gonadotropindir. Mandalarda uzun sureli protein eksikliği FSH eksikliğine yol açmaktadır. Bu hormanın az salgılanması yumurta gelişimini ve döl tutma oranını azaltmaktadır (Sevgican, 2001).

Gebelik Döneminde Mandaların Protein Gereksinimi
Gebelik süresince uterus, plesanta ve süt bezlerinin büyümesi (yükselen anabolizma) yüzünden mandalarda fizyolojik değişmeler ortaya çıkmaktadır. Gebelik süresince ihtiyaç duyulan besin maddelerin önemli bir kısmı bu ihtiyaçların karşılanması için kullanılmaktadır. Gebeliğin ilk 2/3 lük döneminde fötüsün besin madde ihtiyacı düşüktür. Kurudaki mandalara ihtiyaç duyduğunda biraz üzerinde besin maddesi verip dişinin vücut reservlerini geliştirmesi şansı sağlanmalıdır. Yaşama payı ve bunun biraz üzerinde yapılan besleme yeterli olmaktadır. Gebeliğin son haftalarında fötüs hızla büyümekte, süt bezleri gelişmektedir. Fötüste meydana gelen canlı ağırlık artışın büyük kısmını gebeliğin son 1/3 ünde sağlanan artış oluşturmakta ve toplam ağırlığının % 65'ini bu dönemde kazanmaktadır. (Sevgican, 2001). Bu dönemde protein ve enerji ihtiyaçları önemli ölçüde artmaktadır (Çizelge 1ve 2). Gebelik süresince fötüste en fazla biriken besin maddesi proteindir. Özellikle gebeliğin son haftalarında protein ihtiyacı giderek yükselmektedir. Fötüs büyümede tüketilen ptoteinin % 60'ından yararlanabilmektedir. Gebeliğin son aylarında enerji birikiminin % 85' i protein formunda olmaktadır.

Çizelge 1. Kurudaki Mandaların Protein ve Enerji İhtiyaçları

Periyot	Gebelik süresi	% Ham protein	İhtiyaç TSBM %	İhtiyaç Mcal
I	240-270	12	55.4	2.00 /kg ME
II	270-308	14	60.6	2.19 /kg ME

Kaynak. Paul ve ark., 2007

Çizelge 2. (CA; 600) Kuruya Çıkmış Mandanın Besin Madde Gereksinimleri

KM tüketimi kg/gün	10.5	10-12
NEL Süt FU/kg KM	0.65	0.63-0.65
Ham protein, % KM	10.5	10-11
Ham selüloz, % KM	30.0	-
NDF, % KM	60.0	52-58
Nişasta	9.0	8-10

Kaynak. Proto, (1993), Bertoni ve ark., (1992)

Malakların Beslenmesinde Proteinin Önemi

Özellikle genç malakların günlük canlı ağırlık artışının yüksek oluşu nedeniyle protein gereksinimi ve dolayısıyla et artışı fazla olmaktadır (Çizelge 3). Ancak, Kazein içermeyen protein ikameleri, abomasumda aşırı şişkinliğe yol açmakta ve protein yarayışlılığını azaltmaktadır. Nitekim, soya veya by pass kaynaklı süt ikame yemleri sindirim sistemindeki sekrotorik HCl, rennin, pepsin, tripsin ve kimotripsin salgılarını azalttığı düşünülmektedir. Ayrıca, soyanın antijenik potensiyeli bağırsak vilusları kısaltarak abomasum ve bağırsak hareketliliğini hızlandırmakta ve böylece ishal ile sonuçlanan etkilere neden olmaktadır (Gay, 1991, Bartocci, 2002).

Yeni doğan malaklara öncelik papilla gelişimi üzerine ağırlık verilmelidir. Malak başlangıç yemi besin madde içerikleri bakımından zengin olmalıdır (ham protein % 18 ham kül, % 8 ham sellüloz, % 12 metabolik enerji 2800 (Kcal/kg) vitamin ve mineral madde) ve tam yağlı sütle birlikte verilmelidir. Malak başlangıç yemi buzağı başlangıç yemiyle benzerlik gösterir. Karma yemin yapısında buğday, arpa, mısır kırmaları, buğday kepeği, yağlı tohum küspeleri, vitamin ve mineral katkıları, tuz ve mermer tozu yer almaktadır. KM tüketiminin artması ve rumen gelişimesi nedeniyle daha ekonomik olan buzağı büyütme yemi 3-6 aylık dönemde malaklara verilebilir. Buzagı büyütme yeminin protein ve enerji içeriği açısından (% 17 HP 2600 ME A Vitamini, 5.000 IU/kg, D3 Vitamini, 600 IU/kg,E Vitamini, 25 mg/kg) başlangıç yemine göre daha düşüktür.

Çizelge 3. Genç Malakların Protein ve Enerji İhtiyacı (gün)

Aylar	Canlı ağırlık (kg)	Enerji	Protein (gr)
0-4	30-102	1.8	200
5-12	102-258	5.2	580
13-18	258-384	6.4	610
19-24	384-456	6.8	630

Kaynak. Naydenova L. ve ark., (1993), KE; Enerji Birimi; Yem EnerjiÜnitesi 1 KE=1410 kcal

Araştırıcılar, besiye alınan malakların rasyondaki protein düzeyi artışından olumlu yönde etkilenmediğini bildirdiler. Araştırıcı Malaklar %12,6, 16 ve 19,4 ham protein içeren rasyonlarla beslenmişlerdir. Her gruba %26 saman ve %74 kesif yem verilmiştir Rasyonlarda canlı ağırlığın %2,2 si kadar kesif yem kuru maddesi, canlı ağırlığın %0,8'i kadar kaba yem kuru maddesi kullanılmıştır. Rasyonlardaki farklı protein düzeylerinin günlük canlı ağırlık artışı ve yemden yararlanmaya önemli derecede etkisinin olmadığı anlaşılmıştır.

Araştırıcı, 8 aylık yaştaki toplam 18 erkek malağı % 10.1, 12.8 ve 15.1 ham protein içerikli rasyonlarla 197 gün beslemişlerdir. Araştırma sonucunda, farklı protein düzeyleri ile beslenen manda grupları arasında günlük canlı ağırlık artışı ve yemden yararlanma oranlarının benzerlik gösterdiği belirtilmektedir (Aksoy, 1989).

Manda Düvelerin Protein Gereksinimi

Düveler geleceğin süt veren hayvanı olduğundan bakımına özen göstermek gerekir (Çizelge 4). Cinsi olgunluk öncesi (pupertas) yüksek besleme düzeyi serum somatotropin düzeyini düşürerek memedeki parankim doku miktarını azaltmakadır (Görgülü, 2019).

Laktasyon Döneminde Manda İneklerin Protein Gereksinimi

7 kg/gün süt veren Anadolu mandası günlük olarak 490 g yağ, 245 g protein, 350 g laktoz, 14 g Ca, 8.4 g P ve 10.5 g Na mineralleri her gün vücudundan dışarı atılmaktadır (Değirmencioğlu, 2020). Nitekim yaşama payı gereksinimlerine ek olarak süt ile dışarı atılan besin maddelerin mandalarda karşılanması zorunludur. Mandaların gereksinmeleri laktasyon dönemine ve fizyolojik özelliklerine gore farklılık gösterir. Manda sütleri inek sütlerine kıyasla daha fazla yağ ve yağsız kuru madde içerdiğinden, manda sütlerinin kalorisi inek sütünden daha yüksek bulunmaktadır. Manda ineklerinin protein gereksinimi genotipe, yaşa, sütün yağ düzeyi ve süt verimine oranına, ve rasyonun yapısına gore değişiklikler göstermektedir. Sütteki protein oranı, manda yaşlandıkça ve laktasyon

dönemine doğru azalır. Sütün yağ miktarı düştükçe protein seviyesi de düşmektedir. Süt veriminde proteinden faydalanma oranının % 65 -70 arasındadır. Pratik olarak manda ineklerinin sindirilebilir protein ihtiyaçları için, sütte bulunan protein miktarının 1.5 katı kadar bir proteinin verim payı için verilmesi gerekmektedir. Farklı oranlarda yağ ve protein içeren sütlerin yapımı için gerekli sindirilebilir protein ihtiyacını aşağıdaki gibi bildirmektedir (Çizelge 5).

Çizelge 4. İtalyan Manda Düvelerinin Besin Madde Gereksinimleri

	Canlı ağırlık (kg)			
	100-200	200-300	300-400	400-500
Kuru madde kg	3.5-4.5	4.5-7	7.9-9	9.5-11
Ham protein % KM	15-16	15-16	15-16	13
NDF % KM	35	35	38	40
M cal/kg KM	1.40	1.40	1.40	1.30
Kalsiyum % KM	0.60	0.60	0.48	0.45
Fosfor % KM	0.40	0.40	0.32	0.30
Vit A IU/kgKM	3000	3000	3400	3200
Vit D IU/kgKM	1100	1100	1300	1200
Vit E IU/kgKM	31	31	34	32

Kaynak. Terramoccia ve ark., ,(2005)

Çizelge 5. Sindirilebilir Protein İhtiyacı, (g/kg süt)

Yağ oranı %	**Sin Prot ihtiyacı, g** (O. Kellner-M. Becker)
3.0	50.0
3.5	55.0
4.0	60.0
4.5	65.0
5.0	70.0
5.5	75.0
6.0	80.0

Mandalar için laktasyon döneminde protein ihtiyaçları söyle bildirilmektedir (Çizelge6).
% 6 yağa göre düzeltilmiş süt verimi (1lt) = 90.3 g HP ve 55.2 g SHP Paul,(2002)
Canlı ağırlık artışı (1kg) = 330 g HP ve 230 g SHP Paul,(2002)
% 7 yağa gore düzeltilmiş süt verimi (1 lt) = 0.37 nişasta birimi (NB) kg ve 86 g sindirilebilir protein (SP) verilmesi önerilmektedir.
1 g süt proteini için = 2.74 g HP (Zicarelli, 2001)
1 g süt protein için = 2.0 g SP (Di Lella, 1996)

Çizelge 6. Verim Payı Protein Gereksinimleri (**1 lt manda sütü için**)

Süt protein,%	3.5	3.7	3.9	4.1	4.3	4.5	4.7	4.9	5.1	5.3	5.5
Ham protein	99	105	111	116	122	128	134	139	145	151	157

Kaynak. Proto,(1993)

Farklı protein içerikli rasyonların mandaların verim ölçütleri üzerine etkilerini araştırdıkları bir çalışma da manda rasyonlarına ham protein içeriğinin % 17.8 den % 19.18 çıkarılması süt verimi (0.70 kg/gün) üzerine önemli düzeyde etki yaptığı saptanmıştır. Ayrıca süt bileşimi üzerinde olumsuz bir etkisinin olmadığı belirlenmiştir (Değirmencioğlu,2022). Süt inekleriyle yapılan benzer bir çalışma da ise rasyonun ham protein içeriğini (HP) % 15'ten % 16'ya yükseltmenin, süt üretimini 0.75 kg / gün artırdığı, rasyonun HP düzeyini % 19'dan % 20'ye çıkarılması ise süt verimini olumlu yönde etkilediğini tespit etmişlerdir (0,35 kg / gün). Anonymous (2001

Sonuç

Mandaların protein ihtiyaçları sığırlarla benzerlik gösterir. Bu nedenle süt sığırları için önerilen protein gereksinimleri mandalar için de önerilebilir. Mandaların yetersiz beslenme koşullarına dayanıklı olduğu düşüncesinden vazgeçilmelidir. Bu kapsamda mandaların yaşama payı protein gereksinimleri baklagil kaba yemleri ile, verim payı protein ihtiyaçları ise küspe ile karşılanabilir. Manda yetiştiricilerin bulunduğu alanlarda mera ıslahına önem verilmelidir. Manda yetiştiricileri aynı zamanda tarla tarımıyla uğraşmaktadır. Bu yerlerin yem bitkileri üretiminde kullanılması yönünde teşvikler sağlanması ile sorun büyük ölçüde çözümlenebilir.

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Determination of Phytochemicals and Antioxidant Capacities of Fresh Scots Pine (Pinus Sylvestris L.) Sprouts Consumed as Herbal Tea

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Abstract
In this study, the phytochemicals and antioxidant capacity of fresh Scotch Pine (Pinus sylvestris L) sprouts consumed as herbal tea in the regions where it grows were investigated. The total amounts of phenolic and flavonoid substances in fresh yellow pine shoots were determined as 19.92±1.65 mg GAE/g and 6.20±0.74 mg QE/g, respectively. The free radical scavenging activity of the pine shoots used in the study was determined to be 18.80±0.35 µg TE/mL using 1,1-diphenyl-2-picrylhydrazil (DPPH) radical. In addition, the reducing antioxidant capacity was determined as 2.13±0.01 µg TE/mL with the FRAP method and 16.20±3.20 µg TE/mL with the CUPRAC method. As a result, it was seen that fresh Scotch pine sprouts have the potential to be a natural antioxidant source. However, there have been doubts about the widespread use of its consumption may cause various problems in terms of the development of the plant. New studies are needed to eliminate the hesitations caused by regional consumption.
Keywords: *Pinus sylvestris L, Phenolic substance, Flavonoid substance, Antioxidant*

Bitkisel Çay Olarak Tüketilen Taze Sarıçam (*Pinus Sylvestris* L.) Filizinin Fitokimyasallarının ve Antioksidan Kapasitelerinin Belirlenmesi

Özet
Bu çalışmada yetiştiği bölgelerde bitkisel çay olarak tüketilen taze Sarıçam (*Pinus sylvestris* L) filizlerinin fitokimyasalları ve antioksidan kapasitesi araştırılmıştır. Taze sarıçam filizlerinin toplam fenolik ve flavonoid madde miktarlarının sırasıyla 19,92±1,65 mg GAE/g ve 6,20±0,74 mg QE/g olduğu tespit edilmiştir. Çalışmada kullanılan çam filizilerinin serbest radikal giderme aktivitesinin 1,1-difenil-2-pikrilhidrazil (DPPH) radikali kullanılarak 18,80±0,35 µg TE/mL olduğu belirlenmiştir. Ayrıca indirgeyici antioksidan kapasitesi FRAP yöntemiyle 2,13±0,01 µg TE/mL ve CUPRAC yöntemiyle 16,20±3,20 µg TE/mL olarak tespit edilmiştir. Sonuç olarak taze Sarıçam filizlerinin doğal antioksidan kaynağı olma potansiyeline sahip olduğu görülmüştür. Ancak tüketiminin yaygınlaşmasının bitkinin gelişimi açısından çeşitli problemlere neden olabileceği ile ilgili tereddütler oluşmuştur. Bölgesel tüketiminden kaynaklı tereddütlerin ortadan kaldırılması için yeni çalışmalara ihtiyaç vardır.
Anahtar Kelimeler: *Pinus sylvestris* L, Fenolik madde, Flavonoid madde, Antioksidan

Giriş
Bitkisel çayların besleyici özelliklerinin yanında rahatlatıcı, iyileştirici ve koruyucu etkilerinin de olduğu bilinmektedir. Bu amaçla daha çok bitkilerin yaprak, çiçek, tohum, kök ve gövde gibi kısımları kullanılmaktadır. Bitkinin özelliğine bağlı olarak infüzyon (demleme), dekoksiyon (kaynatma) ve maserasyon (bekletme) gibi teknikler kullanılarak tüketime hazır hale getirilirler. Tatları buruktur. Bu burukluğun giderilmesi için tüketimlerinde çeşitli tatlandırıcılar kullanılmaktadır (Özdatlı ve ark., 2014)

Dünyada sıcak ve soğuk olarak en çok tüketilen bitkisel çay *Camellia sinensis* bitkisi yapraklarından yapılan çaydır (Balentine ve Paetau-Robinson, 2000; Wang ve ark., 2000). Tüm dünya toplumları tarafından tüketilen, *C. sinensis* çayının geçmişi 5000 yıl öncesine dayanmaktadır. Bu çayından başka adaçayı, ıhlamur, kuşburnu, papatya ve nane gibi bitkisel çaylar da yaygın olarak tüketilmektedir (Atoui ve ark., 2005). Tüketimi yıllar öncesine dayanan ve bölgeye özgü doğal bitkiler kullanılarak hazırlanan pek çok çay çeşidinin var olduğu da bilinmektedir.

Beslenme kaynaklı bozuklukların artışı doğal ürün kullanımını da artırmıştır. Bu durumdan çay olarak tüketilen bitkilerde etkilenmiş ve artan talebin karşılanması için alternatif kaynak arayışı artmıştır. Bu kapsamda sarıçam (*Pinus sylvestris* L) taze sürgünlerinden yapılan çay önemli potansiyele sahip bir üründür. Bu çayın hazırlanışı taze olarak çam ağaçlarından toplanmış filizlerinin (genç sürgünler) hiçbir işleme tabi tutulmadan kaynatılmaları (dekoksiyon) yöntemi şeklinde olur. Sarıçam genç sürgünleri geniş, yastık şeklinde olup tomurcuk kısımları kırmızı-kahverenginde ve pullu yapıdadır (Yaltırık ve Akkemik, 2011). Ayrıca bu sürgünler güzel kokulu ve uçucu yağ bileşenleri yönünden de zengindir (Hannus, 1976). Bu çayın ülkemizin kuzey doğusunda Erzurum, Artvin ve Ardahan bölgesinde yaşayan insanlar tarafından tüketimi yaygındır. Tüketimi yıllar öncesine dayanmaktadır. Bu çayın başta solunum yolları olmak üzere, karaciğer, saç, cilt ve diş sağlığı üzerine olumlu etkisinin olduğuna inanılmaktadır.

Bu çalışmada, bölgesel olarak bitkisel çay olarak tüketilen sarıçam filizlerinin biyoaktif bileşenlerinin toplam madde miktarı ve antioksidan kapasitesinin belirlenmesi amaçlanmıştır

Materyal ve Yöntem

Bitki Örneklerinin Toplanması

Çalışmada kullanılacak numuneler Nisan ayında Erzurum Olur ilçesinde özel mülk içerisinde bulunan ağaçlardan toplanmıştır (40°49'50°N'42°07'4″E 1317 m). İşlem sırasında numunelerin taze ve temiz olmalarına dikkat edilmiştir. Toplanan örnekler oda şartlarında sabit tartıma gelinceye kadar kurutulmuş ve kullanımına kadar +4 ^{o}C'de saklanmıştır.

Ekstraktların Hazırlanışı

Öğütücüyle parçalanan örneklerden 5 gr alınarak ağzı kapalı erlene yerleştirilmiş ve üzerine 100 mL metanol ilave edilip manyetik karıştırıcıda karıştırılmıştır. Daha sonra karışım süzülülüp çözücüsü 45 °C'de evaporatör yardımıyla uzaklaştırılmıştır. Elde edilen ekstrakttan 1000 ppm stok çözelti hazırlanmıştır (Ergün, 2021).

Toplam Fenolik Madde Miktarı

Folin-Ciocaltaeu metodu ile yapılmıştır (Slinkard ve Singleton., 1977). 1000 ppm olarak hazırlanmış stok çözeltiden 50 µL alınarak üzerine destile su ilavesinden sonra üzerine reaktif olarak 40 µL Folin- Ciocaltaeu ilave edilmiştir. 3 dk bekletildikten sonra karışıma %2'lik Na_2CO_3 çözeltisinden 120 µL eklenmiştir. Oda sıcaklığında 2 saat inkübe edilen karışım 760 nm'de absorbansı ölçülmüş ve fenolik madde miktarı standart grafik yardımıyla mg GAE/g olarak belirlenmiştir.

Toplam Flavonoid Madde Miktarı

Bitki numunesinin alüminyum nitrat metodu kullanılarak **t**oplam flavonoid madde miktar tayini yapılmıştır. Toplam flavonoid madde miktarı mg KE/g olarak belirlenmiştir (Nieva Moreno ve ark., 2000).

DPPH• Serbest Radikal Giderme Aktivitesi

Serbest radikal giderim aktivitesi Blois (1958) metodu kullanılarak belirlenmiştir. Troloks kullanılarak standart grafik oluşturulmuş ve bitki ekstraktının DPPH radikal giderici aktivitesi troloks eşdeğeri olarak hesaplanmıştır.

Fe^{3+} -Fe^{2+} İndirgeme Gücü

Fe^{3+} indirgeme gücü tayini Oyaizu (1986) metodu kullanılarak yapılmıştır. Bu metod da Fe^{3+}'ün Fe^{2+}'ye indirgenmesi bağlı olarak meydana gelen renk değişiminin 700 nm'de tespitine dayanmaktadır. Çalışmada trolox kullanılarak standart grafik çizildi ve sonuçlar troloks eşdeğeri olarak hesaplanmıştır.

Cu^{2+} indirgeme antioksidan kapasitesi (CUPRAC)

Cu^{2+} indirgeme kapasitesi Apak ve ark., (2004)'e göre yapıldı. Bunun için 1'er ml $CuCl_2$, Neokuprin ve NH_4CH_3COO ilave edildi. Üzerlerine ekstrak çözeltisi ilave edildikten sonra toplam hacim 4 ml'ye saf su ile tamamlandı. 30 dk inkübasyondan sonra 450 nm'de absorbansı okunmuştur. Sonuçlar troloks eşdeğeri olarak hesaplanmıştır

İstatistiksel Analiz

Çalışma sonuçlarının incelenmesinde SPSS istatistik programı kullanılmıştır Bütün analizler üç tekrar olarak planlanmış ve sonuçlar 3 tekrarlı ölçümlerin ortalaması ± standart sapma olarak ifade edilmiştir.

Bulgular ve Tartışma

Bu çalışmada, yetiştiği bölgelerde çay olarak da tüketilen sarıçam taze filizlerinin toplam fenolik ve flavonoid madde miktarı tespit edilmiştir (Tablo 1).

Tablo 1. Toplam fenolik ve flavonoid madde miktarları

Fenolik Madde Miktarı (mg GAE/g)	Flavonoid Madde Miktarı (mg KE/g)
19,92±1,65	6,20±0,74

Bitkisel gıdaların yapısında bulunan fenolik bileşiklerin varlığı bize bitkinin antioksidan kapasite hakkında bilgi verir. Çalışmada toplam fenolik madde miktarının 19,92±1,65 mg GAE/g olduğu tespit edilmiştir. Yapılan literatür taramasında benzer şekilde çeşitli bitkisel çaylar üzerinde yapılmış bilimsel çalışmaların olmasına rağmen taze sarı çam filiz çayına ait bilgiye ve araştırmaya rastlanmamıştır. Dünyada ve ülkemizde en çok tüketilen siyah ve yeşil çayın kökeni *Camellia sinensis* L bitkisinin yapraklarıdır. Türkiye de yetiştirilen *Camellia sinensis L.* bitkisi üzerinde yapılmış bir çalışmada toplam fenolik madde miktarının 1. hasatta 59.44 µg GAE/mg, 2. hasatta 80.69 µg GAE/mg ve 3. hasatta 62.88 µg GAE/mg olduğunu bildirmişlerdir (Ercişli et al., 2009). Başka bir çalışmada yapraklı bitki çaylarının etanol ekstraklarındaki fenolik madde miktarının Biberiye çayında (Rosemary tea) 39,44 ± 0,92 mg GAE/g olduğu, Dut yaprağı çayında (Mulberry leaf tea) 10.98 ± 0.38 mg GAE/g olduğu, Limon çayında (Lemongrass tea) 17.32 ± 0.32 mg GAE/g ve Trabzon hurması yaprağı çayında ise (Persimmon leaf tea) 46,42 ± 0,95 mg GAE/g olduğu bildirilmiştir (Oh ve ark., 2013). Bulduğumuz değer *Camellia sinensis* L. bitkisi, Biberiye (Rosemary tea) ve Trabzon hurması yaprağı(Persimmon leaf tea) çaylarına ait değerden düşük, Dut yaprağı (Mulberry leaf tea) çayına ait değerden ise yüksektir. Ayrıca Limon çayının (Lemongrass tea) toplam fenolik madde miktarına benzemektedir. Bu farklılıkların tür arası farklılıklardan kaynaklanmış olabileceği ve ayrıca bitkilerin toplam fenolik madde miktarına mevsim ve vejetasyon dönemi gibi faktörlerin etkisinin olabileceği düşünülmektedir.

Çalışmada ayrıca toplam flavonoid madde miktarı 6,20±0,74 mg QE/g olarak tespit edilmiştir. Karık ve Sağlam (2018) yılında Marmara bölgesinden topladıkları ada çayı (*Salvia fruticosa Mill.*) üzerinde yaptıkları çalışmada

toplam flavonoid madde miktarını 5,52-7,93 mg QE/g olarak bulmuşlardır. Benzer şekilde Papatya çayı (*Marş arvensis*) üzerinde yapılmış bir çalışmada ise toplam flavonoid madde miktarının 13.12 ± 0.1 mg QE/g olduğu bildirilmiştir (Djeridane et al., 2006). Bulduğumuz değer, Karık ve Sağlam (2018)'ın bildirdiklerine benzer, Djeridane et al., (2006)' inden küçüktür. Beklenen bir durum olarak karşımıza çıkan sonucun tür farklılıklarından kaynaklanmış olabileceği sonucuna varılmıştır.

Çalışmada bitki ekstraktının IC_{50} değeri, DPPH• serbest radikal giderme aktivitesi (DPPH), Fe^{3+} -Fe^{2+} indirgeme gücü tayini (FRAP), Cu^{2+}-Cu^{+} indirgeme antioksidan kapasitesi (CUPRAC) değerleri hesaplanmıştır (Tablo 2).

Tablo 2. Bitki ekstraktına ait toplam IC_{50}, DPPH, FRAP ve CUPRAK değerleri

	IC_{50} (µg /ml)	**DPPH** (µg TE/g)	**FRAP** (µg TE/mL)	**CUPRAK** (µg TE/gr)
BHT	38,84±0,46	120,24±1,43	7,42±095	324,64±2,89
Bitki Ekstraktı	470,95±4,62	18,80±0,35	2,13±0,01	16,20±3,20

Çalışmada DPPH• serbest radikal giderme aktivitesinin belirlenmesinde standart olarak BHT kullanılmıştır ve taze çam filizlerinin radikal giderme aktiviteleri 18,80±0,35 µg TE/g olarak belirlenmiştir. Ada çayı olarak tüketilen *Salvia fruticosa* bitkisi üzerinde yapılmış benzer çalışmada bitkisel ekstraktın toplam radikal giderme aktivitesi 820,00-876,79 µmol TE/100g kuru madde olduğu bildirilmiştir (Karık ve Sağlam, 2018). Farklı bir çalışmada ise Hibiskus çayının (*Hibiscus sabdariffa L.)* radikal temizleme aktivitesinin 323,1-505,0 mg TE/L olduğu tespit edilmiştir (Naji ve ark., 2021).Türlerin farklı olması radikal giderme aktivitelerinin de farklı olması sonucunu doğurmuştur. Burada önemli olan çay olarak tüketilen diğer bitkilerde olduğu gibi sarıçam filizi çayının da radikal giderme aktivitesine sahip olmasıdır.

Çalışmada taze çam filizlerinden elde edilen bitki ekstraktının Fe^{3+}-Fe^{2+} indirgeme gücü (FRAP) değerinin 2,13±0,01 µg TE/mL olduğu tespit edilmiştir. Ihlamur (*Tilia platyphyllos Scop)* ve reyhan üzerinde yapılmış benzer bir çalışmada Fe^{3+}-Fe^{2+} indirgeme gücünün (FRAP) ıhlamurda 4.82±0.38 mg Troloks/g olduğu ve reyhanda ise 2.95±0.31 mg Troloks/g olduğu bildirilmiştir (Karadağ, 2019). Ayrıca Eser (2018) yılında Türkiye'deki bitkisel çaylar üzerinde yaptığı çalışmada, bitkilere ait etanol ekstraktlarında bu değerlerin; Adaçayı çayında (*Salvia officinalis*) 0.27 ± 0.74 mM Trolox, böğürtlen çayında (*Rubus procerus*) 0.15 ± 0.05 mM Trolox, elma çayında (*Malus domestica*) 0.15 ± 0.04 mM Trolox, ekinezya çayında (*Echinacea angustifolia*) 0.15 ± 0.04 mM Trolox, limon çayında (*Tilia platyphyllo*) 0.15 ± 0.03 mM Trolox, kuşburnu çayında (*Rosa canina*) 0.15 ± 0.01 mM Trolox ve yeşil çayda ise (*Camellia sinensis*) 0.15 ± 0.01 mM Trolox olduğunu bildirmiştir (Eser 2018). Taze çam filizlerinin Cu^{2+} -Cu^{+} indirgeme antioksidan kapasitesi (CUPRAC) 16,20±3,20 µg TE/gr olarak belirlendi. Bu değerin çay olarak tüketilen ıhlamurda 192.18±3.20 mg Troloks/g olduğu, karanfilde ise 2.73±0.17 mg Troloks/g olduğu bildirilmiştir (Karadağ, 2019). Ayrıca adaçayı üzerinde yapılmış farklı bir çalışmada ise Cu^{2+} -Cu^{+} indirgeme antioksidan kapasitesi 0,438±0,029 0,2 mg/mL olarak bildirilmiştir (Işık, 2020).

Sonuç

Çalışmada Erzurum Olur bölgesindeki özel mülkiyet içerisinde bulunan çam ağaçlarından toplanan ve çay olarak tüketilen taze çam filizlerinin toplam fenolik ve flovonoid miktarı ile antioksidan aktiviteleri araştırılmıştır. Taze çam filizlerinin toplam fenolik ve flavonoid bileşik miktarının yüksek ve antioksidan özelliğinin ise yüksek olduğu belirlenmiştir. Çay olarak tüketilmesi durumunda günlük antioksidan ihtiyacının karşılanmasına yardımcı olabileceği düşünülmektedir. Fakat bitkinin gelişmesi için çok önemli olan genç sürgünlerin bu şekilde toplanıp değerlendirilmesinin bitkinin gelişmesini olumsuz yönde etkileyebileceği yönünde tereddütler oluşmuştur. Bu konuda yeni çalışmalara ihtiyaç vardır.

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ID:488

Determination of Phytochemicals and Antioxidant Capacity of *Satureja hortensis* L.

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Abstract

Thyme is one of the spices that is widely consumed in the regions where it grows and is used in many dishes, especially soups, and gives a regional identity to the dish where it is used. In this study, the amount of phytochemicals and antioxidant capacity of the plant *Satureja hortensis* L. (süpürge kekiği, çibriska) which grows spontaneously and is used as a spice in meals in the Karakoçlar settlement area of Olur district of Erzurum province was investigated. The total amounts of phenolic and flavonoid substances were determined to be 40.85±0.85 mg GAE/g and 26.52±0.46 mg QE/g, respectively. In addition, the DPPH radical scavenging activity of the plant extract was calculated as 45.24 ±3.47 µg TE/mL and the IC_{50} value was calculated as 177.11±0.99 µg/mL. It was determined that the Cu^{2+} reducing antioxidant capacity of the *S. hortensis* plant extract was 2162.09±113.61 µg TE/mL and the Fe^{3+} reducing antioxidant capacity was 24.36±4.59 µg TE/mL. As a result, it was concluded that the *S. hortensis* plant, which is known with different names in different regions, has antioxidant potential and can be used as a natural antioxidant source in addition to its common use.
Key Words: *Satureja. hortensis L., Phenolic and Flavonoid substance, CUPRAC, FRAP, DPPH.*

***Satureja hortensis* L.'nin Fitokimyasallarının ve Antioksidan Kapasitesinin Belirlenmesi**

Özet
Kekik yetiştiği bölgelerde yaygın olarak tüketilen ve başta çorbalar olmak üzere birçok yemekte kullanılan ve kullanıldığı yemeğe bölgesel kimlik kazandıran baharatların başında gelmektedir. Bu çalışmada, Erzurum ilinin Olur ilçesi Karakoçlar yerleşim yeri bölgesinde kendiliğinden yetişen ve bölgede yemeklerde baharat olarak kullanılan *Satureja hortensis* L. (süpürge kekiği, çibriska) bitkisin fitokimyasal madde miktarları ve antioksidan kapasitesi araştırılmıştır. Toplam fenolik ve flavonoid madde miktarlarının sırasıyla 40,85±0,85 mg GAE/g ve 26,52±0,46 mg KE/g olduğu tespit edilmiştir. Ayrıca bitki ekstraktının DPPH radikal giderme aktivitesi 45,24 ±3,47 µg TE/mL ve IC_{50} değeri ise 177,11±0,99 µg/mL olarak hesaplanmıştır. *S. hortensis* bitki ekstraktının Cu^{2+} indirgeyici antioksidan kapasitesinin 2162,09±113,61 µg TE/mL olduğu ve Fe^{3+} indirgeme antioksidan kapasitesinin ise 24,36±4,59 µg TE/mL olduğu belirlenmiştir. Sonuç olarak farklı bölgede değişik isimlerle anılan *S. hortensis* bitkisinin antioksidan potansiyele sahip olduğu ve yaygın olarak kullanım şekline ilave olarak doğal antioksidan kaynağı olarak kullanılabileceği kanaatine varılmıştır.
Anahtar Kelimeler: *Satureja. hortensis L., Fenolik ve Flavonoid madde, CUPRAC, FRAP, DPPH.*

ID:494

Synthesis Of N_1,N_3-Di(N_1',N_1'-Didesoxymethylazon-N'-Monodesoxymethylazone) Diphenylquanidine And Research As A Corrosion Inhibitor

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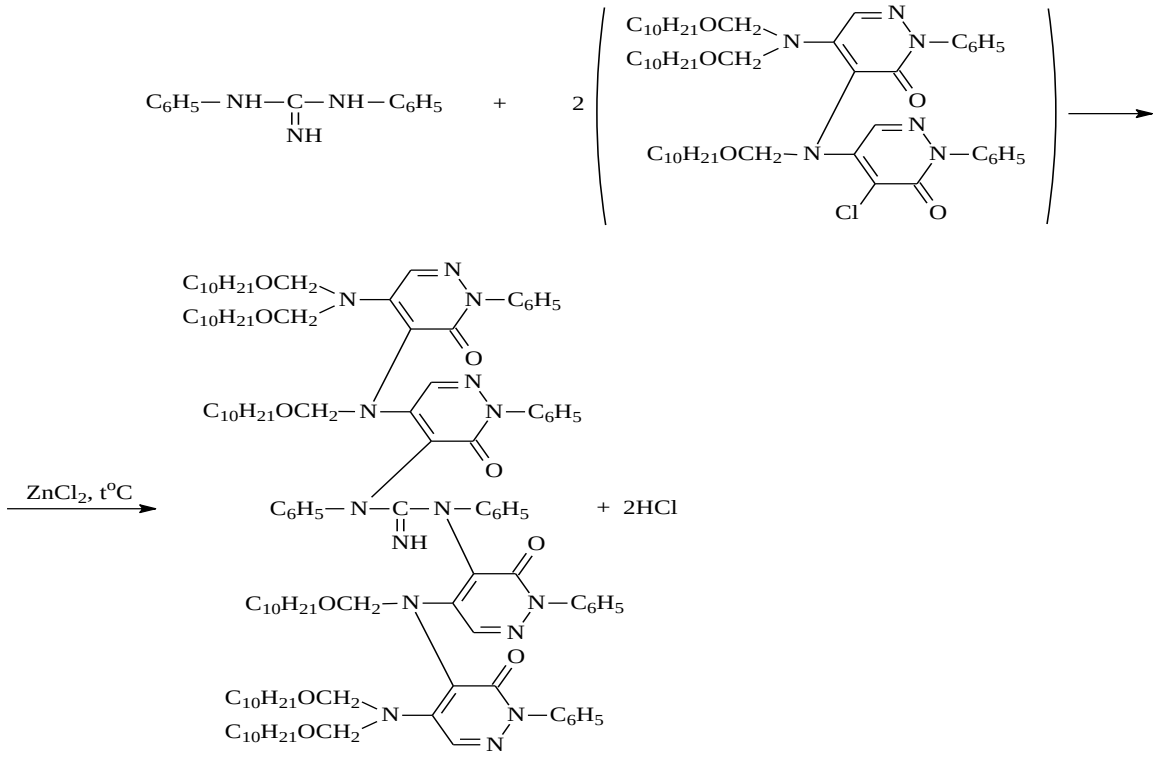
Based on the information provided in the technical literature and the results of our many years of research, it has been proved that organic compounds containing nitrogen atom, $ROCH_2$-functional group, $-CH_2$-group, C_6H_5-group and many double bonds have high effective corrosion inhibitor properties.Therefore, the synthesis of this type of organic compounds and its study as a corrosion inhibitor is considered one of the most relevant topics.
For this purpose, diphenylquanide derivative N_1,N_3-di(N_1 ', N_1'-didesoxymethylazon-N'-monodesoxymethylazon)diphenylquanidine (conventionally denoted DQ-2 compound), which forms coordination bonds in aggressive environments on the metal surface, was developed by the methods previously developed by us [1-3] synthesized accordingly and studied as a corrosion inhibitor.
This compound was synthesized in several stages by the reaction of diphenylquanidine with N_1, N_1-didesoxymethylazon-N'-monodesoxymethylazone ether.



DQ-2
The composition and structure of the synthesized DQ-2 compound were determined by methods known in analytical chemistry.Research to determine the corrosion inhibitory properties of this compound was carried out in accordance with the methods described in the literature[1-3].
Based on the results of the study, it was determined that the effectiveness of the synthesized DQ-2 compound of diphenylquanidine in the presence of highly aggressive[3% NaCl + oil (10: 1) + H_2S 500 mg / l; 0.3 N HCl + gasoline (1: 7) + H_2S 1000 mg / l]environments in the laboratory, even at concentrations of 0.5-1.5 mg / l, is 99.92-100%.
The non-corrosion of the Cm.3 steel (metal) used in the sample during the study was determined by the gravimetric method. The reasons for the effectiveness of the corrosion inhibitor of the DQ-2 compound have been clarified by us on the basis of the data given in the literature[1-3] as follows.
As noted in other studies, the inhibitory effect of each nitrogen-containing organic compound is likely to be passive and non-corrosive due to the large number of nitrogen atoms, functional groups, double bonds and their coordination with the metal surface. Therefore, the presence of 15 nitrogen atoms, 6 $C_{10}H_{12}OCH_2$-functional group

and 25 double bonds in the DQ-2 compound is likely due to the simultaneous increase in electron density “group-metal”coordination bonds are formed, forming a very thin layer on the surface of the metal. As a result, the surface of the metal plate in the study becomes passive and does not corrode.

According to the results of the research, the use of DQ-2 compound as an economically and environmentally effective inhibitor of 100% corrosion protection of steel technological equipment used in the oil and gas and petrochemical industries in high temperatures and aggressive environments can be considered scientifically based.

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ID:495

Synthesis Of N_4, N_5-Di(N_1',N_1'-Didesoxymethylazon-N'-Monodesoxymethylazone) Diphenylcarbazone Compound And Research As A Corrosion Inhibitor

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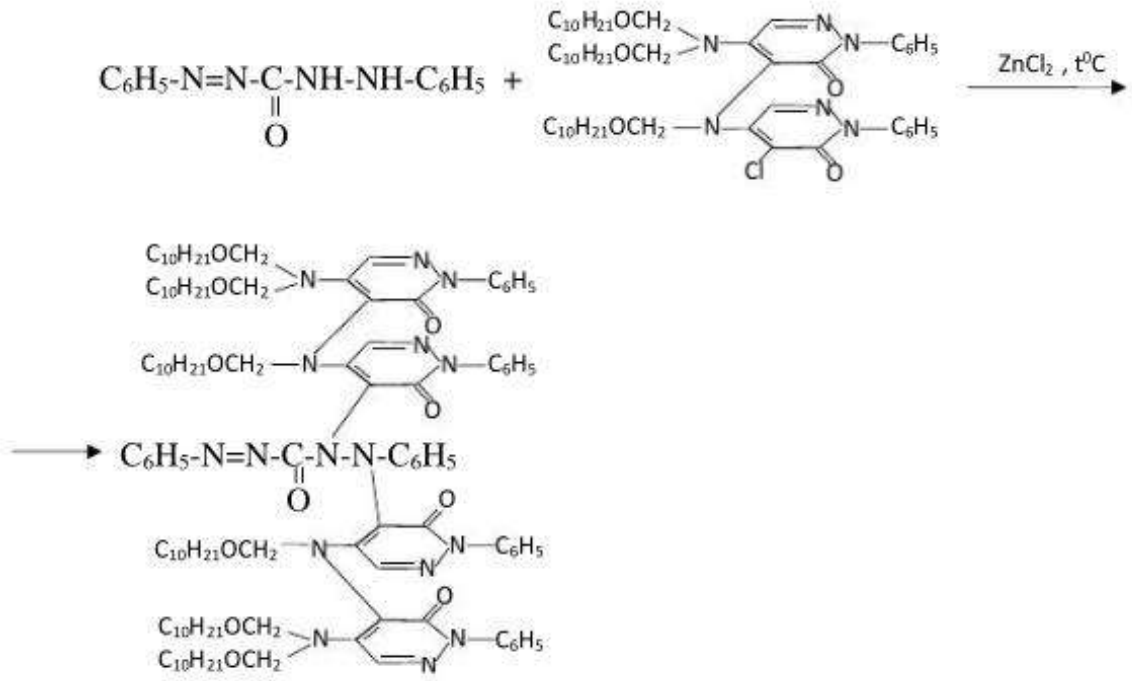
One of the main environmental problems of the oil and gas and petrochemical industries is the corrosion of steel technological equipment in the production areas of these industries. That is why the synthesis of highly inhibitory substances and their study as a corrosion inhibitor is one of the most pressing issues.

For this purpose, on the basis of cheap raw materials, a new derivative of diphenylcarbazone (conventionally marked KB-4 compound) containing a carbon atom, a nitrogen atom, the $ROCH_2$-functional group, and many double bonds was synthesized.The synthesis of diphenylcarbazone compound N_4, N_5-di (N_1 ', N_1'-didesoxymethylazon-N'-monodesoxymethylazon) was carried out in the final stage by the following reaction in accordance with previously known methods[1-3] by us.



KB-4

N_4, N_5-di (N_1 ', N_1'-didesoxymethylazon-N'-monodesoxymethylazone) diphenylcarbazone (KB-4) compound synthesized 6 Corrosion inhibitor efficacy is established in highly aggressive [3% NaCl + oil (10: 1) + H_2S 500 mg/l: 0.3N HCl + gasoline (1: 7) + H_2S + 1000mq/l] environments organized in the laboratory by us. Mass loss of steel plates of "cm.3" brand in these environments on the basis of "gravimetric" method for determination of corrosion rate of KB-4 compound at concentrations of 0.25: 0.5: 1.0 mg/l, temperature 70^0C, for 4 hours, 600 period/min. research work was carried out with rapid mixing.

Based on the results of the study, it was determined that the effectiveness of the corrosion inhibitor of the KB-4 compound is 99.96-100%, even at the low concentrations mentioned above. The scientific results obtained in our previous researches and explanations in the technical literature have been proved in the mentioned research work. Thus, the scientific data and explanations show that organic compounds containing $ROCH_2$ functional group, nitrogen atom, $-CH_2$-group double bonds have a highly effective corrosion inhibitor effect.New synthesized derivatives of diphenylcarbazone N_4, N_5 (N_1 ', N_1'-didesoxymethylazon-N'-monodesoxymethylazone) diphenylcarbazone (KB-4)

The following explanations can be given for the corrosion inhibitor effectiveness of the compound, which is noted in the literature[1-3].

Due to the presence of 6 $C_{10}H_{21}OCH_2$-functional groups, 6 C_6H_5-groups, 4 azonyl groups, 54-CH_2-groups in the KB-4 compound, as well as an increase in electron density and Vander-Waltz forces due to the presence of 32 double bonds, it is likely that the steel plate "Azonyl group-metal" coordination bonds are formed on the surface and passivate the metal surface by adsorbing on the metal surface. As a result, the metal surface does not corrode. According to our research, the inhibitory effect of KB-4 compounds is many times more economical than the inhibitors currently used in the oil and gas and petrochemical industries to protect technological steel equipment from corrosion, as well as the results of research (even awarded an invention patent). and has a huge environmental advantage.

Thus, the use of synthesized and inhibitory KB-4 compounds in the oil and gas and petrochemical industries in the corrosion protection of steel process equipment operating in high temperature and aggressive environments can be considered scientifically based.

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ID:496

Study Of Antibacterial Properties Of Salicylic Acid Derivatives

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Abstract

One of the important methods for obtaining antimicrobial polymer materials is the incorporation of biologically active monomers into the polymer chain at the stage of macromolecule synthesis. In this regard, the synthesis of monomers with new biological activity attracts the attention of many researchers. Thus, the synthesis of monomers, polymers, co-polymers based on potential antibacterial salicylic acid and the use of obtained high-molecular compounds as antibacterial additives is considered a very promising direction].

The presented work is dedicated to the study of the antibacterial properties of salicylic acid, acetylsalicylic acid, allyl and vinyl esters of salicylic acid. Both allyl and vinyl esters of salicylic acid and acetylsalicylic acid were synthesized by known methods.

The study of the antibacterial properties of the synthesized substances was studied by the serial dilution method. For this, 1:100, 1:200, 1:400, 1:800 dilutions of the 1% solution of substances prepared in ethyl alcohol in sterile distilled water were performed. The antimicrobial effect of these substances was studied at a rate comparable to alcohol, 1% phenol and nitrofungin used in medical practice. Golden staphylococci (St aures), Gram-negative intestinal bacilli (E.coli), blue-green pus bacilli (Ps. Aeruginoza) from pigment-forming ones, and C. albicans from the genus Candida were taken as test cultures. EPA (meat-peptone agar) was used to cultivate bacteria, and Saburo nutrient medium was used to cultivate fungi.

On the basis of experiments, it was determined that the synthesized substances have different effects on different types of organisms, and when these substances are diluted at a ratio of 1:100, they show strong antimicrobial activity against all tested test cultures. Based on these, vinylacetate is more active antimicrobic. Thus, in 1:400 dilution, it destroyed candida fungus in 20 minutes, intestinal and blue-green pus bacilli in 10 minutes, and staphylococci had a negative effect in 20 minutes when diluted in 1:700 ratio, but the other dilutions did not affect one hour.

Based on their antibacterial activity, the studied salicylic group is classified primarily as salicylic acid, vinylsalicylic acid, allylsalicylic acid, vinylsalicylate and allylsalicylate.

Developed antibacterial monomers can be used in the composition of polymers in household, medicine, and in the preparation of coatings for corrosion protection.

***Key words**: antibacterial, polymer, salicylic acid, fungi*

ID:497

A Review: Covıd-19 Impacts On Soıl

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Abstract
The Covid-19, the biggest challenge facing humanity since World War II, spread rapidly all over the world. It created health, economic, social and environmental problems. The increasing need and supply of food with Covid-19 has once again shown us how important the soil and nature are. The effects of Covid-19 on the soil and its solutions have become a very important issue and have also become a concern with the increasing amount of waste. During Covid-19, people produced solid waste during their stay at home, and soil was used for the disposal of this waste. Contamination of the soil was also very important in that it served as a sink. It is necessary to understanding the relationship between COVID-19 and human activities related to soil pollution and its functionality. There is a strong need to address the role of soil science in understanding and mitigating the problems caused by COVID-19 in the short and long terms. The purpose here is to find national and international solutions that can be done for the protection, improvement, repair and maintenance of the soil during and after Covid-19.
Keywords: *Covid-19, Soil, Soil Pollution, Impacts*

Introductıon

In December 2019, a new infectious respiratory disease named COVID-19 (coronavirus disease 2019) emerged by the World Health Organization (WHO) in Wuhan, Hubei province, China. The COVID-19 pandemic has been hailed as the greatest challenge facing humanity since World War II, the most significant global health disaster of the century. It quickly spread around the world and created enormous health, economic, environmental and social challenges for all of humanity.

The virus, which was not taken very seriously at the beginning, spread all over the world in an incredible short time, as if we were living in sci-fi movies, causing the death of hundreds of thousands of people. Against the "common enemy", which still continues with all its violence and remains uncertain, countries are trying to reduce their economic losses while trying to protect their citizens.

The coronavirus (Covid-19), which forces us to stay at home, upsets our social and kinship relations, questions our habits, and turns economies upside down, is also the result of environmental intervention and nature intervention. After the epidemic spread in the world, the first decisions taken by countries were to impose restrictions on the trade of agricultural products. In other words, agricultural policies and rural policies began to come to the fore. The main purpose here was primarily to ensure the food safety and security of its own citizens. The coronavirus epidemic has seriously affected the global economy and still does. At this point, the effects of covid 19 on the soil has also been an important issue that causes concern.

Soıl And Soıl Polutıon Durıng Covıd-19

Soil is the most important part of the ecosystem that both regulates the environment and regulates food production, climate and water (Mishra et al., 2020). Pollution of soil will decrease crop yield and quality if it is caused by anthropogenic activity, especially urbanization, which will also vary soil organic matter, biodiversity and groundwater quality (Singh and Singh, 2020). During the Covid-19, a significant reduction in solid waste has been reported. Soil pollution may reduce cop quality and yield and, as well as change SOC (soil organic matter), biodiversity, and groundwater quality (Singh et al. 2020). Air pollution may originate from different anthropogenic and natural sources, which are able to bio-accumulate and bio-magnify in the trophic levels, and thus increase their toxicity in the food chain (Lee et al. 2020).

Soil plays a central role in production on individual farms with global developments,. It is also a fundamental condition for the resilience and productivity of agriculture in crises. Managing the soil both for recovery from COVID-19 and for long-term sustainable soil control is important not only to preserve yields but also to keep the soil healthy for many functions and new generations.

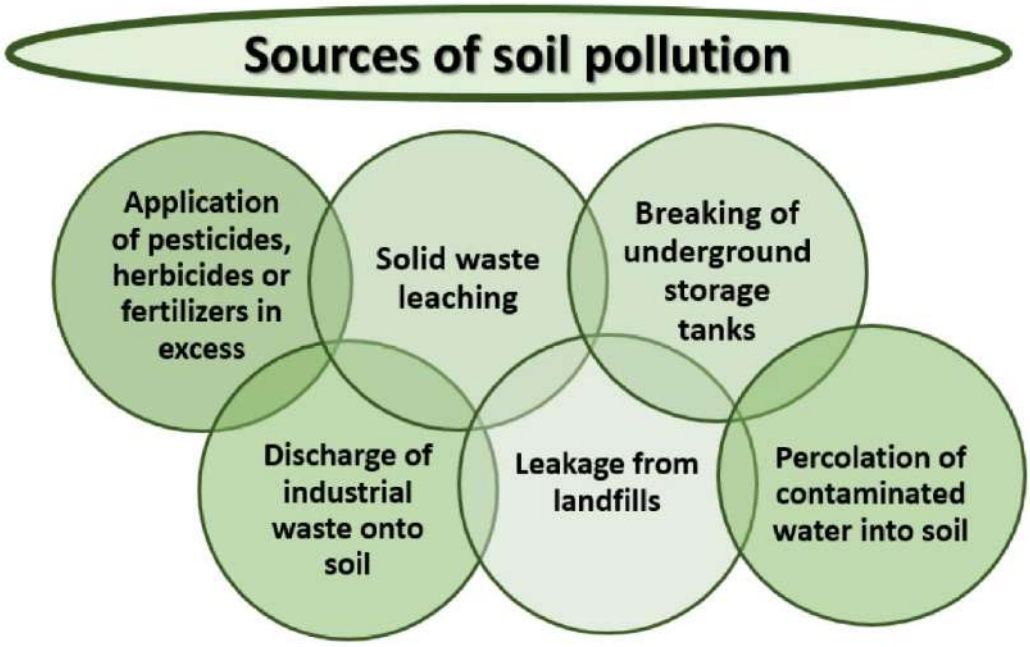

Figure 1. Some relevant sources of soil pollution (reused from Gavrilescu, 2021)

Soil pollution sources can be listed as follows; apllication of pesiticides, herbicides or fertilizers in excess, solid waste leaching, breaking of underground storage tanks, discharge of industrial waste onto soil, leakage from landfills, percolation of contaminated water intp the soil (Fig.1) During Covid-19, Solid waste leaching is to be a very important reserach topic in the World.

As known, soil pollution of natural or anthropogenic origin poses a serious threat to global food security, especially in the context of COVID-19 (Lal et al. 2020). During COVID-19, huge amounts of medical waste (e.g. tissue paper, gloves, face masks, plastic bags, empty liquid soap cans and disinfectant bottles) were produced that could contaminate the soil and require close monitoring (Lal et al. 2020). Therefore, it is necessary to understand the interrelationship between COVID-19 and human activities related to soil pollution (e.g., HMs, antibiotics, polycyclic aromatic hydrocarbons and petroleum products) and its functionality (Lal 2020; Lal et al. 2020). Thus, there is a strong need to address the role of soil science in understanding and mitigating the problems caused by COVID-19 in the short and long terms (Lal et al. 2020; Steffan et al. 2020).

Covıd-19 Impacts On Soıl

There are several environmental impacts of Covid-19 pandemic on soil, these are sometimes negative and sometimes positive effects. For instance, as air pollution increases, so does Covid-19, so it is positively correlated. Along with the decrease in greenhouse gas emissions, the decrease in industrial refineries and activities, the decrease in the use of vehicles and transportation systems due to social distance, quarantine and quarantine, also led to an increase in air quality and a decrease in the risk to human health (Heet al. 2020; Juan-Reyes et al. 2021). Many studies have been published and are still awaiting publication to illustrate the complex interactions of the environment and human system with COVID-19. (Sarkar et al. 2021), increasing plastic waste due to COVID-19 as very common materials (gloves and masks) used during this pandemic (Patrício Silva et al. 2021), the pollution of wastewater by COVID-19 virus (Lahrich et al. 2021), impact of COVID-19 on forest fires (Paudel 2021), environmental surfaces during the COVID-19 (Hu et al. 2021) incubation period.

Conversely, COVID-19 may negatively impact human society through, global food crisis or insecurity, the global economic recession, public health risks, and lowering psychological resilience (Sarkar et al. 2021). Land management needs to be addressed and adjusted the food supply chain disruption, labor shortages, difficulties in performing farm operations, negative impacts on essential and high-value crops, and food and medical waste disposal issues during the COVID-19 (Lal et al. (2020)).

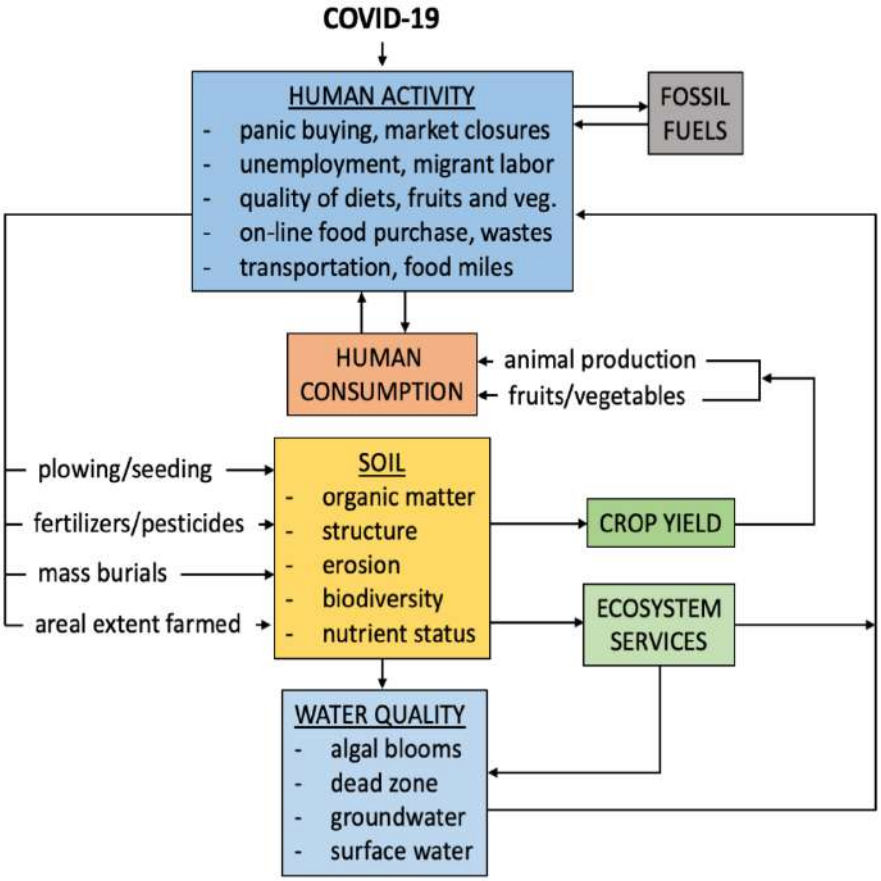

Figure 2. How soil has been affected by COVID-19? (reused from Lal et al, 2020)

The most immediate soil impacts and responses of COVID-19 are human activities resulting from the decrease in human consumption leading to excess food being thrown away and added to the soil (Figure 2) It led to reduced food waste, meat consumption and the use of U.S. Department of Agriculture (USDA) soil maps to find areas suitable for mass burial of pigs and poultry in the United States (Anonymous., 2020). This is what is done; It has long-term results on groundwater quality, land use, human health, biodiversity, and land value (Bernton., 2020, Lal et., al., 2020).

To combat the ongoing COVID-19 effects, it is necessary to policy guidelines for the appropriate management of waste and treatment, and to apply them at the international and national levels, and to understand the environmental and ecological COVID-19 effects in the future so that it can be effectively addressed (Ankit et al., 2021).

Conclusion

Environmental pollution is still one of the most important problems today especially during Covid-19 period, which is also linked to human activities and health. Pollution of soil and air, which are the most important elements of agricultural ecosystems, is still a global problem. COVID-19 has affected all aspects of our lives and has had many impacts reaching all sectors of public health, socio-economic issues and the wider environment. How soil management can help us address the COVID-19 pandemic and how it can be transmitted through soil are important questions that need to be addressed. There is a positive correlation between air pollution and COVID-19. Some open questions regarding soil and air pollution during the COVID-19 era still need to be explored as human activity patterns have changed in a way that has resulted in a number of relevant impacts around the world. The COVID-19 has shown once again that the injured skin of the planet, the fragile soil, must be protected, healed, repaired and sustained. Some lands need to be acidified and returned to nature in order to improve and restore planetary processes through prudent management, reducing food waste and resource (soil, water, nutrient) losses.

Soil science should also be relevant to the general public, both as a consumer of food and as a beneficiary of the soil and other ecosystem services that provide for its management. Farmers and landowners are concerned about carbon sequestration, water quality and renewability, soil biodiversity, etc., which should be rewarded and encouraged through payments for ecosystem services su such as current and emerging global challenges.

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ID:499

Modeling Surface water resources for effective Water Allocation Using Water Evaluation and Planning (WEAP) Model, the case of Dabana Watershed, Dhidesa Sub basin of Ethiopia

Abraham Dirbaba Guyysasa

Abstract

Water demand evaluation to varied competitive uses is more and more necessary in watershed that has different users. Within the study watershed, there are a variety of surface water users, however, no effective surface water potential and demand assessment exists for either the watercourse of Dabana or the complete watershed under study hence which is making area for competition between among these users including the environment. The study watershed is important because it forms a site in the Dhidesa sub basin that supports the ecosystem of the Blue Nile Basin in western Ethiopia. The main purpose of this study was to simulate surface water resources in the study watershed using the WEAP (Water Evaluation and Planning) model for effective surface water allocation. The outputs of the model were analyzed using tables, figures, percentages and arc gis 10.4 under reference and three future demand scenarios (climate change, increase irrigation area and population increase). The simulated monthly flow has shown a good agreement with the observed flows for a period (2000 –2020). The NSE was 0.92, RSR was 0.89 and R^2 was 0.85 for the calibration period and 0.85,0.78 and 0.76 for the validation period respectively. The annual average surface water potential of the study watershed was estimated at 1329.6 Mm^3, 1119.0Mm^3 1308.2Mm^3 and 1313.6 Mm^3 under the reference(2020), Climate change, Increase irrigation area and population increase scenarios, respectively at 2030 G.C. The demand for domestic users, livestock population, irrigation agriculture and Bedele Beer factory during the reference period was estimated to be 4.1 Mm^3, 6.1 Mm^3, and 11.1 Mm 3 and 0.3 Mm 3, respectively. This surface water demand will raise to 5 Mm3, 9.2 Mm^3, 16.6 Mm^3 and 0.316 Mm^3 respectively by 2030. On the other side, the environmental flow requirement for the health of ecosystem within the watershed and in the downstream of the study watershed was estimated to be 332.2 Mm^3 and 279.75 Mm^3 respectively during the reference (2020) and Climate change scenario (2030) respectively. The study has revealed that WEAP model is good decision support tool to assess the water demand, water resource availability and resource reliability of demand sites of study watershed. Based on the result of this research it has been recommended that both surface water supply and demand side management measures should be well implemented through integrated watershed management manner.

Key words: *Environmental flow Requirement, WEAP, Scenarios, Dabana watershed.*

ID:501

Establishment Of An Efficient In Vitro Regeneration System For Spinach (Spinacia Oleracea L.)

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Abstract
Here we report efficient direct *in vitro* regeneration in *Spinacia oleracea* which results in healthy plants with fleshy leaves. Five different types of explant tissues were tested on different plant growth regulators at varying conc plant growth regulators. Only petioles exhibited response for direct regeneration, hence it was used in further experiments. More than 35% of petioles regenerated directly into shoots which were later separated and cultured onto rooting medium. All other explants showed variable responses however, none of them could regenerate *in vitro*. As far as the role of plant growth regulators is concerned, Giberrelic acid (GA_3) appeared to be the most imperative one for direct *in vitro* regeneration and bringing about maximum regeneration in Murashige and Skoog's (MS) medium augmented with 2 mg/L GA_3, 0.4 mg/L NAA and 1 mg/L BAP. The resultant plants were acclimatized in the green house and resulted in heathy fleshy leaves. The protocol reported here describes efficient direct *in vitro* regeneration from green tissues. Hence, it may be a step forward to engineer/edit genome of this green vegetable for valuable traits including agronomic traits improvement, biofortification and biopharmaceutical production in future.

Keywords: **In vitro regneration, Spinach, Plant Growth Regulators, Recalcitrance.**

ID:502

Upregulatd gene expression Profiles of BAK1 and BAK1/BCL2 cause Age Related Hearing Impairment (ARHI) by Triggering Apoptosis

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Abstract

Presbycusis or Age Related Hearing Impairment (ARHI) is a progressive, very common and most ignored neuro-sensory disorder in the older people that usually results in social isolation of the affected individuals. Programmed cell death of cochlear cells is the key reason in animal models of presbycusis. Since cochlear cells cannot regenerate, their apoptosis causes permanent hearing impairment. Discovery and characterization of molecular components can aid in developing prophylactic and therapeutic measures. The study involved comparison of expression profiles *BAK1* and *BCL2* genes between normal and age related hearing impairment subjects. These genes have been reported to be the integral part of intrinsic apoptotis pathway. Both normal and affected subjects were enrolled after detailed ENT examination, audiometry and otoscopic investigation and blood samples were taken after written informed consent. Samples were subjected to RNA extraction and degree of gene expression was determined through real time PCR. *BAK1* and the *BAK1/BCL2* ratio were found statistically significantly high in presbycusis subjects. The ratio was positively correlated with audiometric results. Our results show that *BAK*-mediated cell death may be the chief mechanism in the development of presbycusis in humans. The study reveals that the changes in gene expression profile of these genes can be used as a simple and quick marker for diagnosis of presbycusis.

Keywords: *Presbycusis, BAK1 and BCL2, expression profile, biomarker, diagnosis and treatment*

ID:503

Heavy Metal Contamination Levels in Vegetables Grown around the Riruwai Mining Area, Kano State, Nigeria

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Abstract
Vegetables grown in mining areas can accumulate significant amounts of heavy metals (HMs), which can cause serious developmental disorders and have long-term negative effects on public health. In the present study, HMs contamination levels in vegetables grown around the Riruwai mining area in Kano State, Nigeria were investigated. Fifteen (15) vegetable samples, including lettuce (*Lacuta sativa*), tomato (*Solanum lycopersicum*), and bean (*Phaseolus vulgaris L*), and their corresponding soils were collected. The concentrations of arsenic, cadmium, chromium, mercury, manganese, nickel, lead, and zinc were determined using Microwave Plasma Atomic Emission Spectrometry, and the measured concentrations were used to compute the bioaccumulation factor (*BAF*). Heavy metal concentrations in the investigated vegetables and soils were found to be significantly high, with the majority of levels exceeding the WHO/FAO (2007) recommended limit. Pollution levels for heavy metals and vegetable types differed significantly ($p \leq 0.05$). Cadmium had the highest *BAF* value, with a value significantly greater than one, and *L. sativa* had the highest accumulation of all vegetables studied. The higher concentration of these metals in vegetables necessitates immediate scientific attention and further research to determine the optimum concentration required for human health. Planting of vegetables for human and animal consumption should be stopped until this is accomplished.
Key Words: *BAF, Heavy metals, Microwave Plasma Atomic Emission Spectrometry, Riruwai, Vegetables*

Introduction

Heavy metal (HMs) contamination of soils and vegetables has remained a threat to public health around the world, particularly in developing countries (Bayissa and Gebeyehu, 2021). Vegetables grown in mining areas can accumulate significant amounts of HMs, which can cause serious developmental disorders and have long-term negative effects on public health (Cao et al., 2010; Gebeyehu and Bayissa, 2020; Guo et al., 2020). Mining operations have historically played a significant role in national and regional economies. However, mining operations are usually carried out uncontrollably, resulting in profound ecological problems, particularly HMs pollution (Zhuang et al. 2014). Vegetables cultivated in mining areas can accumulate significant amounts of HMs, resulting in negative health effects on humans and other animals (Halim et al., 2015). Short and long-term exposure to HMs could result in numerous human health issues, including dermal, cardiovascular, gastrointestinal, hematological, renal, and hepatic effects (Lin et al., 2013; Zhuang et al. 2014). HMs contamination of soils is a major pathway for HMs exposure to humans, as they can enter the human body through ingesting contaminated vegetables (Makanjuola et al., 2019). Vegetables are important edible crops that are a necessary segment of the human nutrition regimen. They are high in nutrients that are essential for good health and provide carbohydrates, vitamins, minerals, and fiber (Khan et al., 2015). HMs are easily absorbed by vegetable root systems and can accumulate at high levels in the edible portions of vegetables even at low levels in the soil (Hu et al., 2013; Liu et al., 2013). It is clearly evident that more than 70% of the dietary intake of HMs is contributed to the food chain (Liu et al., 2013).

Riruwai, located in the southern part of Kano State, Northwestern Nigeria, is principally a mining community. A large-scale mining operation began in 1979 and was expanding rapidly with close to nine hundred (900) tons of zinc and tin ore production every day. The mine was stopped after five years of continued mining. However, small-scale mining has continued regularly in the area. There is growing evidence across the globe that HMs pollution in mining areas is causing health problems for the local residents (Li et al., 2014; Irzon et al., 2018). The residents of the mining communities are constantly at risk of being exposed to these metals through the consumption of vegetables. There is, therefore, a need to investigate the HMs contamination levels in the soils and vegetables grown in the mining area in order to protect the environment and public health. To the best of our knowledge, this is the first scientific study that investigated the HMs contamination levels in the soils and vegetables of farmland around the Riruwai mining area, Kano state, north-western Nigeria.

Materials and Methods

Description of the Study Area

Riruwai covers an area of 129 km^2 and is located between latitude 10°43"97"N - 10°45'01"N and longitude 8°43"3"E - 8°47'39" E (Fig. 1). The climate was classified as tropical savanna by KÖppen, with mean annual rainfall ranging from 400 to 1,200 mm/year (Alhaji et al., 2017). Riruwai is one of Nigeria's younger granite complexes. The complex is an example of decayed roots of an alkaline volcano that formed as component of an early Jurassic chain of anorogenic centers. It is surrounded by a collection of metamorphic and calc-alkaline meta-igneous rocks that transitioned from Precambrian to Cambrian ages (Olasehinde et al., 2012). According to the 2006 census, the population of Riruwai is estimated to be 150,645 people. The projected population is 257,479 people as at 2015 at 3.2 % growth rate (NPC, 2006). The occupation of majority of people of the community is farming. Riruwai is one of the promising historical sites in Kano State that is well-known for its beautiful natural and man-made sites (Yakubu et al., 2019).

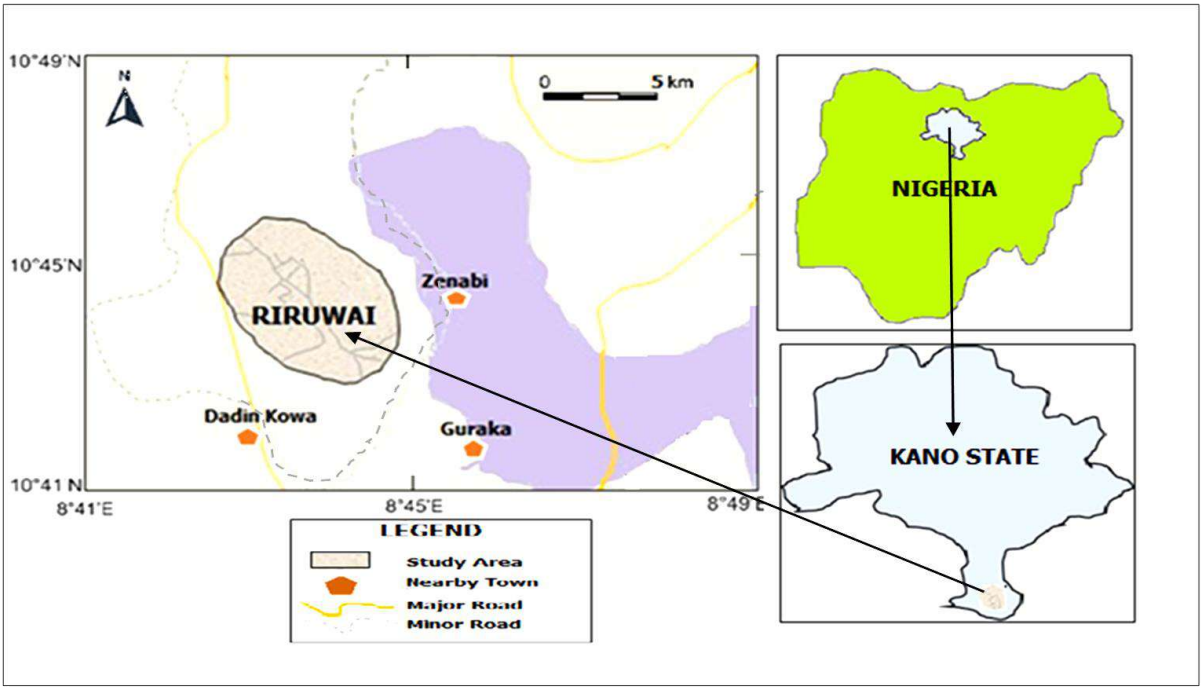

Figure 1. Map showing the study Area

Vegetables Sampling and Pre-treatment

A total of fifteen (15) vegetables that represent the species commonly grown in the area were collected directly from the farms in the study area. The vegetables include lettuce (*Lacuta sativa*), tomato (*Solanum lycopersicum*) and beans (*Phaseolus vulgaris L*). The specific sampling quantities were 4 *L. sativa*, 6 *S. lycopersicum*, and 5 *P. vulgaris*. The collected vegetable samples were washed three times with tap water to remove dust particles, blotted with tissue paper to dryness, and separated into edible and non-edible parts. The edible parts were oven-dried at 30 °C until they reached a consistent weight, then ground into powder with a blender (Jamali et al., 2009).

Determination of Heavy Metals in Vegetables

A 0.50 g sample of each treated vegetable was digested in a 5:1:1 tri-acid mixture of HNO_3, H_2SO_4, and $HClO_4$. The mixture was heated to 80 °C until clear, then filtered into a 50 cm^3 volumetric flask using Whatman filter paper number 42. The filtrate was diluted with deionized water to mark. A blank sample was also prepared using similar acid mixtures into empty digestion vessels. Microwave Plasma Atomic Emission Spectrometer (MP-AES, Model: 4200) was used for the determination of HMs concentrations at their respective wavelengths in the soils and vegetable samples.

Determination of Heavy Metals in the Soils

The sample was air-dried at room temperature and visible materials such as stones, and plants residues were removed. The sample was pulverized, passed through a 0.15 mm nylon screen, sieved and homogenized. The soil sample was digested with a mixture of three concentrated acids (HNO_3, HF and $HClO_4$). Soil sample (0.50 g) was placed in a 200 cm^3 Teflon beaker. 10.00 cm^3 of HNO_3, 10.00 cm^3 of HF and 10.00 cm^3 of $HClO_4$ were added and the mixture was heated on an electric hot plate at 180 °C until the solution was almost dried. The beaker was

removed and cooled to room temperature. 5.00 cm^3 of concentrated HNO_3, 5.00 cm^3 of HF and 5.00 cm^3 of $HClO_4$ were added and the mixture was boiled until dense white fumes appeared. The beaker was removed, cooled and 15.00 cm^3 of deionized water was added and boiled for 5 minutes. The digest was filtered using Whatman filter paper no. 42 into a 50 cm^3 volumetric flask. The wall of the beaker was washed three times with 10.00 % dilute HNO_3. The solution was made up to the mark with the HNO_3 for HMs analysis. Blank solution was treated and prepared in a similar way. The concentrations of As, Cd, Cr, Hg, Mn, Ni, Pb and Zn were analysed at their respective wavelengths using Microwave Plasma Atomic Emission Spectrometer (MP-AES, 4200). The concentrations of heavy metals were reported in mg/kg.

Determination of Bioaccumulation Factor (BAF)

The bioaccumulation factor (*BAF*) is a ratio of HMs present in vegetables to those found in the soil (Hossen et al., 2021):

$$BAF = \frac{C_{vegetable}}{C_{soil}} \quad (1)$$

Where: $C_{vegetable}$ and C_{soil} are the HMs concentrations in vegetables edible portions and soils on a weight basis, respectively.

Quality Control

Analytical grade reagents were used with no further purification. All glassware and plastic containers were soaked in 10% (v/v) nitric acid overnight before being washed three times with distilled water and three times with distilled deionized water. They were oven dried overnight at 50–60 °C. After oven drying, the containers were desiccated for about 20 minutes before being analyzed. All samples were analyzed three times, the standard solution for each metal was prepared by sequential dilution of certified standards (1000 mg/L) obtained from Sigma Aldrich, and a calibration curve for each metal was created. Blanks were determined using similar procedure.

Statistical Analysis

All data was transformed into the mean standard deviation of three replicates. One-way Analysis of Variance (ANOVA) was used to compare heavy metal concentration levels in different vegetable samples. A statistically significant difference was established using the Tukey HSD post-hoc test ($p \leq 0.05$). Statistical analyses were carried out using SPSS 23.0 (Chicago, USA), while Microsoft Excel® 2010 was used in plotting the graph.

Results and Discussion

Concentrations of Heavy Metals (HMs) in Vegetables

The concentrations of arsenic, cadmium, chromium, mercury, manganese, nickel, lead, and zinc in vegetables cultivated around the Riruwai mining area are presented in Table 1. The levels of arsenic, cadmium, chromium, mercury, manganese, nickel, lead, and zinc in lettuce (*Lacuta sativa*) samples are 0.20, 1.21, 3.66, 0.50, 1.46, 0.57, 6.43, and 64.25 mg/kg, respectively. Zinc accumulated the highest in *L. sativa*, while arsenic was found to be the lowest accumulated metal. The HMs in *L. sativa* accumulated in decreasing order of Zn > Pb > Cr > Mn > Cd > Ni > Hg > As. The values of all the HMs in *L. sativa* are above the threshold values established by WHO/FAO (2007), except for zinc. This indicates that *L. sativa* cultivated in the study area is contaminated with HMs due to mining activities. High concentrations of HMs in lettuce, especially zinc, lead, and chromium, might be due to their corresponding high concentrations in the soils. This was consistent with the findings of Monterroso et al. (2014), who investigated the HMs distribution in plants grown in a Pb and Zn mining area in northwestern Spain. The concentrations of HMs (mg/kg) in tomato (*Solanum lycopersicum*) samples were: arsenic (0.19), cadmium (0.27), chromium (2.80), mercury (0.04), manganese (0.25), nickel (0.21), lead (0.40), and zinc (106.23). Zinc accumulated the most, while mercury had the lowest uptake. The uptake of HMs in *S. lycopersicum* follows a decreasing order of Zn > Cr > Pb > Cd > Mn > Ni > As > Hg. The concentrations are above the WHO/FAO (2007) maximum reference standards, indicating contamination of *S. lycopersicum* by heavy metals. The levels of arsenic, cadmium, chromium, mercury, manganese, nickel, lead, and zinc in bean (*Phaseolus vulgaris L*) samples are 1.05, 1.15, 2.56, 0.09, 0.33, 0.28, 5.94, and 77.06 mg/kg, respectively. A high level of zinc accumulation was found in *P. vulgaris*, followed by lead, chromium, cadmium, arsenic, manganese, and nickel, with mercury having the lowest accumulation. Except for zinc, the levels of all HMs in beans exceed the WHO/FAO (2007) threshold values. Generally, the findings of this study revealed that the investigated vegetables are polluted with HMs and might pose a significant health risk to consumers. Similar reports of heavy metal overload in edible plants grown on contaminated sites are well documented (Gebeyehu and Bayissa, 2020). *L. sativa* accumulated the most heavy metals. This is because *L. sativa* is a leafy vegetable, and leafy vegetables grow faster and have higher transpiration rates than non-leaf vegetables. Consequently, leafy vegetables can increase the uptake of HMs by plant roots, causing metal to move from roots to other vegetable tissues (Luo et al., 2011; Chang et al., 2014). Moreover, due to their broad leaf area, leafy vegetables are more prone to HMs contamination by the dust from soil (Chang et al.,

2014). The high level of HMs accumulated by vegetables is clearly consistent with the fact that plants in contaminated areas develop mechanisms to absorb greater amounts of the contaminants (Liang et al., 2017). HMs concentrations varied significantly ($p \leq 0.05$) between vegetables. This could be due to differences in their accumulation abilities caused by physiological and genetic differences as well as differences in soil properties (Khan et al., 2015; Liu et al., 2013). Consumption of HMs-contaminated foods for an extended period may result in an unending accumulation of toxins in the liver and kidneys of humans, thereby causing disruptions in biochemical processes such as liver, kidney, cardiovascular, nervous, and bone disorders (WHO (2006). Lin et al. (2013) recommended that leafy vegetables should be cultivated in soil with low HMs content and non-leaf vegetables in soil with comparatively high HMs content in order to reduce HMs pollution in the vegetables.

Heavy Metals	**Vegetables**			**WHO/FAO (2007)**
	L. sativa	***S. lycopersicum***	***P. vulgaris***	
As	$0.20^{a} \pm 0.03$	$0.19^{a} \pm 0.01$	$1.05^{a} \pm 0.04$	0.15
Cd	$1.21^{a} \pm 0.01$	$0.27^{a} \pm 0.03$	$1.15^{a} \pm 0.09$	0.2
Cr	$3.66^{b} \pm 0.04$	$2.80^{b} \pm 0.11$	$2.56^{b} \pm 0.05$	2.3
Hg	$0.50^{c} \pm 0.03$	$0.04^{a} \pm 0.03$	$0.09^{c} \pm 0.03$	----
Mn	$1.46^{a} \pm 0.01$	$0.25^{a} \pm 0.04$	$0.33^{c} \pm 0.01$	0.2
Ni	$0.57^{c} \pm 0.03$	$0.21^{a} \pm 0.02$	$0.28^{c} \pm 0.00$	0.1
Pb	$6.43^{d} \pm 0.06$	$0.40^{a} \pm 0.01$	$5.94^{d} \pm 0.09$	0.3
Zn	$64.25^{e} \pm 0.09$	$106.23^{c} \pm 0.55$	$77.06^{e} \pm 0.04$	100

Values are mean ± standard deviation (n = 3). The values on the same column with same superscript letters are statistically the same ($p < 0.05$), whereas values on the same column with different superscript letters are statistically different ($p < 0.05$), as revealed by one-way ANOVA and the Tukey HSD post-hoc test

Concentrations of Heavy Metals in the Soils

The concentrations of arsenic, cadmium, chromium, mercury, manganese, nickel, lead, and zinc in the farmland of the Riruwai mining area are 21.54 8.81, 1.51 0.06, 96.44 30.75, 0.50 0.09, 148.11 47.56, 18.31 5.32, 87.21 20.15, and 426.51 35.69 mg/kg (Fig. 2.). The concentration of HMs decreases in the following order: Zn > Mn > Cr > Pb > As > Ni > Cd > Hg, with As, Pb, and Zn exceeding the recommended limit set by WHO/FAO (2001). High concentrations of Pb, Zn, and As observed in the farm area beyond their respective safe limits indicate the spread of heavy metal pollution from the mining sites. Acidic drainage and dust transport by wind may be the primary mechanisms causing pollution dispersion (Rodr guez et al., 2009).

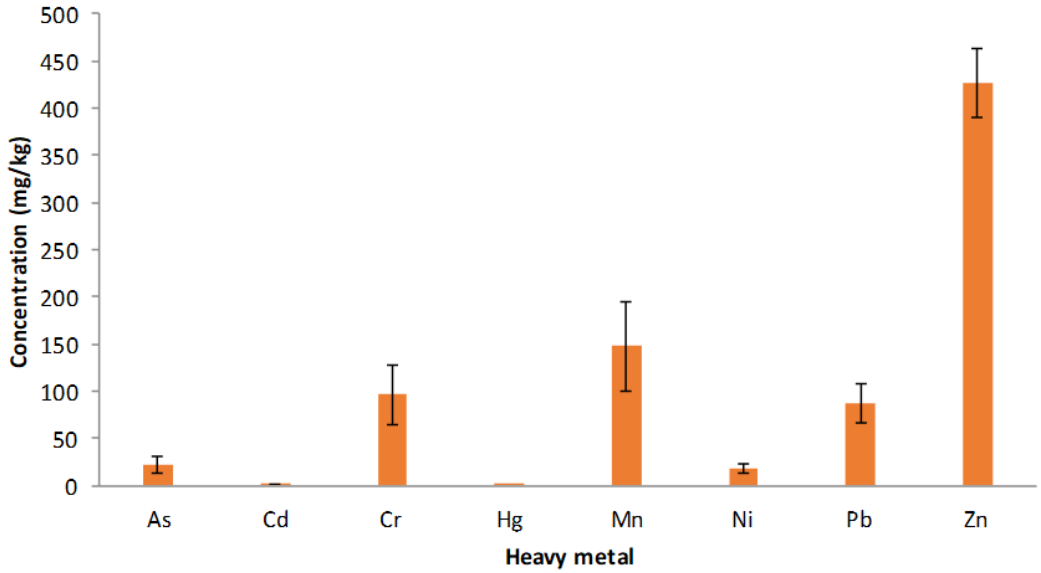

Figure 2. Heavy metals concentration in Riruwai mining area

Bioaccumulation Factor (BAF)

The results of *BAF* values in vegetables grown around the Riruwai mining area are presented in Figure 3. The *BAF* values of arsenic, cadmium, chromium, mercury, manganese, nickel, lead, and zinc in *L. sativa* are 0.02, 13.43, 0.05, 1.40, 0.02, 0.05, 0.10, and 0.18, respectively. Cadmium had the highest *BAF*, whereas manganese had the

lowest. According to Monterroso et al. (2014) and Bhatti et al. (2016), metal excluders have a *BAF* value of less than one, while accumulators have a *BAF* value of greater than one. The *BAF values* of arsenic, chromium, manganese, nickel, lead, and zinc were less than one, indicating that *L. sativa* is not an accumulator of *these metals*. Cadmium and mercury, on the other hand, had a *BAF* greater than one, which signifies that cadmium and mercury are accumulators of *L. sativa*. The *BAF values* of HMs in *S. lycopersicum* are arsenic (0.01), cadmium (3.00), chromium (0.04), mercury (0.11), manganese (0.003), nickel (0.02), lead (0.01), and zinc (0.29). Cadmium had the highest *BAF*, while manganese had the lowest value. With the exception of cadmium, the *BAF values* of all the studied HMs in *S. lycopersicum* were less than one. This shows that only cadmium is the accumulator of *the plant*, while the rest of the metals are excluders. The *BAF* values of arsenic, cadmium, chromium, mercury, manganese, nickel, lead, and zinc in *P. vulgaris* are 0.08, 12.76, 0.04, 0.25, 0.003, 0.02, 0.09, and 0.21, respectively. The *BAF* value of cadmium was the highest among the HMs, whereas that of manganese was the lowest. The *BAF of cadmium was significantly greater than one, demonstrating that cadmium had a considerably high accumulation capacity in P. vulgaris.* The *BAF values* of arsenic, chromium, mercury, manganese, nickel, lead, and zinc were, however, less than one, which signifies their low accumulation capacities. Generally, the *BAF* of cadmium is the highest and greater than one in all the vegetable samples. High *BAF* values in cadmium could be attributed to competition between Cd^{2+} and Ca^{2+}. Because of the similarities in their ionic radius and valence state, Ca^{2+} is more easily replaced by Cd^{2+} than other metals (Chang et al., 2014).

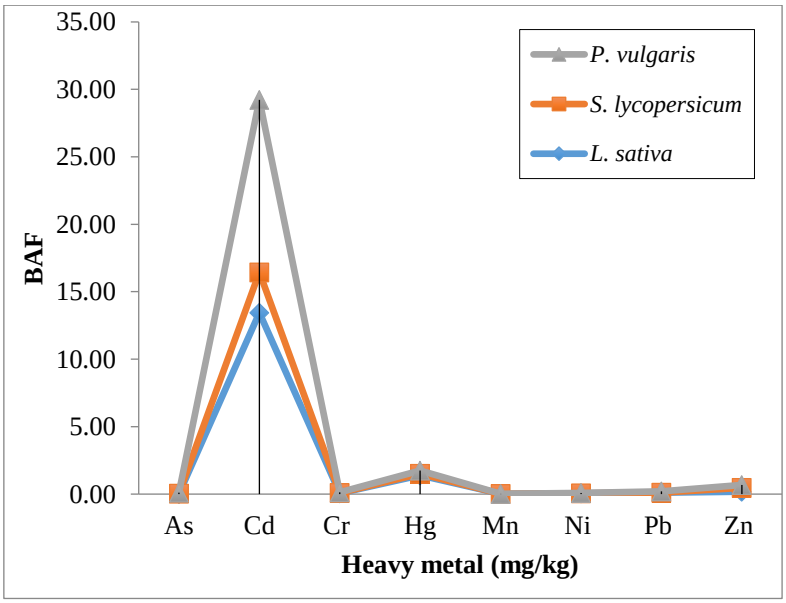

Figure 3: Bioaccumulation Factor (*BAF*) Vegetables Grown around Riruwai Mining Area

Conclusion

In this study, the HMs contamination level in vegetables grown around the Riruwai mining area in Kano State, Nigeria, and their corresponding soils were investigated. The findings of the study showed that HMs concentrations in the investigated vegetables were found to be significantly high, with the majority of levels exceeding the WHO/FAO (2007) recommended limit and the concentration of HMs in the soil decreased in the order of Zn > Mn > Cr > Pb > As > Ni > Cd > Hg, with As, Pb, and Zn exceeding the WHO/FAO (2001) recommended limit. Pollution levels were found to significantly differ ($p \leq 0.05$) between HMs and vegetable types. The *BAF* of all the HMs is less than one in all the vegetable samples except for mercury in *L. sativa*, which signifies that *L. sativa* is the accumulator of Hg. It is recommended, therefore, that planting of vegetables for human consumption should be stopped in the area until immediate scientific attention is given to the vegetables grown in the area and further research is conducted to determine the optimum concentration of HMs suitable for human consumption.

Acknowledgements

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ID:504

Effect Of Carrot And Cowpea Powder Incorporation On The Nutritional Quality Of Biscuits

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Abstract
The study was carried out to develop biscuits with the incorporation of carrot and cowpea powder at the Institute of Food Sciences and Technology, Sindh Agriculture University, Tandojam, Pakistan. The sample were prepared with various percentages of carrot and cowpea powder. That includes: T_0: 100% wheat flour (control), T_1: 90% wheat flour (WF), 5% cowpea Powder (CF), 5% Carrot Powder (CP), T_2: 80% WF, 10% CF, 10% CP and T_3: 70% WF, 15% CF, 15% CP. The results revealed that the variation in the physico-chemical characteristics and sensory quality of biscuits was significantly ($P<0.05$) associated with the flour, carrot and cowpea powder ratio. The incorporation of carrot-cowpea powder supplementation resulted in a significant increase in protein, fat and ash contents of the biscuits. The biscuit width, thickness and weight also increased significantly. The sensory analysis also revealed significant differences ($P<0.05$) amongst all treatments. It is concluded from the research that, biscuits prepared with 70% wheat flour, 15% cowpea flour, and 15% carrot powder had a significant impact on biscuit quality.
Keywords: *Nutritional quality ,cowpea powder, carrot powder ,biscuit*

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Evaluation Of Elite Sugarcane Genotypes In Nepal

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Abstract
Sugarcane is the sole crop for supplying raw materials for industries and contributes more than 60 % of sugar demand in Nepal. As compared to neighboring countries, there is still low production and productivity due to a lack of high-yielding and abiotic and biotic resistant varieties. So, the experiment was conducted in NSRP, Jitpur, Bara for evaluating the early maturity genotypes for assessing high yielding and abiotic and biotic resistance in both plant cane and ratoon. The experiment was laid in IET, CVT, CFFT, and AVT under abiotic and biotic stress conditions with RCBD design replicated thrice in 2018-2022 year. Yield and yield attributes and juice quality (Brix %, Purity %, SR %) were recorded at the harvesting stage. Among the tested genotypes under IET plant cane and ratoon, CoS 08272 gave the highest yield 107 t/ha, followed by CoP 2061 (97.2 t/ha), CoS 08276 (90.3 t/ha), and Cos 13231 (80.2 t/ha) while CoP 2061 and CoS 08272 has the higher ratooning ability. Overall performance of genotypes under different experiments, season, location, and year, CoS 08272, CoS 98014, Co 0118, and CoS 13231 were found high yielding and ratooning capacity as well as good sugar recovery. Under waterlogged condition, Co 98014 and CoS 08272 produced higher yields, while in rain-fed conditions CoS 08272 and Co 0118 provided higher plant cane and ratoon yields. Considering the farmers and sugar mills preference, CoS 08272, Co 0118, CoS 13231, and Co 98014 was superior over yield, abiotic and biotic resistant, and, good ratooning ability. So these genotypes should proceed for the release and registration process in Nepal.
Key words: *Sugarcane, NSRP. Plant-Cane, Ratoon, Yield, Juice Quality*

Introduction

Sugarcane (*Saccharum officinarum* L.) is one of the major cash and industrial crops and plays a pivotal role in the Nepalese economy. It is being grown in all agro-ecological zones but intensive commercial productions are the highest in the Terai region. The high demand for sugarcane-derived products has stimulated the expansion of sugarcane cultivation and sugar factories establishment in recent year (MoALD, 2020). The sugarcane area has been increased by fourfold (17,480 to 68,565 hectares) and total production increased by almost eight folds (408,260 to 3,400,175 tons) from 1985 to 2019 (MoALD, 2020). The productivity of Sugarcane during FY 2019 was 49.59 mt/ha (MoALD, 2020) which is very low as compared to neighboring and other developed countries.
Sugarcane is the sole crop in Nepal, providing raw materials for the production of sugar to fourteen sugar mills and about a dozen of the jaggery mills in the country. Sugarcane is grown in an area of 68.5 thousand hectares producing 3.4 million tons of cane with a national average yield of 49.5 mt/ha (MoALD, 2020) which is very low as compared to neighboring and other developed countries. Primarily, this is due to a lack of highly productive genotypes and poor adoption of improved technologies. There is an urgent need to replace the old low-productive sugarcane varieties with high-yielding sugarcane clones (NSRP, 2021) To meet the requirement of both the farmers and industries, it is always better to have more diverse cultivars with different sucrose content, maturities and stress resistance so that proper and effective varietal scheduling can be practiced to have a higher yield of quality cane that are resistant/tolerant to biotic and abiotic stress. Lack of different maturity group genotypes shorten the cane supply period to the industry.
Sugarcane requires land for up to 12-18 months for its maturity and is ready to harvest as raw materials to industries. It is a long duration and time-consuming crop compared to other traditional field crops grown in Nepal. On the other hand, there is a lack of suitable varieties for production for different growing areas with different maturation period and high sucrose content and recovery (Shrestha & Thapa, 2020). Therefore, the sustainability of sugarcane cultivation in this country is threatened. For the sustainable development of sugarcane production of Nepal, focusing on biotic and abiotic stress management, nutrient balance, and its efficiency, enhancing sugar recovery and sustainable running of industries has become a major concern. The development of varieties is an important consideration for enhancing production and productivity and tolerance to biotic and abiotic stress (Ekpelikpeze et al 2016) .

Materials And Methodology

Varietal Improvement Trials Of Sugarcane Clones

The sequence of testing and evaluation are listed in Table 1.

Table 1: Varietal testing methods for registration of sugarcane followed by National Sugarcane Research Program, Nepal, as per guidelines described .

Varietal Evaluation Methods	Description
Coordinated varietal trials (CVT)	The third steps of varietal improvement where, selected varieties were evaluated in different location for their genotypic and environment interaction and their stability. This trial was also conducted in RCBD design with 3 replication in different location (NSRP, Bara, Indu-shankar Sugar Mills Sarlahi, Himalayan Sugar Mills Siraha, Eastern Sugar Mills Sunsari).High yielding and stable genotypes were selected for CFFT trials. Plot size were maintained 5 row line with 5 m long and 0.9 m row to row spacing
Coordinated farmer field trials (CFFT)	4 genotypes with check was selected for evaluating their performance in farmer field as design by scientist and management by farmer of Bara, Parsa and Sarlahi. Plot size were maintained 10 row line with 10m long and 0.9 m row to row spacing. DUS test was conducted in farmer field in participation of farmers, sugar industries, and extension officer for selecting their varieties as per their requirement. Then selected varieties was proposed for release and register process.

Study Sites And Planting Materials

Three different field experiments were conducted during 2018 to 2022 in National Sugarcane Research Program (NSRP). The soil of the experimental fields was sandy loam, slightly acidic, low in total nitrogen and organic carbon and medium in available phosphorus and potassium. Three budded sett of healthy canes were planted in furrow methods. Seed treatment was done with solution of Carbendazim 45% WP at rate of 1.5 gm. per liter water and with Chloro-pyrifos 25% EC at 1.5 ml per liter water each dipped for five minutes. The fertilizer was applied at the rate of 150:60:40 and 200: 60: 40 kg NPK per hectare for plant cane and ratoon crop respectively. Before planting, half dose of N and full dose of phosphorus and potassium were applied and mixed with soil as basal. Remaining half dose was applied as two split top dressed each at 60 and 90 days after planting. The genotypes used in this experiment were listed in Table 2 with detailed parentage and source of donors.

Table 2: List of genotypes used in the experiment and their respective parentage and donors

S.N	Varieties	Parentage	Source
1	CoS 08272	CoSe 92423 (GC)	AIRCP, India
3	CoP 2061	HR 83/85* CoLk 8102	AIRCP, India
4	CoS 08276	CoS 08436* Co 89003	AIRCP, India
5	CoS 08279	NA	AIRCP, India
6	Co 0118	Co 8347*Co 86011	AIRCP, India
7	Co 98014	Co 8316 *Co 8213	AIRCP, India
8	CoS 13231	CoSe 95255 * CoSe 510	AIRCP, India
9	UP 05125	NA	AIRCP, India
10	CoJ 64	Co 976 * Co 617	AIRCP, India
11	CoS 08452	CoS 08436* Co 89003	AIRCP, India
12	CoPk 05191	Co 1158 GC	AIRCP, India
13	Co 0238	CoLk 8102* Co 775	AIRCP, India
14	Jitpur-4	BO 91* Co 453	AIRCP, India

Co: Coimbatore, Se: Serohi, Lk: Lucknow, J: Jharkhand, AIRCP: All India Research Coordinated Program

The preliminary characterization form was based on the description of morphological traits and growth characters like stool habit, tops, trashing, leaf blade and sheath, dewlap, ligule, node, internode and bud. Following (Chidambaram et al., 2017), all the data were collected at 180 days after planting

Table 3: List of plant morphological traits and observation

Qualitative data	**Type of variable**	**Evaluation Level**
Data were taken at 6 months after planting	Stem external color	Yellow (1), Green (2), Black (3), Red (4), Yellow reddish (5), Brown green (6), Violet (7)
	Shoot habit	Erect (1), curved (2)
	Leaf sheath color	Green (1), Yellow (2), Red (3), Brown (4), Other (5)
	Color of dewlap	Brown (1), Brown green (2), Green (3), Other (4)
	Shape of the buds	Oval (1), other (2)
	Bud cover	Present (1). Absent (0)
	Pubescence	Present (1). Absent (0)
	Internode alignment	Heterogeneous (1), other (2)
	Leaf appearance	Erect and stiff (1), Just bend at tips (2), other (3)
Data taken at 12 months after planting	Flowering	Present (1). Absent (0)
	Split of the stem	Present (1). Absent (0)
	Shape of inter-node	Cylindrical (1), Other (2)
Data collecting period	**Quantitative traits**	**Measurement techniques**
Six months after planting	Leaf width	Width of the broadest portion of the third fully opened leaf from tip measured
	Length of leaf (cm)	Distance between the leaf tip and base measured on the third fully opened leaf from the tip
	Length of leaf sheath (cm)	Measured in cm

Data Collection For Both CVT And CFFT

Five canes were randomly selected for measuring single cane weight and stalk length from 2nd row from both sides while central three row of the plot were harvested (area 13.5 m^2 for CVT and 27 m^2 for CFFT) for counting number of millable cane and finally yield of plot. Then, yield per hectare was converted. Three canes were randomly selected for measuring cane diameter and sugarcane juice analysis. Horne's Dry Lead method was used for sugar recovery (sugar content) quantification.

$$Average\ Pol\ \% = \frac{Pol\ reading}{\{0.00576\ x\ brix(brix + 0.014752) + 3.83545)\}}$$

$$Sugar\ recovery\ (\%) = [Pol\ \% - 0.4\ x\ (brix - Pol\%\ )x\ 0.74]$$

Where, Pol % mean sucrose content in sugarcane juice. Pol reading was optical rotation of juice extract solution, measured by manual Polarimeter ($\pm\ 130^0$). Brix (total soluble solute) was measured by digital brix refractometer and data calibrated in 20^0C ambient temperature.

Data Analysis

All recorded data were processed and accomplished statistics in R studio (R Core Team 2013). Arithmetic mean of the respective data file per plot was taken for statistical analysis. Analysis of variance (ANOVA) of sugarcane yield, and yield attributing parameter were calculated with generalized least square model with replications (nlme package (Pinheiro et al 2014*)* to access the treatments effect. Individual effect analysis was only conducted and means comparison was done by DMRT. In case of CFFT, individual farmers were allocated as replication and analysis was done as simple RCB Design. The differences were considered significant at 0.05 probability level. Model residuals were checked for normality and homoscedasticity prior to ANOVA analysis.

Result And Discussion

IET On Sugarcane Plant Cane And Ratoon In 2018-19

The Initial Evaluation Trials was conducted in National Sugarcane Research program for testing the genotypes for disease and insect-pest resistance, high yielding and sucrose recovery. The tested genotypes showed the significant variant among them in terms of millable cane, Cane yield (t/ha), diameter, stalk length and single cane weight (g) in both plant cane and ratoon. At 5% level of significance, Table 1 depict plant cane and ratoon yield which was significantly varied with different genotypes. Based on plantcane, CoS 08272 showed higher yield (107.3 t/ha) which was followed by CoP 2061 (97.2 t/ha), CoS 08276 (90.3 t/ha) and least yield was obtained from check varieties Jitpur 4.Similarly, in the respect of ratoon, CoP 2061 produced the higher cane yield (84.1 t/ha), followed by CoS 08272 (81.1 t/ha), CoS 08279 (65.1 t/ha) and least by CoS 08452 (41.9 t/ha).

Table 4: Yield analysis of both plant cane and ratoon of different varieties in IET trial 2018-19

Genotypes	Yield (t/ha)				Total	Rank
	Plant cane	Rank	Ratoon	Rank		
CoS 08272	107.3	I	81.1	II	188.4	I
CoP 2061	97.2	II	84.1	I	181.3	II
CoS 08276	90.3	III	57.4	VI	147.7	III
CoS 08279	75.3	VIII	65.2	III	140.5	IV
Co 0118	78.9	VI	49.2	X	128.1	V
Co 98014	68.9	IX	58.8	IV	127.7	VI
CoS 13231	80.2	IV	45.5	XI	125.7	VII
UP 05125	63.2	XI	58.4	V	121.6	VIII
CoJ 64	67	X	51.4	IX	118.4	IX
CoS 08452	75.8	VII	41.9	XII	117.7	X
CoPk 05191	65.1	XI	52.2	VII	117.3	XI
Co 0238	83	V	45.3	XII	128.3	V
Jitpur-4	60.3	X	51.8	VIII	112.1	XII
Grand Mean	**77.5**		**58.1**		**135.6**	
SEm (±)	11.5		21.5		33	
LSD (0.05)	6.8		12.8		19.6	
CV (%)	3.71		6.9		10.61	
P-value	<0.001		0.023		<0.001	

Table 5: Cane yield and yield attributing characters of various genotypes in Initial Evaluation Trial Planted during 2018-19

Genotypes	Stalk length (m)		Stalk diameter		Single cane weight (g)		Millable cane (No)	
	Plant-cane	Ratoon	Plant-cane	Ratoon	Plant-cane	Ratoon	Plant-cane	Ratoon
Co 98014	2.3	2.2	18.7	19.8	813	600	88519	97619
CoJ 64	1.9	1.8	21	21.3	645	683	78704	68571
CoP 2061	2.5	2.3	18.9	20.2	753	605	125926	132857
CoPk 05191	2.1	2.0	21.1	21.1	758	647	94074	103810
Co 0118	2.1	2.1	20.4	21.4	778	750	100741	69048
CoS 08272	2.1	1.9	19.6	21.1	690	752	94815	102381
CoS 08276	2.4	2.1	20.7	21.7	907	750	81481	74762
CoS 08279	1.8	2.3	21.6	20.8	675	740	83333	80952
CoS 08452	1.9	1.9	21.4	21.7	701	725	82963	59524
CoS 13231	2.0	2.0	20.2	21.4	664	640	104815	87619
Co 0238	2.1	1.6	21	21	1135	832	78520	73450
Jitpur-4	2.4	2.2	21.4	20.3	868	846	85556	87619
UP 05125	1.9	1.9	20.3	20.9	656	686	100741	86667
Grand Mean	**2.1**	**2.1**	**20.5**	**21.0**	**742**	**702**	**93472**	**87619**
SEm (±)	0.11	0.09	0.99	1.1	62.6	50.2	6885	12001.3
LSD (0.05)	0.34	0.28	3.07	3.4	194.8	156.4	21430.6	37356.1
CV (%)	7.2	6.2	6.8	7.4	11.9	10.1	10.4	13.1
P-value	0.008	0.03	Ns	Ns	Ns	Ns	0.019	0.012

Table 2 showed that stalk diameter, single cane weight of both plant cane and ratoon crops was not found significant at level of 5% of significance. But plant height and millable cane was varied in both plant cane and ratoon. The average height of stalk ranges from 1.8 to 2.5, while tallest plant height was of CoP 2061 (2.5 m) and least by CoS 08278 (1.8m). Another important traits that enhances the yield of sugarcane is millable cane that is directly linked to yield. At 5% level of significance, higher millable cane was produced by CoP 2061, followed by CoPk 05191, Co 98014 and least by Co 0118.

Performance Of Sugarcane In Coordinated Varietal Trials At Different Location Of Madhesh Province And Province 1

Comparing the yield of sugarcane under different location, Table 6 and 7 showed that there were significant variations in yield among the genotypes. Among the tested region, Sarlahi showed overall good production of sugarcane yield which as followed by Bara, Sunsari, and Siraha. Overall mean yield, at the 5% level of significance, CoS 08272 produced higher cane yield (95.6 t/ha) followed by Co 0238 (92.8 t/ha), CoPk 05191 (87.3 t/ha) and least by Jitpur-1 (61.4 t/ha).

Table 6: Performance of early maturing genotypes in coordinated varietal trials under different location of Province 1 and 2

Genotypes	**Yield**				
	Mean	Bara	Sarlahi	Siraha	Sunsari
Co 0118	83.9 bcd	82.2	95.4	76.5	81.5
Co 0238	92.8 ab	102.2	99.8	78.3	90.8
Co 98014	75 d	74.8	77.0	72.5	75.6
CoPk 05191	87.3b	94.1	85.6	82.9	86.5
CoS 08272	95.6 a	98.6	104.1	90.9	88.8
CoS 13231	82 cd	92.7	82.5	83.1	69.6
CoS 91259	83 bcd	88.5	87.2	69.1	87.3
Jitpur-1	61.4 e	63.2	56.9	61.2	64.4
Grand Mean	**82.6**				
SEm	3.26	6.52			
LSD	9.2***	Ns			
CV		15.8			
G*Y		***			
L*Y		***			
G*L*Y		Ns			

Table 7: Variation of yield (t/ha) of sugarcane genotypes over two year in CVT Trials 2021-2022

Genotypes	**Mean**		**Bara**		**Sarlahi**		**Siraha**		**Sunsari**		Overall
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022	Mean
Co 0118	80.6	87.2	73.1	91.3	89.9	101	80.5	72.4	78.8	84.1	83.9 bcd
Co 0238	82.0	103.5	80.9	123.5	81.8	117.8	79.2	77.3	86.2	95.5	92.8 ab
Co 98014	61.4	88.6	57.3	92.3	61.7	92.4	67.8	77.1	58.7	92.8	75 d
CoPk 05191	92.8	81.7	84.8	103.4	103.9	67.4	87.1	78.6	95.4	77.5	87.3b
CoS 08272	87.9	103.3	86.1	111.1	86.7	121.6	94.9	87	83.9	93.6	95.6 a
CoS 13231	78.5	85.4	72.2	113.3	89.4	75.6	79.1	87	83.9	93.6	82 cd
CoS 91259	68.8	97.3	55.4	121.7	78.3	96.2	67.7	70.4	73.7	100.8	83 bcd
Jitpur-1	55.2	67.6	56.9	69.4	56.1	57.6	55.4	67	52.4	76.3	61.4 e
Grand Mean	**82.6**										
SEm	4.61		9.21								3.26
LSD	13.02***		26.0								9.2***
CV	15.8										

Table 81: Evaluation of yield attributes of genotypes in CVT trials during 2021-2022

Genotypes	**Millable cane (Nos/ha)**			**Single cane weight (g)**			**Cane diameter (mm)**			**Stalk Length**		
	2021	**2022**	**Mean**	**2021**	**2022**	**Mean**	**2021**	**2022**	**Mean**	**2021**	**2022**	**Mean**
Co 0118	78889	92000	85444	916	650	783	21.1	19.9	20.5	2.2	2.3	2.2
Co 0238	111111	113333	112222	871	945	908	19.9	22.9	21.4	2.3	2.7	2.5
Co 98014	88519	108444	98481	861	805	833	18.1	18.9	18.5	2.6	2.8	2.7
CoPk 05191	125926	178222	152074	827	602	714	19.2	18.5	18.9	2.4	2.5	2.5
CoS 08272	100370	124889	112630	928	722	825	20.2	20.8	20.5	2.4	2.2	2.3
CoS 13231	117037	171556	144296	976	644	810	18.6	18.9	18.8	2.1	2.4	2.2
CoS 91259	64074	113704	888889	780	846	813	20.2	20.9	20.6	1.9	2.4	2.2
Jitpur-1	120000	176444	148222	641	506	574	18.3	17.4	17.9	2.1	2.2	2.2
Grand Mean	**100741**	**134824**	**117782**	**850**	**715**	**782**	**19.5**	**19.8**	**19.6**	**2.3**	**2.4**	**2.3**
SEm	8166.8	15903	13596.6	99.6	105.9	81.2	1.63	0.87	0.82	0.19	0.17	0.12
LSD	27310.3*	53183*	39777 *	Ns	Ns	237.5	Ns	Ns	Ns	Ns	Ns	Ns
CV	11.5	16.7	23.1	16.6	20.9	20.8	11.9	6.2	8.3	11.7	9.8	10.4

The yield attributes of sugarcane under CVT trials illustrated in Table 8 explained that single cane weight, cane diameter and stalk length was found non-significant to genotypes but Millable cane number was significantly varied among the genotypes. Higher millable cane was noted in CoPk 05191, followed by Jitpur-1, CoS 13231 and least in CoS 91259.

Ratoon Performance In Co-Ordinated Varietal Trial Of Early Maturing Genotypes During 2021-2022

Table 9: Performance of ratoon of different varieties of sugarcane in Jitpur condition in 2022

Genotypes	Stalk length (m)	Single cane weight (g)	Stalk diameter (mm)	Millable cane (No/ha)	Yield (t/ha)	Rank
Jitpur-1	1.8	366	17.4	114074	37.5 d	V
Co 0238	2.3	964	21.8	65926	70 b	II
Co 0118	2.1	937	22.5	63457	60 bc	III
Co 98014	2.2	682	19.1	89383	59.6 bc	III
CoPk 05191	2.0	491	19.5	95062	62.7 bc	III
CoS 08272	1.9	712	20.8	102222	96.1 a	I
CoS 13231	1.9	538	18.4	108395	71.8 b	II
CoS 91259	1.8	580	20.1	75802	46.6 cd	IV
UP 05125	1.9	607	19.1	92346	61.9 bc	III
Grand Mean	**2.0**	**653**	**19.9**	**89630**	**62.9**	
SEm (±)	0.07	55.3	0.66	6557.7	5.62	
LSD (0.05)	0.22	165.6	1.99	19660	16.8	
CV (%)	6.5	12.7	5.8	12.7	10.5	
P-value	0.002	<0.01	0.001	<0.001	<0.001	

Table 9 depicts the performance of sugarcane ratoon under CVT during 2021-2022. The stalk length, single cane weight, millable cane number, Yield was significantly influences due to genotypes effect. At 5% level of significance, all yield and yield character were highly significant. The average length of stalk of ratoon crops was 2 m while its ranges from 1.8 to 2.3 m. The average single cane weight and stalk diameter was 653 g and 19.9 mm which laid in medium thick criteria but some genotype consists thin diameter and low single cane weight i.e Jitpur-1which falls in thin criteria. Ratoon yield varied among genotypes where CoS 08272 contributed to higher yield (96.1 t/ha), followed by CoS 13231 (71.8 t/ha), CoS 0238 (70 t/ha) and least by Jitpur-1 (37.5 t/ha).

Table 10: Juice quality of different sugarcane genotypes

Genotypes	**Sucrose (%)**	**Purity (%)**	**Sugar Recovery (%)**
CoS 08272	19.6	93.2	13.9
Co 98014	19.0	92.7	13.4
Jitpur-1	16.9	89.9	11.8
Co 0238	18.0	89.5	12.5
CoSe 91259	13.9	84.5	9.4
Co 0118	19.1	87.1	12.1
CoS 13231	18.2	92.0	12.8
CoPk 05191	16.1	88.3	11.1

Overall evaluation of juice quality of individual genotypes presented in Table 10 showed that Cos 08272 consists of higher sucrose, purity and sugar recovery percentage followed by Co 98014, Co 0118, CoS 13231 and least by Jitpur-1.

Table 11: Preference testing of both farmers and Mills

Genotypes	Farmer marking	Farmer Ranking	Mills score	Mills Rank
CoS 08272	6.8	II	8	II
Co 98014	4.3	VII	9	I
Bo 120	3.4	VIII	6	III
Co 0238	7.0	I	8	II
CoSe 91259	6.1	III	5	IV
Co 0118	5.3	IV	9	I
CoS 13231	4.9	V	8	II
CoPk 05191	4.8	VI	5	IV

Based on preference and ranking of farmer based on yield performance and by mills based on sugar recovery, higher preference was given to Co 0238 and CoS 08272 and higher rank was provided to Co 98014 and CoS 08272 by Mills.

Varietal FFT on Sugarcane(Early) in sarlahi

Table 12: Yield of early sugarcane genotypes in Farmer's Field Trial in 2021-22

Genotypes	Yield			Average
	L1	L2	L3	
Co 0238	96	99	80	91.67
CoS 08272	90	96	84	90
Co 0118	84	90	76	83.33
Jitpur-1	72	78	68	72.67
SEm (±)				84.42
LSD				12.34
F-test				*

Table 13: Yield of early sugarcane genotypes in Farmer's Field Trial in 2021

	Yield (Mt/ha)					
	Bara			Parsa		
Genotypes	F1	F2	Average	F1	F2	Average
Co 0238	102.00	93.00	97.50	96.00	89.10	92.55
Co 98014	72.00	78.00	75.00	78.00	66.00	72.00
CoS 13231	69.00	72.00	70.50	65.10	63.00	64.05
Jitpur-1	78.00	72.00	75.00	66.00	63.60	64.80
GM			79.50			73.35
LSD			13.22			12.34
F-test			**			*

Table 14: Yield of early sugarcane genotypes in Farmer's Field Trial in 2022

Genotypes	Cane yield (mt/ha)
	Sarlahi
Co 0238	75.87a
Co 0118	71.01b
CoS 13231	68.99b
CoS 08272	67.71b
Jitpur-1	62.50c
LSD (0.05)	3.75
CV (%)	4.8
Grand Mean	70.22

Based farmer based performance, CoS 08272, Co 0118, CoS 13231 were better performer as compared to their local genotypes and local check Jitpur-1.

Varietal screening under Abiotic stress during 2019

Table 14: Yield and yield attributes of sugarcane under rain-fed condition

Genotypes	Mill able Cane/ha	Plant Height (m)	Single Cane Weight (g)	Yield (t/ha)	Cane Diameter (mm)
Jitpur-1	78148	1.578	497.3	37.7 ab	18.41
Co-0118	61111	1.517	642.7	44.83 a	20.52
Co-98014	61481	1.625	609.3	40.96 a	18.11
CoJ-64	52222	1.452	445.3	25.37 b	19.26
CoP-05125	53704	1.542	476	25.87 b	18.26
CoPk-05191	42593	1.315	625.3	25.16 b	19.56
CoS 07250	40741	1.548	517.3	23.13 b	21.15
CoS 13231	65000	1.231	394.7	40.03 a	18.67
CoS-08272	70741	1.653	669.3	48.79 a	21.15
CoSe-91259	66296	1.763	562.7	41.11 a	18.96
SEm(±)	4957.5	0.123	52.4	7.78	0.7
LSD (0.05)	14729.6	0.367	155.7	23.11	2.08
CV (%)	14.9	14.1	16.7	40.5	6.3
P-value	<0.01	0.184	0.02	0.328	0.034
Grand mean	57704	1.52	544	33.3	19.4

Table 14 depicts that the performance of genotypes under rainfed condition, all the character showed significant variation except plant height. Higher millable cane was found in CoS 08272, and CoS 13231 and similar higher in single cane weight and cane diameter. The yield of these genotypes found prominent among other genotypes.

Table 15: Performance evaluation of genotypes under lowland condition in 2019

Genotypes	Mill able Cane/ha	Stalk Length (m)	Single Cane Weight (g)	Yield (t/ha)	Cane Diameter (mm)
Jitpur-1	155185	1.777	460.7	47.89	16.59
Co-98014	130741	2.36	801.3	**77.63**	19.26
CoJ-64	120370	1.693	595.3	53.54	19.33
CoPk-05191	165556	1.747	655.3	68.54	20.11
CoS-07250	116296	2.07	768	78.45	20.22
CoS-08272	139259	1.828	820.7	**95.84**	21.26
CoS-13231	135926	1.675	525.3	**57.16**	18.56
CoS-08452	88519	1.983	870	**74.11**	21.89
CoSe-91259	103704	1.934	725.3	63.39	20.52
UP 05125	150370	1.67	530	64.75	18.96
SEm(±)	12440.9	0.0768	38.9	11.66	0.413
LSD (0.05)	36963.9	0.228	115.6	20.65	1.227
CV (%)	16.5	7.1	10	9.7	3.6
P-value	0.09	<0.001	<0.001	0.02	<0.001
Grand mean	**130593**	**1.874**	**675**	**68.1**	**19.67**

Based on the performance of genotypes under water logged condition, all character was found highly significant at 5% level of significance. Higher millable cane number was found distinctly higher in CoS 08272 and Co 98014 and similar trend was observed in other traits. Yield of CoS 08272, Co 98014 and CoS 08452 were found higher among other genotypes yield.

Table 12: Agronomical and Morphological description for varietal identification

Morphological character	CoS 08272	Co 0118	Co 98014	Cos 13231
Parentage	**CoSe 92423 (GC)**	**Co 8347* Co 86011**	**Co 8316* Co 8213**	**CoSe 95255 * CoSe 510**
Stool Habits	Erect, straight, very close emergence with tall and spindy character	Lean outward, spreading emergence with tall and spindy character	Erect, spreading emergence with tall and spindy character	Erect, very close emergence with tall and spindy character
Leaves	Light Green with yellow midrib, semi-clasping, droop towards the middle, both side lanceolate auricle, light tops	Green, medium clasping, droop towards the middle, both sides lanceolate auricle, light tops	Green, mid-rib with red patches, strong clasping, droop towards the middle, lanceolate auricle, medium tops	Green, strong clasping, droop just at tips, incipient auricle, medium tops
Leaf sheath	Green with purplish spot, crescent ligule, incipient dewlap, strong leaf blade texture, yellowish green color dewlap	Purplish , ligular dewlap	Green with purple tinge, Crescent ligule, deltoid dewlap with green color	Purplish green, linear ligule, double crescent dewlap with brown color
Stem/cane	Yellow color, bobbin with straight internode alignment, ovate with wings shaped bud, medium pithiness, presence of medium splits with heavy waxiness, yellowish green root band color with irregular arrangement, sub-medium germ-pore, aerial roots absent, Ivory marks present	Green color, Obconoidal with straight internode alignment, ovate with wings shaped bud, medium pithiness, absence of splits, brown root band color with irregular arrangement, sub-medium germ-pore, aerial roots absent, waxiness	Greenish yellow color, Conoidal with straight internode alignment, round ovate shaped bud, medium pithiness, presence of medium splits with heavy waxiness, pale yellow root band color with irregular arrangement, Apical germ-pore, aerial roots present,	Green color, cylindrical with straight internode alignment, oval bud shape, medium pithiness, absence of splits, medium waxiness, yellow root band color with irregular arrangement, medium germ-pore, aerial roots present, bud cushion present

Discussion

Morphological Traits Of Registered Varieties

The morphological traits were found distinct among the varieties that help for easy identification of respective varieties in farmers field for further evaluation and breeding process. These three genotypes showed distinct character in different morphological traits like prominent bud shape, leaf color, auricle and ligule shapes, clasping and appearance of leaves and stem orientation. These characters could be used as descriptors for identification, distinctiveness, uniformity, and stability performance of varieties and maintaining purity in sugarcane seed and commercial production (Ahmed & Obeid, 2012). (Hunsigi, 1993) stated that the width of the medium leaf blade, dewlap shape, ligule, and sheath auricles are the characters of value for the identification of different sugarcane cultivars. (Chang & Milligan, 1991) reported that the most important geomorphological characteristics of sugarcane varieties are the shape, color, and wax of aerial organs.(Srivastava & Gupta, 2008) reported that the most outstanding, organographic characters of the sugarcane stalk were the bud shape.

Yield and yield attributes

There is prominent variation in yield and yield attributes among the tested genotypes. Variation in character is the characteristic of individual genotypes, while it may varies with climatic condition, soil parameters and other agronomical practices. Besides on same management and other practices, significant role in variation plays role by varietal characterization. Among the tested genotypes, the average yield was 64 t per ha which is 20t more than the ratoon yield. But in case of varieties CoS 08272, Co 0118,Co 98014 and CoS 13231 , the cane yield is similar to ratoon yield which is very beneficial to farmers in terms of yield and enhancing productivity and profitability. Farmers in Nepal prefer the varieties that have higher ratoon capacity because ratoon cultivation saves 30% cost of cultivation due to land management and sett costs (Shrestha et al 2021). Also, other yield attributing characters i.e. number of millable cane, weight of single cane, stalk length and diameter showed similar results. Sprouts of left stubbles in the field allows growth of ratooning, thus saving total production costs by saving on seed bed preparation, seed materials, and planting operations. And, naturally the productivity of ratoon is 10 to 30% less than the plant crop of sugarcane despite of its 20-25% higher requirement of nitrogenous fertilizers over normal recommended dose (Arshad et al 2020). Such reduced yield of ratoon crop is mainly due to low and differential ratooning potential of cultivars and sub-optimal crop management and cause 35% loses in productivity (Arshad et al 2020)

Juice and Juice quality

Canes Pol %, cane Brix %, commercial cane sugar (CCS), and ton cane per hectare (TCH) are the sugar yield parameters which is usually used to determine cane maturity, however (Ahmed & Obeid, 2012; Hunsigi, 1993) reported Pol % of cane as the mostly used parameter by the researchers, whose value ranges from 10.49 to 17.86. Also, (Acland, 1971) reported the cane with 16% or more and purity of more than 80 were considered equal to maturity and are commercially acceptable. (Nisha et al 2019) reported there is a great importance of study of agronomic and commercial traits of interest in the progenies of hybrids of sugarcane to pick better performing progenies for further utilization in the breeding programs.

Conclusion

Under the supervision of varietal improvement trails like IET, AVT, CVT & CFFT, during interval of 4 years, and other agronomical and biotic and abiotic stress trails, observation showed that Co 0238, CoS 08272, CoS 13231, Co 98014 & Co 0118 found most promising in yield and sugar recovery. This variety comes under the choice of both the farmer and industries, due to its good yield in plant cane and ratoon crops as well as good sugar recovery.

Declarations Author contribution statement:

- Abhisek Shrestha performed the experiment, analyzed and interpret the data, wrote the paper
- Bharti Thapa conceived and designed the experiment
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Ecological Assessment of Transboundary Rivers of Azerbaijan

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Abstract

There are 21 transboundary rivers in the country, and most of them belong to the basins of the Kura and Araz rivers. The Kura and Araz basins are located in four and five countries, respectively. According to various estimates, the water resources of the Kura River basin (including Araz) vary from 25.9 to 26.9 km3. The water reserve of the Araz River basin is 9.10-9.30 km3, the inflow from neighboring countries is 7.70-8.10 km3 or 85-87%, and the local flow is 1.04-1.40 km3. The water resources of the rivers flowing into the Caspian Sea as a whole are 2.17-3.41 km3, the inflow from neighboring countries is 0.14 km3, and the local flow is 2.17-3.27 km3. According to various calculations, the total water resources of the rivers of the Republic of Azerbaijan are 28.1-30.3 km3. The inflow from neighboring countries to the territory of the Republic is 19.7-20.3 km3 or 67-70%. The volume of flow formed in the country is 7.81-10.6 km3. Thus, the inflow from neighboring countries is 2.0-2.5 times higher than the local inflow.

There is a shortage of water in Azerbaijan, which can be reflected in the water supply per 1 km3 of the area. Provision of the Republic's territory with local flow is 90-122 thousand m3/year. Taking into account the inflow from foreign countries, the total water supply of the Republic is 324-350 thousand m3/year.

Water quality in Azerbaijan is monitored on 25 indicators. Water samples are usually taken once a month. The frequency of monitoring at the confluence of transboundary rivers is once every 10 days. Water quality is assessed by the decision of the Cabinet of Ministers of the Republic of Azerbaijan in accordance with the Standards adopted in the former USSR. Unfortunately, according to research, more than 90% of industrial and domestic wastewater in transboundary river basins is discharged directly into these rivers. With the inflow of wastewater into the aquatic environment pollution problems are increasing and are spreading throughout the basin.

Pollution of rivers in the area occurs mainly in two ways. First, physical pollution occurs due to increased turbidity of river water during periods of turbulence and floods under the influence of natural factors. Second, chemical and biological pollution includes anthropogenic pollution of water with substances harmful to the human body. The studied areas show that anthropogenic pollutants enter the rivers from many sources. The most harmful sources are the untreated discharge of wastewater from various industries, especially the oil and petrochemical complex, metallurgy and mining industry, urban wastewater. In addition, a number of chemical and mineral fertilizers, pesticides, defoliants used for agricultural purposes in the area flow into the rivers and streams by irrigation water and groundwater.

In general, the following factors have a greater impact on the ecological status of rivers flowing directly into the Caspian Sea, forming both transboundary and in the territory of Azerbaijan:

- Discharge of industrial and municipal wastewater into rivers;
- Deforestation in the basins of local rivers;
- Illegal misappropriation of river protection zones;
- Increased amount of water taken from rivers;
- Non-compliance with international conventions and local legislative acts on the use of territorial rivers.

Thus, the main pollutants of transboundary rivers are minerals, inorganic salts and acids, heavy metals from mining enterprises, hydrocarbons, nutrients from the agricultural sector and chlorine organic pesticides, surface erosion products in the basin as a result of intensive deforestation, etc.

Keywords: Transboundary rivers, water quality indicators, pollutants, wastewater

ID:508

Modern Ecological Situation and Pollution of the Araz River

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Abstract

The Araz River is the largest tributary of the Kur, and the second largest river in the South Caucasus in terms of flow. Its length is 1072 km, the basin area is equal to 102 thousand km^2. The Araz River originates from numerous lakes in the northern foothills of the Bingöl mountain range of Turkey (at an altitude of about 3000 m). The part up to the confluence with Akhuryan river is in the territory of Turkey. From that place to the vicinity of Bahramtepe water junction in Imishli district, approximately 600 km away, it forms the state border with Turkey, Azerbaijan, Armenia and Iran.

The total catchment area of Araz is 102,000 km^2, 18,740 km^2 or 18% of this area is in Azerbaijan. Many factors affect the formation of the natural features of the Araz River basin. Among them, the relief formed as a result of the interaction of endogenous and exogenous processes, severe continental climate, geographical position, orographic conditions, changes in hypsometry over a wide range, higher average altitude, location in the transition climate zone, anthropogenic influence, etc. is quite important.

Due to the strengthening of the influence of anthropogenic factors, significant changes have occurred in the chemical composition of the water of the transit rivers and their tributaries. After the well-known events between Armenia and Azerbaijan, the process of pollution of these rivers has become even more cruel by the Armenians. Before these waters enter the territory of the country, they are exposed to contamination with various chemical elements and compounds, organic substances, and bacteria exceeding the sanitary-hygiene norms have been found. Starting from Gyumru, the Araz River receives domestic and industrial wastewater from more than 10 industrial cities of Armenia along its flow to the border area with Nakhchivan MR. Especially the rivers Gederchay, Vorotan, Akhuryan, which join the Araz from the territory of Armenia, have been polluted with extremely toxic substances. Waste water from industrial enterprises of Razdan, Charensavan, Abovyan, Yerevan cities and domestic waste from other residential areas located on the banks of the river are thrown into this river, which Razdan ranks first in Armenia in terms of its water pollution. There is almost no oxygen in the waters of these rivers, acidity has decreased to pH 2.4, microflora has decreased by 200 times, vegetation along the river banks has also been destroyed. Between Armenia and Nakhchivan MR (Sadarak and Surenavan villages), in the water of Araz, phenols are 220-1160 times, salts of heavy metals 36-44 times (copper, molybdenum, etc.), nitrogen-phosphorus salts 26-34 times, chlorides 28 times, hydrocarbons of petroleum origin are 73-113 times higher than the permissible concentration.

Keywords: Araz river, industrial wastewater, pollution, heavy metals, phenols

ID:511

Soil Suitability Assessment For Sustainable Production Of Cucumber (Cucumis sativus L.) In The Southern Guinea Savanna Zone Of Nigeria

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Abstract

The problem of selecting the correct land for the cultivation of a certain crop is a long-standing and mainly empirical issue and nowadays, sustainability is one of the important issues in land use system. A Typic Plinthustalfs soil developed on Pre-Cambrian basement complex rocks was evaluated for its suitability for cucumber **(*Cucumis sativus* L.)** in the southern guinea savanna zone of Nigeria. Three mapping units that were established along the topo-sequence and three profile pits that were dug in 2017 were used for the experiment. Linear parametric and square root models were used for assessing the suitability of the soils for sustainable cucumber production. Land qualities considered in the study were climate, topography, wetness, soil fertility and soil physical properties. Except for the fertility status of the land, other qualities were not a constraint to the production of cucumber at study site. None of the pedon is highly suitable for production of cucumber by both linear and square root models with index of current productivity (IPc) that ranged between 18.7 and 70. Linear model indicated pedon 2 as currently not suitable with IPc of 18.7. Potentially, the index of potential productivity (IPp) ranged between 25 and 70 which rated pedon 1 and 3 as moderately suitable and pedon 2 as marginally suitable for cucumber production by both linear and the square root model. The limiting factors were mainly low levels of available macro-nutrients (N, P, K, Mg), low organic carbon (<0.54%), and low cation exchange capacity (<5.61cmol/Kg) in all three pedons studied. Field trial also confirms the claim as application of both organic and NPK fertilizers significantly affect the yield of cucumber in all the pedons. In conclusion, it is therefore recommended that Insecticides, organic and Inorganic fertilizer should be applied for sustainable cucumber production on soils of the studied site.

Keywords: *Soil suitability, Typic Plinthustalfs, Linear Parametric and Square root Models, Limiting factors, organic and Inorganic fertilizers, Macro-nutrients.*

Introduction

The need for increase food production to feed the ever increasing human population cannot be over emphasized. Hence it is of great importance to carry out land evaluation assessment in relative to crops that are planted in different regions of the Nation.

Land sustainability assessment is a method of land evaluation, which identifies the major limiting factor for planting a particular crop. Land suitability assessment includes qualitative and quantitative evaluation, it is important to step in the process of land use planning where resources are limited. The assessment is carried out separately for each categories of land use (Reshmideri *et.al*, 2009).

Land suitability assessment provides information on constraints and opportunities for land use and hence serves as guide for decisions on optimal utilizations of the land resources; whole knowledge is an essential prerequisite for land use planning and development. (Kappo *et. al*, 2004).

These kinds of assessment identify the main limiting factors for the agricultural production and enable decision makers such as land users and agricultural support services to develop crop management that can overcome such constraints thereby increasing yield (Rabia, 2012).

Soil assessment can tell farmers how suitable their land is in terms of soil limitations to specific land use and management practices.

Soil suitability classifications are therefore based on the knowledge of crop requirements, prevailing soil conditions and defined soil management. From the basic soil requirements of crop, a number of soil characteristics directly related to crop yield performance. (Jimoh, *et. al.* 2018)

Nutrients deficiencies and imbalance are the main constraints of crop production in Nigeria, and thus assessing the suitability of soil for agricultural production is very important in the production of crops to meet the ever increase in population.

The food sub-sector of Nigerian agriculture parades a large array of crops, amongst this crop is cucumber (*Cucumis sativus*). It belongs to the cucurbitaceae family which comprised of 118 general and 825 species.

Compared with other Vegetables, cucumber occupies fourth place in importance in the world, following tomatoes, Cole crops and onion. In 1987 world acreage of cucumber was estimated at about 850,000ha with a total production of 12.5 million tons. About half of this production was from Asia, with China leading at 240,000ha and 3.7 million tons.

Fertile soils are used for the cultivation of cucumber, infertile soil result in bitter and mish happen fruits which are rejected by consumers, fresh cucumber supply thiamine, Vitamin C, Niacin, Phosphorus, Iron and Calcium.
Soil suitability assessment for agriculture is a means to evaluate the ability of soil to provide optimal ecological requirements of a certain crop variety. This is a strategy for achieving food security as well as sustainable environment.
Information on soil-site suitability evaluation for cucumber production is not available for the study area. The present study was therefore undertaken to unfold this information. Therefore, the main objective of this study is to evaluate the soils of teaching and research farm, Malete, Kwara State, for sustainable production of Cucumber (*Cucumis sativus*).

Materials And Methods
The study area was Kwara State University Teaching and Research farm, Malete. It is located in Southern Guinea Savanna ecological region of Nigeria. It lies between Latitude $08^0$71'N; longitude $04^0$44'E in Moro Local Government Areas of Kwara State at 360 m above sea-level and the relief is very gentle.

Climate
The climate of the teaching and research farm is characterized by distinctive wet and dry seasons with a mean annual rainfall of about 1150mm, with a double maximal pattern between April and October. The wet season begins in April and ends around October while the dry season begins in November and ends in March. In addition, the annual mean temperature ranges from 25 to 28.9^{0C}.

Geology of the area
According to Alabi *et al*. (2017), the soil at the Teaching and Research farm of Kwara State University, Malete is Sandy loam and slightly acidic. The Kwara State University land area forms part of the South-Western sector of Nigerian basement complex, a zone of basement reactivation.

Vegetation and Land Use
The natural vegetation of the Kwara State University Teaching and Research has been destroyed due to farming activities and procedures such as ploughing, harrowing and ridging by man making it anthropogenic. Presently, the type of vegetation in the area is savannah woodland. The area is predominantly used for the cultivation of arable crops such as maize, groundnut and cowpea, perennial trees such as cashew and mango. The site also contains woody species such as baobab (Adansonia digitata), Neem tree (Azadractha indica) and acacia (*Acacia species*), grasses such as spear grass (*Cylindrica imperata*), Elephant grass (*Pennisetum purpreum*) and guinea gamba grass (*Andropogon gayanus*).

Field Survey and Sampling
Detailed soil survey was conducted in the area using rigid-grid method. Three mapping units and soil profiles that was already dug in the study area for its classification in 2017 was used and Surface samples were collected at 0-20 cm for laboratory analysis.

Laboratory analysis and procedure
Samples were collected from eight different locations and air-dried. The samples were passed through a 2mm sieve to separate the large particles, stones and debris. The soil was analyzed to detect the macro and micro nutrients present in the soil. Particle size analysis was determined using the hydrometer method modified by Gee and Or, 2002. Soil pH was determined electrometrically in 1:1 soil water suspension.
Organic carbon is determined by Walkey-Black method while Total Nitrogen was determined by the Micro-Kjeldahl method (Bremner and Mulvaney, 1982) and extractable P was determined by Bray and Kurtz, 1945). Exchangeable Ca, Mg, Na and K were extracted with 1M ammonium acetate (1M NH4OAc) solution buffered at pH 7.0, as described by Anderson and Ingram (1998). The exchangeable sodium (Na^+) and potassium (K^+) content of the filtrates were determined by Flame photometer while the exchangeable calcium (Ca^+) magnesium (Mg^+) were determined by EDTA titration method and were read with atomic absorption spectrophotometer (AAS).
Micronutrients (Fe, Cu, Mn, Zn and B) of the soils was extracted by Mehlich-III multi-nutrient extraction method.

Land Evaluation Procedure
The pedons were first placed in suitability classes by matching their characteristics with the requirements in Table 2 below. The suitability class of a pedon is that which is indicated by its most limiting characteristics. This affirms the well famous "Law of Minimum" in agriculture, which states that crop yield will be determined by the plant nutrient in lowest supply (FAO,1984). Secondly each limiting characteristic would be rated for the parametric method. The index of productivity (IPp) for each pedon was calculated using the equation below:

$$IPc = A \times \frac{B}{100} \times \frac{S}{100} \times \frac{C}{100} \times \frac{F}{100} \ldots\ldots\ldots (i)$$

$$IP = A.\sqrt{\frac{B}{100} \ldots \frac{C}{100} \ldots \frac{F}{100} \ldots\ldots\ldots (ii)}$$

Where A is the overall lowest characteristic rating, B, C…F are the lowest characteristics rating for each land quality group.

The five land quality groups to be used in this study are climate, topography, soil physical properties, wetness and chemical fertility. Only one member in each group would be used because (IPP) and current (actual) index of productivity (IPC) would be calculated without putting the calcium (Ca) mole fraction and available phosphorous (Bray's P1) into the 'f' group, while the IPC would be calculated with the calcium mole fraction (exchangeable Ca2+ as a fraction of cation exchange capacity) and available phosphorous (Bray's P1) forming part of the 'f' group.

Table 1: Rating of the limiting characteristics

Symbol	Suitability classes	Land index
S1	Highly suitable	1.00 – 0.90
S2	Moderately suitable	0.89 – 0.75
S3	Marginally suitable	0.74 – 0.50
N	Currently not suitable	0.49 – 0.25

Source; Guntulu and Orhan (2020)

Table 2: Soil–site suitability criteria (crop requirement) for Tomato/ Cucumber/Cabbage

SUITABILITY RATING						
Land quality	Soil-site characteristics	Unit	S1	S2	S3	N
Climate	Total Rainfall	Mm	600-750	500-600 750-1000	450-500 >1000	
	Mean Temperature in growing season	0C	25-28	29-32 20-24	33-36 15-19	<15 >36
	Rainfall in growing season	Mm	>150	120-150	90-120	
	Length of growing season	Days	>150	120-150	90-120	
Topography (t)	Slope	%	1-3	3-5	5-10	>10
Wetness (w)	Soil drainage	Class	Well drained	Moderate	imperfect	poor
Soil physical properties (s)	Texture	Class	Sl,l,cl,scl	Sicl,sic,sc,c(m/k)	c (ss)	Ls,s
	Coarse fragment	Vol (%)	<15	15-35	>35	
	Effective soil depth	Cm	>75	50-75	25-50	<25
Fertility (f)	Ph	1-2.5	6.0-7.0	5.0-5.9 7.1-8.5	<5	
	CEC	Cmol(p+)/kg	>15	10-15	<10	
	Caco3 in root zone	%	Non-calcareous	Slightly calcareous	Strongly calcareous	
Soil toxicity (n)	Salinity (EC)	dSm-1	Non-saline	Slightly saline	Strongly saline	
	Sodicity (ESP)	%	Non-sodic	Slightly sodic	Strongly sodic	

S1=Highly suitable (IP = 100-75%), S2=Moderately suitable (IP = 74-50%); S3=Marginally suitable (IP = 49-25); N=Not suitable (24-0%).Source: Modified from NBSS&LUP, 1994

Table 3: Land requirement for suitability classes for cucumber cultivation

Land quality	Unit	S1	S2	S3	N
Climate (c):					
Mean temperature	^{0}C	25 – 28	29 – 32	33 – 36	<15
Total rainfall	mm	600 – 750	500 – 600	450 - 500	
Rainfall in growing season	mm	> 150	120 – 150	90 – 120	
Length of growing season	days	> 150	120 – 150	90 – 120	
Topography (t)					
Slope	%	1 – 3	3 – 5	5 – 10	>10
Wetness (w)					
Soil drainage	class	well drained	moderate	imperfect poor	
Soil physical properties (s)					
Texture	class	sl, l, cl, sclsicl, sic, sc, c (m/k)	c(ss)	ls, s	
Coarse fragments	vol(%)	<15	15 – 35	>35	
Effective soil depth	cm	>75 50 – 75	25 – 50	<25	
Fertility (f)					
pH	1 – 2.5	6.0 – 7.0	5.0 – 5.9	<5	
CEC	cmol[p+]/kg	>75	10 – 15	<10	
$CaCO_3$ in root zone	%	non-	slightly	strongly	
Soil toxicity (n)		calcareous	calcareous	calcareous	
Salinity [EC saturation extract]	dS m^{-1}	non-saline	slightly saline	strongly saline	
Sodicity [ESP]	%	non-sodic	slightly sodic	strongly sodic	

S1=Highly suitable (IP = 100-75%), S2=Moderately suitable (IP = 74-50%); S3= Marginally suitable (IP = 49-25); N=Not suitable (24-0%).
Source: Modified from NBSS&LUP, 1994.

Agronomic Evaluation

The performance of cucumber was evaluated experimentally using a 3 × 3 factorial experiment. The factors were topo-sequence and types of fertilizer or soil amendments. There are three levels of each factor; namely, upper slope, middle slope and lower slope, application of farmyard manure, N P K and control

Experimental Design and Land Management

The experiment was carried out using a randomized complete block design (RCBD) with 3 replications. Experimental plots consisted of 17m by 11m in each mapping unit. Pre planting herbicide was applied at 2 weeks before planting at 100 ml of Paraquat and Pendimenthalin 250 ml rate, farmyard manure was applied at two weeks before planting. Plant spacing of 0.60 m × 0.30 m was used. Marketmore variety of cucumber was planted and 2 seeds were planted per stand.

Data collection

Growth and Yield parameters collected include: Number of leaves at 4,6 and 8 weeks after planting **,** Vine length at 4,6 and 8 weeks after planting (m)**,** Leaf area at 4,6 and 8 weeks after planting (cm)**,** Days to 50% flowering **,** Days to 50% fruit setting**,** Fruit length (cm), Fruit yield per plant, Fruit weight (g)**,** Yield per ha (ton)**.**

Statistical Analyses

Data collected was subjected to analysis of variance (ANOVA). Using DSAASAT and treatment means where significant, were separated using Duncan Multiple Range Test, at 5% level of probability

Results And Discussion

Soil Physical and Morphological Properties

The present study was based on the physical and morphological properties of soils of Teaching and Research farm, Kwara State University, Malete that was carried out in 2017 as shown in the Table 4 below. The first profile was located in the upper slope of the topo-sequence on a gentle slope (<3 %) slope. Pedon UPP had colour variations between reddish brown (5 YR 4/3) in the surface soil to a range of red (10 YR 4/6) and Yellowish red (5 YR 5/8) in the subsurface soils. This profile had a loamy sand epipedon overlying a sandy loam to sandy clay loam subsoil. This pedon had high sand content, moderate silt content and clay content increases with depth which shows the evidence of argilluviation in the second, third and fourth horizons of this pedon. The iron- manganese concretions were identified in the subsurface horizon between depth 35- 86cm and 86- 147 cm. The soil was well drained at the time of sampling, but few, distinct dark reddish grey mottles (10 R ¾) were observed at a depth 35 -86 cm.

With increase in depth, the mottles became many, coarse and prominent with a colour change from dark reddish grey to black (5 YR 2/1) at a depth 86 -147 cm.

The pedon had medium sub angular blocky structure in both surface and sub-surface soils. The profile had a consistency that range from friable, loose, slightly- sticky, and slightly- plastic (wet). The boundaries between the horizons were gradual and smooth throughout the pedon.

The second pedon was located on the middle slope of the topo sequence. The colour of the pedon also varies ranging from Dark brown (7.5 YR 4/2) on the surface to dark brown (7.5 YR4/4) and Yellowish red (5YR 4/6 and 5 YR 5/8) in the sub soils. The Pedon had loamy sand texture on the surface horizon and loamy sand, sandy loam in the sub surface soils. The epipedon were fairly stony and free of concretion while iron- manganese concretions were encountered at depth 41-61 cm and 61-156 cm. The soil was deep and well drained at the time of sampling. However, dark gray (5 YR 4/1), fine, medium and distinct to dark reddish brown (5 YR 3/2), many, common, coars0e and prominent mottles were encountered between 41 cm and 156 cm depth.

The structure of the pedon ranged from fine sub angular blocky to single grained on the surface and coarse sub angular blocky to sub angular blocky in the subsurface soils. Profile consistency ranged from friable, loose, non-sticky, non-plastic (wet) on the surface to firm, hard, very sticky, very plastic in the subsoil. The boundaries between horizons were gradual and smooth.

Table 4: **Physical and Morphological Characteristics of the soil of Teaching and Research farm, Malete, Kwara state**.

SS/TOPO	Horizon Depth (cm)	% Sand (g/Kg)	% Clay (g/Kg)	% Silt (g/Kg)	Soil Texture	Soil Structure
UPP	0 - 19	846	60	94	LS	MSAB
	19 - 35	766	120	114	SL	MSAB
	35 - 86	506	340	154	SCL	MSAB
	86 - 147	596	260	144	SCL	MSAB
MDD	0 - 21	846	60	94	LS	FSAB
	21 - 41	826	80	94	LS	SG
	41 - 61	786	80	134	LS	CSAB
	61 - 156	706	140	154	SL	SAB
LS	0 - 40	806	60	134	LS	MSAB
	40 - 61	806	100	94	LS	SG
	61 - 91	646	200	154	SCL	SG
	91 - 156	706	180	114	SL	SG

SS/TOPO	Soil Structure	Consistence	Soil Colour (Moist)	Mottles ++	Concretion +++	Horizon boundary
UPP	MSAB	Fr, s	Reddish brown (5YR 4/3)	Absent	Absent	gs
	MSAB	Fr, shd	Reddish brown (5YR 5/4)	Absent	Absent	gs
	MSAB	Hd	Red (10R 4/6)	10R 3/4; f,fi,fn	Present	gw
	MSAB	Hd	Yellowish red (5YR 5/8)	5 YR 2/1, m,c,pr	Fe- Mn, f, r	-
MDD	FSAB	Fr, shd	Dark brown (7.5YR 4/2)	Absent	Absent	gs
	SG	Hd	Dark brown (7.5YR 4/4)	Absent	Absent	gs
	CSAB	Hd	Yellowish red (5YR 4/6)	5YR 4/1 m,c,pr	Fe- Mn, c, r	gw
	SAB	Hd	Yellowish red (5R 5/8)	5YR 3/2 m,c,pr	Fe - Mn, m, r	-
LS	MSAB	Fr, l	Dark brown (7.5YR 4/2)	Absent	Absent	cs
	SG	Fr, l	Reddish brown (5YR 5/4)	Absent	Absent	gs
	SG	Hd	Red (2.5YR 5/6)	5YR 2/1, m,c,pr	Fe – Mn, f, r	gw
	SG	Hd	Yellowish red (5YR 5/8)	5YR2/1	Fe-Mn,c,r	-

Source: Alabi et al., 2017Soil Chemical Characteristic

The third pedon (LS) was located on the lower slope of the topo sequence. The surface and second horizon of this pedon were dark brown (7.5 YR 4/2) and reddish brown (5YR 5/4) respectively, while the subsurface horizons were red (2.5 YR 5/6) and yellowish red (5 YR 5/8). The pedon had loamy sand in the first and second horizons and sandy clay loam to sandy loam in the third and fourth horizons. There was evidence of argilluviation in the subsoils due to increase in clay content. The profile was well drained. However, black (5 YR 2/1) fine, coarse distinct, prominent mottles were noticed between 61 cm to 156 cm depth. The profile had medium sub angular blocky structure in the surface soils to single grained in the subsurface soils. The consistency of the horizons ranged from firm, slightly- sticky, slightly- plastic in the surface to friable,loose, non-sticky, non- plastic in the subsurface soils. The horizon boundaries were gradual smooth in the surface horizon but gradual wavy in the sub surface horizon.

Table 5 showed the chemical properties of the pedons dug in 2017. The soils had reactions ranging from moderately acidic to slightly acidic (5.47 -6.31) in distilled water However, the upper slope had the range between 5.80 -6.01, the lower slope had the highest pH value in the second horizon (6.31) and the first horizon (6.16) while other horizons exhibited moderately acid condition. A similar pattern of pH variation was noticed in the middle pedon with the highest value in the first horizon and second horizons.

The Total exchangeable acidity was moderate for all the pedon ranging from 0.15 -0.35cmol/Kg.The total Nitrogen of all the pedons were generally low (0.09-0.24 %), but the middle pedon fell into medium class, having a range between 0.14 -0.24 %. The first horizon of the middle pedon and third pedon had a very high organic carbon, while other horizons of the pedons had moderate to high content of organic carbon with the expectation of third horizon of the upper slope pedon,which was low (0.82 %). The high content of organic carbon exhibited by middle slope pedon is probably due to the presence of Baobab tree around the place; which shed leaves that form litters on the ground. The available Phosphorus were generally low for all pedons (ranging between 0.77 -2.96 ppm).

The percentage Base saturation of the soils was consistently higher than 90 %. The ranged from 92.0 -97.5 %.

Table 5: Chemical Characteristics of the Soils at Teaching and Research Farm, Malete, Kwara State in 2017

Profile	Horizon Depth (cm)	pH (H_2O)	OC (%)	TN (%)	Av. P (mg/Kg)	K^+ (Cmol/Kg)	Ca^{2+} (Cmol/Kg)
Upper slope	0 – 19	5.96	1.48	0.15	2.55	0.29	3.03
	19 – 35	5.89	1.68	0.17	2.98	0.19	2.79
	35 – 86	5.80	0.82	0.09	2.71	0.57	2.67
	86 – 147	6.01	1.31	0.14	1.02	0.34	2.09
Middle slope	0 – 21	6.17	2.29	0.24	5.11	0.54	3.92
	21 – 41	6.11	1.92	0.20	5.96	0.43	2.23
	41 – 61	5.88	1.35	0.14	1.28	0.76	3.64
	61 – 156	6.08	1.27	0.14	1.42	0.42	2.29
Lower slope	0 – 40	6.16	2.17	0.23	1.70	0.44	5.54
	40 – 61	6.31	1.51	0.16	5.67	0.48	6.47
	61 – 91	5.47	1.28	0.13	0.96	0.54	2.18
	91 – 156	5.66	1.52	0.16	0.77	0.51	2.86

Profile	Ca^{2+} (Cmol/Kg)	Mg^{2+} (Cmol/Kg)	Na^+ (Cmol/kg)	TEA(cmol/Kg)	CEC (Cmol/Kg)	% B.S	CEC CLAY
Upper slope	3.03	0.89	0.31	0.25	4.77	94.8	78.63
	2.79	0.83	0.26	0.35	4.39	92.0	36.11
	2.67	0.52	0.43	0.30	4.49	93.3	13.12
	2.09	0.66	0.38	0.20	3.67	94.6	13.94
Middle slope	3.92	0.99	0.33	0.15	5.93	97.5	97.50
	2.23	0.74	0.26	0.15	3.81	96.1	46.79
	3.64	0.66	0.29	0.20	5.55	96.4	68.78
	2.29	0.57	0.31	0.20	3.79	94.7	25.55
Lower slope	5.54	0.81	0.32	0.20	7.31	97.3	118.2
	6.47	0.79	0.36	0.25	8.35	97.0	81.29
	2.18	0.97	0.41	0.20	4.3	95.3	20.54
	2.86	0.79	0.37	0.25	4.78	94.8	25.45

Source: Alabi *et al*., 2017

Table 6: Soil chemical Characteristics of surface sample 2021

Sample No	pH 1:1 (H_2O)	Nitrogen %	Organic carbon %	Organic matter %	Sand %	Silt %	Clay %	Texture
2A	8.4	1.75	0.39	0.67	80.64	6	16.34	S/L
2B	7	1.47	0.54	0.93	82.64	6	13.34	S/L
3A	6.5	1.05	0.19	0.33	82.64	6	11.36	S/L
3B	6.9	1.54	0.19	0.33	80.64	6	13.36	S/L
4A	6.7	1.61	0.36	0.62	80.64	6	13.36	S/L
Block 4	6.8	1.47	0.04	0.06	82.64	6	11.36	S/L
Crop Museum	7.4	1.54	0.04	0.06	80.64	6	13.36	S/L

Sample No	Ca++	Mg++ cmo/kg	Na++	K++	Acidity	Availabl e. P mg/kg	EC.E.C.	Base saturatio n %
2A	2.47	1.08	0.49	0.65	0.8	9.31	5.49	85.43
2B	2.68	0.96	0.36	0.84	0.76	3.36	5.61	86.45
3A	2.11	0.78	0.27	0.76	0.74	7.49	4.66	84.12
3B	2.01	0.71	0.25	0.81	0.6	9.94	4.38	86.3
4A	1.96	0.48	0.27	0.63	0.6	10.36	3.94	84.77
Block 4	1.78	0.44	0.22	0.71	0.8	4.2	3.95	79.74
Crop Museum	2.01	0.38	0.24	0.62	0.84	5.81	4.09	79.46

Soil Classification

Pedon 1(upper slope) has argillic B horizon (Bt1, Bt2). Pedon 2 and pedon 3(middle andlower slopes**)** have no either an argillic or kandic horizon;

All the Pedons (Upper, middle, lower slopes) have CEC of clay < 16 cmol kg^{-1} clay; base saturation > 50% by NH_4OAc at pH 7.0 and ustic moisture regime, Plinthic subsurface horizons and mottling which occupied more than half volume of the soils.

Based on the above properties, all the pedons were classified as Typic Plinthustalf (According to USDA) and according to FAO/ UNESCO, they were classified as (Plinthosol; Cutanic, Hypereutric), At the Soil Series level, all pedons belong to Gambari series.

Land Evaluation for Cucumber production

Suitability ratings of the land characteristics (Table-7) was constructed using the rating of limiting characteristics (Table-1) and land requirements for suitability classification for cucumber cultivation (Table-3) suitability ratings of the various land characteristics as well as their aggregate rating (potential and actual) were computed using the linear and square root parametric models presented in the write up

None of the pedons is highly suitable for Cucumber production by both linear parametric and square root model. Using linear model, the actual productivity (IPc) indicated pedon 2 as currently not suitable (18.7 (N) and pedon 1 and 3 as marginally suitable (37.5 -S3). The limiting factors were mainly low level of CEC, organic carbon and low micro nutrients. The evaluation of the potential suitability without considering fertility factors which are regarded as temporary limitation, using the linear model indicated that pedon 1and 3 are classified as moderately suitable and pedon 2 as marginally suitable for production of cucumber with the productivity index of IPp 70 and 50 respectively.

However, evaluation of the suitability using the square root model, both the actual productivity (IPc) and potential productivity (IPp) ranged from 50 to 70 which indicated pedon 1 and 3 as moderately suitable and pedon 2 as marginally suitable for cucumber production.

Agronomic Evaluation of suitability Mapping Units

The analysis of variance of the data collected on physiological growth and yield parameters for cucumber grown on different mapping units during 2021 planting seasons are presented in Table8

The result showed that the performance of cucumber differed significantly ($P<0.01$) in all measured parameters across the pedons.

NPK Fertilizer application had significant effect in terms of vine length and leaf area. However, in terms of fruit yield, application of manure, NPK and control are significantly different with manure ranking the highest followed by NPK. In terms of number of leaves both at 4 and 6 weeks, the control performing best followed by manure and NPK. The significant effect of NPK fertilizer over Organic manure in terms of Vine length and leaf area may be attributed to delay response in Organic manure in the release of nutrients for plant use. The higher effect of organic manure on the fruit weight and fruit yield over NPK may have resulted from the presence of micronutrients in the organic manure and this may have rectified the micro-nutrient deficiencies observed in the soils. Also, the slower rate of release of nutrients from the mineralization of the organic manure may have synchronized nutrient requirement by the cucumber with nutrient release, thereby minimizing nutrient loss by leaching. There is no significant difference at 50% days to flowering and 50% fruit setting with the application of organic manure, NPK and control.

Table 7. Suitability ratings of land characteristics for cucumber *Cucumissativus L.*) production under Typic-Plinthustalf.

Land Qualities	P1	P2	P3
Climate (c)	100 (S_1)	100 (S_1)	100 (S_1)
Total rainfall	100 (s_1)	100 (s_1)	100 (s_1)
Annual Temperature	100 (s_1)	100 (s_1)	100 (s_1)
Rainfall in growing season	100 (s_1)	100 (s_1)	100 (s_1)
Length of growing season	100 (s_1)	100 (s_1)	100 (s_1)
Topography(t): slope (%)	100(s1)	100(s1)	100(s1)
Soil drainage	100(s1)	100(s1)	100(s1)
Soil Physical properties (s)			
Texture	100(s1)	100(s1)	100(s1)
Coarse fragment (%) 0-60cm	90 (S2)	75 (S2)	100 (S1)
Depth of Profile (cm)	100 (S1)	100 (S1)	100 (S1)
Fertility (f)			
Ph.	75 (S2)	75 (S2)	75 (S2)
CEC	50 (S3)	25 (N)	50 (S3)
	75 (S2)	75 (S2)	75 (S2)
$CaCo_3$ in root zone			
Sodicity (ESP)	90 (S2)	90 (S2)	90 (S2)
Actual suitability†	37.53 (S_3)	18.7 (N)	37.53 (S_3)
Potential suitability†	50 (S_2)	25 (S3)	50 (S_2)
Actual suitability⁎	70 (S_2)	50 (S_3)	70 (S_2)
Potential suitability⁎	70 (S_2)	50 (S_3)	70 (S_2)

†suitability by linear model: S1= Highly suitable, S2= Moderately suitable, S3= Marginally suitable, N= currently not suitable, ⁎suitability by square root model.

Table 8: The analysis of variance of the data collected on physiological growth and yield parameters for cucumber.

Soil Amendment	Fruit weight(g)	Fruit yield per hectare (tons)	Vine length at 4weeks (m)	Vine length at 6 weeks (m)	Vine length at 8 weeks (m)	Leaf area at 4 weeks (cm)	Leaf area at 6 weeks (cm)
Manure	462.01a	8816.9a	0.34b	0.48b	0.73a	67.84b	147.8b
NPK	348.49b	7085.2b	0.42a	0.57ab	0.68a	73.02a	172.1a
Control	278.23b	5165.6c	0.39ab	0.61a	0.72a	65.8b	142.08b
LSD	93.12	660.80	8.01	8.972	6.409	4.39	16.73
Elevation/Location							
Upper	690.02a	11299.1a	0.478a	0.78a	0.904a	104.30a	223.1a
Middle	194.0b	4237.1c	0.308b	0.40b	0.631b	40.32c	116.22b
Lower	204.73b	5531.5b	0.37b	0.49b	0.604b	62.1b	122.76b
LSD	93.12	660.80	8.01	8.972	6.409	4.39	16.73
SOA x Location	*	*	*	*	*	*	*

Soil Amendment	Leaf area at 6 weeks (cm)	Leaf area at 8weeks (cm)	Number of leaf at 4 weeks	Number of leaf at 6 weeks	Number of leaf at 8 weeks	Day to 50% flowering	Day 50% fruit setting
Manure	147.8b	213.52a	17.8b	24.7b	28.2b	35.70a	43.08a
NPK	172.1a	213.7a	17.5b	28.05ab	35.2a	35.70a	43.07a
Control	142.08b	160.916b	20.3a	29.7a	35.9a	35.71a	43.07a
LSD	16.73	7.966	2.12	3.82	2.105	0.9158	1.323
Elevation/Location							
Upper	223.1a	270.39a	32.8a	48.06a	58.49a	35.03b	42.09b
Middle	116.22b	135.809c	9.2c	15.51b	18.13c	37.03a	44.05a
Lower	122.76b	181.9b	13.6b	18.9b	22.8b	35.05b	43.08ab
LSD	16.73	7.966	2.12	3.82	2.105	0.9158	1.323
SOA x Location	*	*	*	*	*	NS	NS

With the application of NPK at 4weeks, leaf area is significantly different from control and manure while the upper, middle and lower elevations have significant difference. This is also similar to that of 6weeks where NPK is significantly different. Upper elevation is significantly different from middle and lower elevation. At 8weeks, application of organic manure and NPK, performed better than control with the upper elevation performing better than the lower and middle respectively.

The cucumber variety used for this experiment differed significantly ($P<0.05$) in its performances across the three delineated mapping units. In terms of fruit weight and fruit yield, the cucumbers in the upper slope pedon were significantly higher than plants in the middle and lower slope. Also, the upper slope pedon maintained a significantly higher average number of leaves per plant and in the average leaf area per plant. The yield at upper slope pedon was slightly higher than that of lower slope and middle slope had the lowest fruit yield.

Although there was no significant difference ($P<0.05$) in the 50% days to flowering and 50% fruit setting, with the application of either organic manure or NPK. But the middle slope pedon performed better than the upper and lower slope pedons. There was interaction between soil amendment and slope positions.

Discussion

Land suitability evaluation enables more accurate and useful predictions to be made for specific purposes. Soil characterization helps us understand soils better and provides useful information for the assessment and monitoring of the behavior of soils. The analysis of research work showed the constraint of these soils to sustainable cucumber production. The constraints include low level of macro nutrients (N, P, K) which are needed in large quantities by the plants especially for cucumber production, low organic carbon and low exchange capacity.

Constraints of soils identified can be managed through some of these management systems; The low levels of micro-nutrients, organic carbon and CEC could be managed through the application of both organic and inorganic manure. Among the different sources of organic manure which have been used in crop production poultry manure was found to be the most concentrated in terms of nutrients content (Yagock and Awoniyi; 1974, Lombin et al., 1992).

Lia and Mathur (1998) stated that inclusion of organic manure improves soil fertility and crop yield. Sarkar et al. (2003) reported that the combination of farmyard manure along the recommended inorganic fertilizer dose increased yield significantly. Incorporation of crop residues could also be suggested as this would control soil erosion, crusting and improve physical conditions of crop root zones (Tarawali et al., 2001, Odunze, 2006). Minimum tillage is also suggested as heavy mechanized land preparation will increase structural destruction.

Conclusion and Recommendation

Three Pedons (upper, middle and lower slope) were established and classified as USDA soil order Alfisol and was classified further as sub-group Typic Plinthiustalfs (Plinthosol, cutanic, Hypereutic) still remain. None of the pedon is highly suitable for the production of cucumber by both linear and square root models. Pedon 2 was classified as currently not suitable but potentially marginally suitable for cucumber production by both models. The limiting factors were mainly low levels of available macro and micro-nutrients (low total Nitrogen, Available Phosphorus, CEC, Organic Carbon and organic Matter). Potentially (without considering soil fertility which is regarded as temporal limitation) by both Models, Pedons 1 and 3 are moderately suitable (S2) for the Production of cucumber.

Field trial confirms the claim that low level of fertility is the major factor limiting the Productive Potentials of the soils for cucumber production in the area. Application of manure and NPK as well as herbicides and insecticides had significant improvement on the growth and yield of cucumber. However, application of manure had the higher effect in terms of Fruit weight, fruit yield per ha and the other parameter taken in the upper slope segment than the middle and lower slope. In conclusion, the productive capacity of the soils for cucumber production can be achieved through the use of insecticides, both organic and inorganic fertilizer.

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Farmer Perception of Trees in a Semiarid Agroecological Zone

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Abstract
Trees in upland, semiarid agroecological zones typically require water efficiency due to low rainfall, cold and dry temperatures as in Niğde Province, Central Anatolia, Turkey. This study quantitatively assessed farmer perception of ecosystem services and production advantage of trees in a semiarid zone. Forty-nine farmers in Niğde Province were surveyed. The survey evaluated two major factors: ecosystem services and production advantage using eleven indicators. The responses were grouped by age, gender, education, district class (rural and urban) and farm settlement (rural and urban) and were analysed by test of association ($\chi 2$) at $p \leq 0.05$. Most farmers had knowledge of trees in their environment and mainly supported the perspective that trees were important mainly for cultural and provisioning ecosystem services. However, they held the opinion that having trees on their farmers was a production disadvantage in a semiarid agroecological zone. Although there were no gender differences in their perspectives, there were significant difference by age, education, district class and farm settlement. Farmers in this semiarid agroecological zone seemed more interested in trees with clear ecosystem services and production advantage such as improved crop yield, water efficiency, weed and pest management, ease of harvesting as well as reduced overall production cost. By implication, trees with multiple benefits are required if further planting by farmers is to be encouraged for agroecosystem improvement. In addition, tree choice will be based on farmer perception of the benefits of trees for ecosystem services and production advantage and further research to identify and promote trees that benefits the widest range of agroecosystems.
Key Words: *Agroecosystem, Farmers, Semiarid zone, Trees*

Introduction

Low precipitation, extreme temperatures and likelihood of drought characterises semiarid agroecological zones (Çalişkan and Boydak, 2017) and the Central Anatolia Region of Turkey fits this description with less than 400 mm/year rainfall, subzero cold winter, dry summer, the vegetation dominated by drought tolerant plants, such as those in the genera *Astragalus, Acantholimon*, *Alnus, Artemisia*, *Elaeagnus*, *Pinus*, *Poplus* and *Querus* (Çalişkan and Boydak, 2017, Kenar et al. 2020).
Based on the Millennium Ecosystem Assessment (MEA) (Dorji et al. 2015), the four categories of ecosystem services are cultural, provisioning, supporting/habitat, regulatory which are linked to community values, such as environmental conservation, wellbeing, socioeconomic, and spiritual sustenance provided by trees. In a study of tree and ecosystem services provided by trees in coffee plantations, Wagner et al., (2019) observed that farmer perception is hinged on the prioritised ecosystem services and Yang et al (2020) underpinned the critical management of agroecosystems to the attitude of farmers to ecosystem services. However, the studies that led to these assertions were done with farmers having either a target crop (coffee agroecosystem) or temperate climate such 800 mm annual rainfall in China. Reviewing the farmland productivity of Zimbabwean semiarid zones, Parwada et al (2022) opined that trees may improve water supply and water use efficiency as well as nitrogen fixing trees having soil health potentials. However, this opinion had not been tested with farmers in semiarid zones of Zimbabwe
Farmer perception of trees in Niğde, Central Anatolia, a semiarid zone was quantitatively assessed to understand their knowledge of the trees, their connection of trees to the ecosystem services and to understand perhaps the production advantages or otherwise the trees served.

Materials and Methods

A questionnaire-based survey was conducted with forty-nine farmers in Niğde Province as guided by the methods of Haines-Young and Potschin (2013). and Dorji et al. (2019). Niğde Province, Central Anatolia, Türkiye has six districts, Altunhisar, Bor, Çamardı, Çiflik, Merkez and Ulukişla, and a population of about 400,000 (TUİK, 2020). Altunhisar, Çamardı, Çiflik, Ulukişla were categorised as rural while Bor and Merkez were considered urban in this survey based on their level of urbanisation and industry. Sociodemographics of the farmers included their age, education, gender, district class (residence of the farmers) and farm settlement (location of the farm).

The farmers' knowledge of trees was ascertained by pictorial matching of 12 common trees in Niğde with their names. The trees were alder, apple, black pine, black willow, chinaberry, hawthorn, oak, poplar, Russian olive, sea buckthorn, Turkish fir and weeping willow. Farmer perception was tested through 10 indicators and these were

subsequently grouped into two major factors, ecosystem services and production advantage (Table 1) and presented in Likert scale of strongly agree to strongly disagree with corresponding scores of 5 to 1. Cultural and provisioning categories had scores 1-5 having one indicator per category while supporting and regulatory had two indicators each and scores 1-10. The survey questionnaire was written in the Turkish language, data collection was done randomly and responses were grouped based on their sociodemographics for analysis. The jjplot package (Patil, 2018; Brunson, 2019; Koneswarakantha, 2019) on jamovi statistical software (The jamovi project, 2021; R Core Team, 2021) was used for test of association ($\chi 2$) at $p \leq 0.05$.

Table 1: *Factors and indicators tested for farmer perception*

Factor	***Description***	***Indicator***	***Plot code***
Knowledge	Can you match the trees to their names?	Trees identification	-
Ecosystem	* Cultural ES	* Environment conservation	ES1
Services (ES)	* Provisioning ES	* Crop yield	ES2
	* Supporting ES	* Reduced fertilizer use	ES3
	* Supporting ES	* Reduced water use	ES4
	* Regulatory ES	* Pest control	ES5
	* Regulatory ES	* Weed control	ES6
Production	* Farms need the support of trees	* Benefits of trees	PA1
Advantage	* Not all trees are beneficial to farms	* Beneficial trees	PA2
(PA)	* Planting trees on farms increase cost of crop production	* Production cost	PA3
	*Crop harvesting is made easy by tree planting	* Harvest	PA4

Results and Discussion

Knowledge of Trees

Most farmers that participated in this study were between 20-50 years old. Two-thirds of the farmers in the study were male, the proportion of male farmers resident in the urban to districts was 48% while 52% resided in the rural districts. Only 7% of the female farmers in this study resided in the rural districts. The high school qualification of the farmers was 40%, vocational qualification (4%) and more than 50% had bachelors and higher degrees Thirty-six farmers could recognise at least six of the 12 trees ($p < 0.05$). Age, gender and district class had no influence on their knowledge of trees (Table 1). All farmers had recognised apple trees (100%) followed by poplar (91%), black pine (86%), hawthorn (84%), oak (82%), chinaberry (81%) and weeping willow (79%).

Niğde Province is known for apple production in Turkey (Bozbuğa and Pırlak, 2012) while poplar, oak, black pine, hawthorn and weeping willow are well adapted trees growing commonly in Central Anatolia (Çalişkan and Boydak, 2017; Ertug, 2000) and these are common trees in Niğde Province. Tree knowledge is important to guiding the farmer choice and preference of tree to either be retained or removed (Wagner et al., 2019) and perhaps their ecosystem services (Yang et al. 2020).

Table 2: *Ecosystem services and production advantage by response groups ($p \leq 0.05$*)*

Factor	***Indicator***	***Response groups***				
		Age	*Gender*	*Education*	*District class*	*Farm settlement*
Knowledge	Tree identification	0.347	0.224	0.023*	0.364	-
	* Environment conservation	0.093	0.437	0.512	0.048*	0.186
Ecosystem	* Crop yield	0.387	0.209	0.495	0.061	0.132
Services	* Reduced fertilizer use	0.881	0.761	0.705	0.151	0.240
	* Reduced water use	0.042*	0.692	0.140	0.122	0.022*
	* Pest control	0.871	0.478	0.004*	0.415	0.627
	* Weed control	0.419	0.105	0.187	0.460	0.600
	* Benefits of trees	0.659	0.417	0.824	0.343	0.661
Production	* Beneficial trees	0.448	0.257	0.508	0.049*	0.147
Advantage	* Production cost	0.504	0.825	<0.001*	0.333	0.192
	* Harvest	0.503	0.552	0.200	0.153	0.017*

Ecosystem Services

There was a strong farmer perception of trees as important for environmental conservation and improved crop yield (Figure 1). Socioeconomic values such as food, fodder and fuel may lead farmers to gravitate towards

provisioning ecosystem services (Wagner et al. 2019) in addition to environmental conservation, a community value linked cultural ecosystem services (Dorji et al. 2019). There was a strong agreement towards trees providing cultural (83%) and provisioning ecosystem services (72%) (Figure 2) while farmers were clearly divided in opinions regarding supporting and regulatory ecosystem services. As suggested by Riley (2021), there is perhaps a need to access a wider range of exotic trees with potential to provide ecosystem services in Central Anatolia, Turkey

The farmers had varying opinions on the possibility of limited use of fertiliser use and water with trees and this significantly differed with those having farms in rural farm settlements. Although it is suggested that water efficiency is increased in an agroforestry system as tree may theoretically influence water cycling, the empirical proofs are limited (Parwada et al. 2022) and the farmers in a semiarid agroecological zone may be unconvinced of this possibility. Also, not many farmers agreed that pest and weed controls could be better achieved with trees on their farms. Tree belts can be used to create buffer zones on and around farms to mitigate pesticide drift (Zaady et al. 2018) and risk of negative impact on pollinators (Vaughan et al. 2017) but not necessarily for reduced use of chemical pest and weed control agent.

Production Advantage

Although many farmers agreed to trees having benefits (Figure 3), they objected to the assertion that trees may provide them some advantage through production cost and ease of harvesting. This agrees with Lehman et al. (2020) which opined that choice of farmers for integrated food and nonfood systems may be influenced by the crop species, production system and agroclimatic zone. Optimum resource utilisation such as water and land with reduced risk of losses due to drought (Golla, 2021) perhaps had shaped the farmer perception of trees as a production disadvantage.

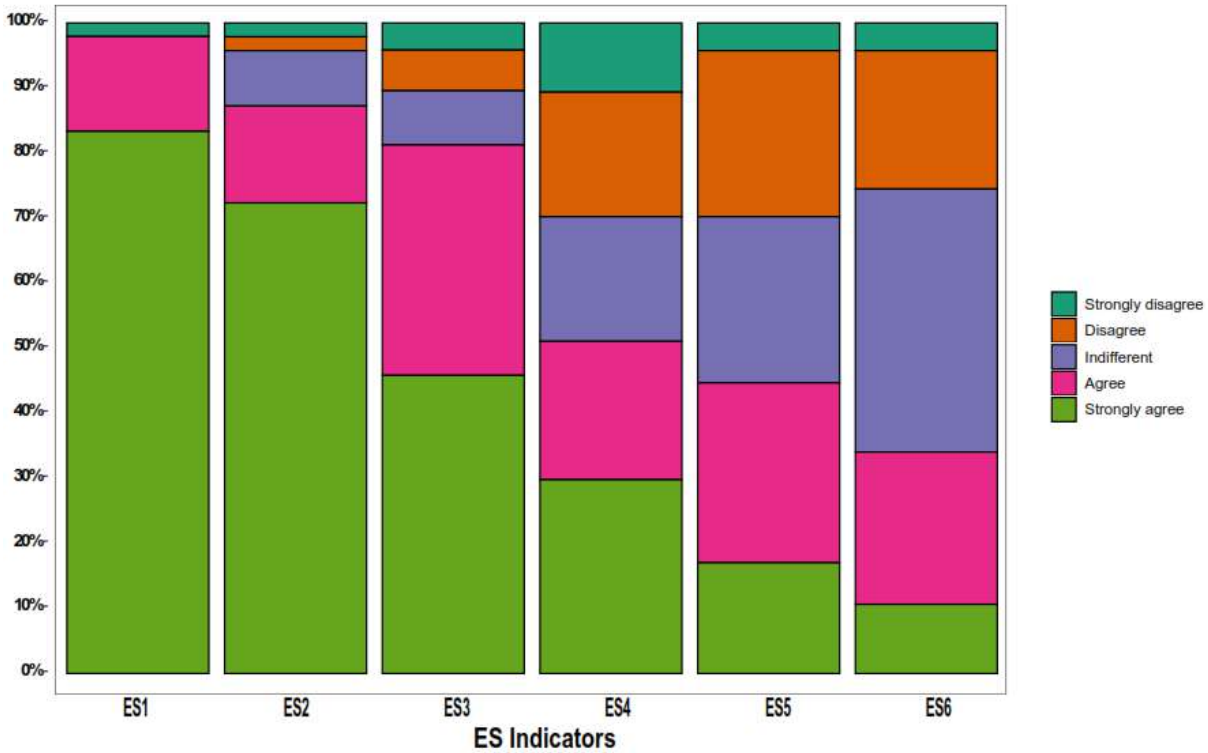

Figure 1: *Farmer perception by ecosystem service indicators. ES1, environmental conservation; ES2, crop yield; ES3, reduced fertilizer use; ES4, reduced water use; ES5, pest control; and ES6,weed control (codes defined in Table 1).*

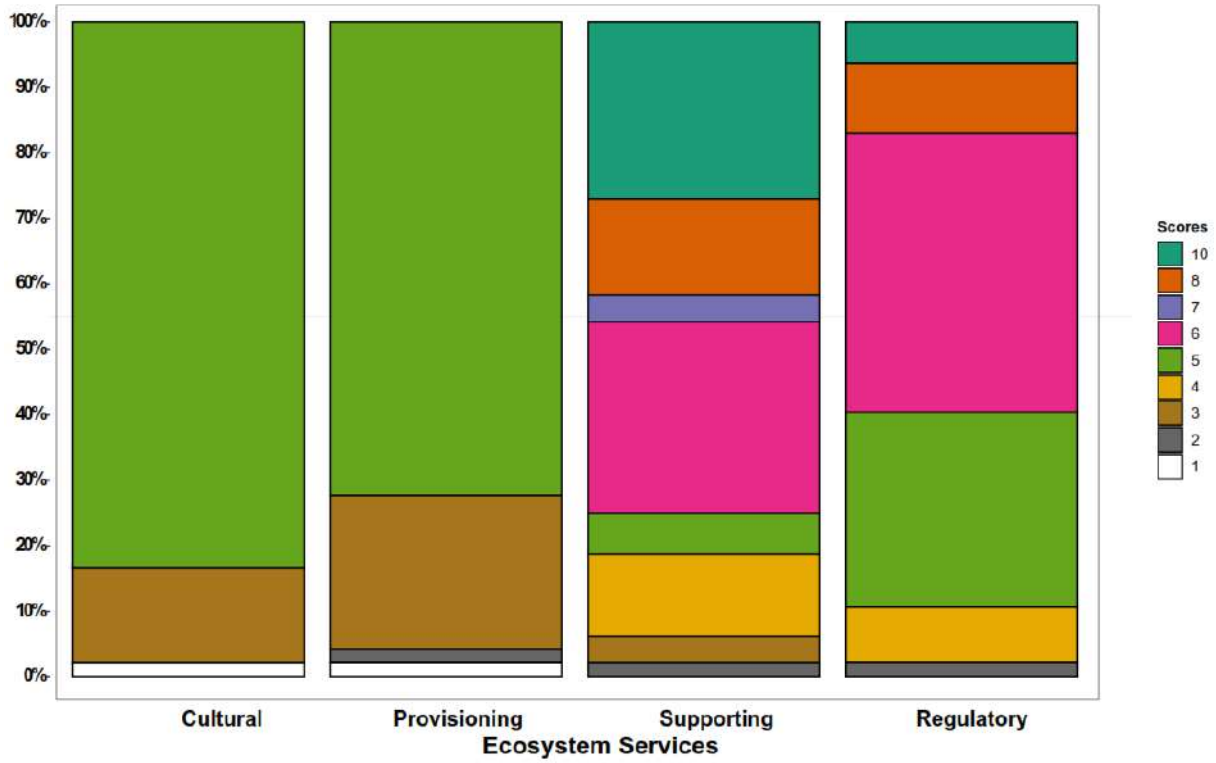

Figure 2: *Farmer perception of ecosystem services of trees. Cultural and Provisioning were scored 1-5 each while Supporting and Regulatory were scored 1- 10.*

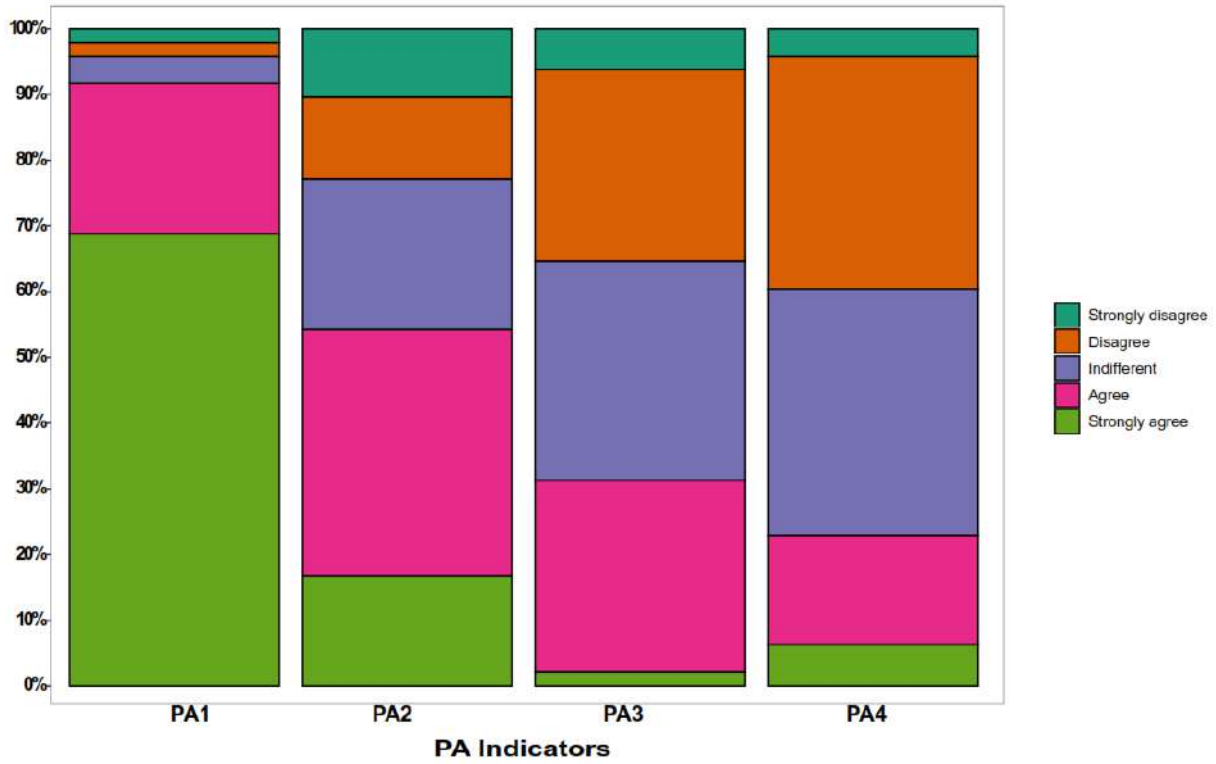

Figure 3: *Farmer perception of production advantage. PA1, farms need the support of trees; PA2, not all trees are beneficial to farms; PA3, reduced production cost; and PA4, ease of harvesting (codes defined in Table 1).*

Conclusion

The knowledge of trees and cropping system is pivotal to the farmer perception of their ecosystem services and possible derivations of production advantage in a semiarid agroecological zone as management options are limited by factors such as water efficiency requirement and unfavourable climatic factors.

Cultural and provisioning ecosystem services were identified in this study as paramount to the farmers compared to supporting and regulatory ecosystem services for socioeconomic and environmental conservation considerations. Since cost reduction and ease of harvesting were not perceived as production advantage where trees are planted on the farmlands, there is a need to further understand other factors such as crop types and production systems that may lead to agronomic productivity in a semiarid zone.

By implication, indigenous trees with multiple benefits and drought tolerant exotic actinorrhizal tree species (Riley, 2021) are required if further planting by farmers is to be encouraged for agroecosystem improvement. Tree choice will be based on farmer perception of the benefits for ecosystem services, production advantage and further research to identify and promote trees that benefits the widest range of agroecosystems.

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ID: 513

Comparison of the effects of *Cannabis sativa* L. (leaves) extracts in Ethyl acetate and n-Hexane on the restoration of muscle function following a peripheral nerve damage

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Abstract

Peripheral nerve injuries are one of those problematic medical disorders for which there is still no effective first-line treatment. Since ancient times, natural substances produced from plants have been used medicinally to treat specific ailments. In this situation, the current work was designed to investigate potential protection against sciatic nerve injury in a mouse model provided by n-hexane and ethyl acetate extracts of *C. sativa* (leaves). For this purpose, a total of 18 albino mice were divided into 3 groups (1 control and 2 treated groups; n=6 /group). The control group was fed on a plain diet, while the treatment groups were offered a diet containing a dose of 10 mg/kg *C. sativa* (n-Hexane and Ethyl acetate extracts). The sensorimotor function restoration was assessed by various behavioral tests: hot-plate test, muscle grip strength, and SFI. We noted a significantly ameliorated functional restoration in the *C. sativa* n-Hexane group when compared with other groups such as the control and *C. sativa* Ethyl acetate extract groups. Additionally, the *C. sativa* n-Hexane extract-treated group showed an improvement in muscle fiber diameter as well as a notable increase in TAC and a significant decrease in the TOS when the muscle fiber cross-sectional area was analyzed morphometrically. These findings, taken together, support the hypothesis that *C. sativa* n-Hexane extract has the ability to accelerate functional recovery after peripheral nerve damage. However, a more in-depth research is needed to identify the true culprits behind these extract-related effects and the mechanism that enhances functional restoration.

ID: 515

A Critical Review on The Accumulation of Microplastics In Agroecosystem and Its Effects on Terrestrial Plants

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Abstract
Microplastics are currently a major global threat, as they enter the ecosystem in large quantities daily and are able to persist in the environment for a long period of time. Current research focuses mainly on aquatic ecosystems where little information is available on the sources, possible accumulation and pathways of microplastics in the agroecosystem. Previously it was thought that plastic particles cannot uptake or accumulate into the plant body but modern technology has found that plastic particles are able to penetrate the plants at the micro and nanoscale through transpiration pulling force and, in some cases, foliar application of leaves. The purpose of the study is to find out potential sources, the way of entry into the agroecosystem as well as into the plant system, and the effects on the plant in its physiological process. We highlight the harmful effects of these pollutants on the agricultural ecosystem. It causes pore space blockage of the root surface, oxidative damage, inhibits nutrient and water uptake, decreases germination capability, product quality and so on.
Keywords*: Microplastics; Terrestrial plants; Agroecosystem; Accumulation; Oxidative damage.*

ID: 517

Small-Scale Farmers' Perception Of The Adoption Of Agroforestry Practices In Tolon District, Ghana

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Abstract
This study was conducted in the Tolon district of Ghana to determine small-scale farmers' perceptions, motivation and problems faced by them in the adoption of agroforestry practices. Primary data were collected through a pre-structured questionnaire from a sample of 200 respondents who were selected using a multi-stage random sampling technique.
Data analysis was done by using the percentage and total weighted score (TWS) method. Most of the farmers in the study area have a positive perception of the adoption of agroforestry practices.
Crop diversification, high returns and risk minimisation were the major motivational factor, whereas small landholding size, lack of awareness and poor knowledge, poor market accessibility, lack of subsidy, credit facility, lack of good quality planting material and longer period for tree growth were the major problems faced by the farmers in the study area.
Thus, the study suggested that farmers can be encouraged to practice agroforestry through improved agroforestry extension services, cooperative groups and distribution of quality planting material to farmers.
Keywords: *Perception, adoption, agroforestry, practices, small-scale farmers*

Introduction

The development of environmentally friendly farming techniques is receiving a great deal of attention nowadays days. Following the goal of achieving sustainable agricultural systems, agroforestry is becoming more important for reducing pressure on natural forests and addressing climate change. Concurrently, it increases returns to small-scale farmers and enhances livelihood security. Agroforestry is viewed as an alternative theory for rural growth around the world, focused on species-rich, low-input farming practices that include a vast variety of new indigenous tree crops, rather than high-input monocultures with just a few main food crops (Krebs & Bach, 2018). As a result, the implementation of agroforestry systems has the potential to solve contemporary issues such as an increase in population, environmental degradation and deforestation (Appiah et al., 2016; Foli et al., 2018). Agroforestry systems have been practiced in Ghana for millennia and handed down from generation to generation (Kiptot & Franzel, 2012). These approaches have allowed indigenous peoples to become self-sufficient and generate economic advantages. Furthermore, although most agroforestry study has been undertaken from a biophysical standpoint, assessing farmers' views and attitudes about agroforestry is critical for raising its adoption rate among farmers. Therefore, this study was conducted in the Tolon district of Ghana to analyse farmers' perception of agroforestry practices, and the motivating variables affecting the adoption of agroforestry practices and to highlight the problems farmers experience while adopting agroforestry practices in the Tolon district of Ghana.

Materials and Methods

The research was carried out in the Tolon District of the Northern Region of Ghana. The district covers a total area of land 1353.65550 km^2 and shares borders with Kumbungu to the North, Central Gonja to the South, Sagnarigu Districts to the East and North Gonja to the West, lies between latitudes 9° 15' and 10° 02' North and Longitudes 0° 53' and 1° 25' West. The district is characterized by grasslands and scattered guinea savannah woodlands and includes drought-resistant species such as *Vitellaria paradoxa, Pakia biglobosa, Adansonia digitata, Acacia longifolia, Azadirachta indica, and Mangifera indica*. The district experiences unimodal annual rainfall. The rainfall begins late in April when low rainfall rises to its peak by July-August and declines suddenly and stops entirely by October-November. The mean yearly rainfall of the district extends from 950 mm to 1200 mm. A continuous dry season occurs between November to March when temperatures rise between 33°C to 39°C during the day, and at night the mean temperature ranges between 20°C to 26°C (GSS, 2019).
The multi-stage random sampling design was used for the study. The first stage involved the purposive sampling of the district due to its significance to food production in the country and most institutes concerning agriculture come from the district. The second stage involved the random selection of four communities namely Kpalsogu, Dimabi, Kpendua, and Tunayili where agroforestry practices were more predominant. The third stage involved randomly selecting 50 respondents from each of the selected communities who were actively involved in agroforestry practice. In total, the sample size for the study was 200 respondents. The researcher trained four

enumerators who were natives of the area for two days. The questionnaire pre-testing was performed by applying it to twenty chosen respondents. The finding of the pretest allowed the researcher to adjust some questions in the questionnaire. During the entire study process, field observation was carried out to guarantee the quality of information gathered from the respondents through the interview schedules.
The secondary data required for the study were obtained from policy documents, journals and books, etc. Simple mathematical and statistical tools such as the percentage method were used to analyse the collected data. Thus, to reduce the variability among the respondents, the total weightage score method was used to provide different weights to the problems. Each respondent was asked to indicate his/her extent of agreement or disagreement against each problem along a 5-point Likert scale: Strongly agree, agree, disagree, strongly disagree and neutral. Weights assigned to these responses were 5, 4, 3, 2 and 1, respectively (Chaudhary et al., 2019). Weight according to their importance was given, and multiplied the values of problems (X) by the weights (W). Then, all the values were added to obtain the total score and the problem with the highest score was given the first rank and the one with the lowest score was given the lowest.

Results and Discussion

Demographic characteristics of Respondents
Table 1. shows the majority (82%) of the respondents were males, while 18% were females. The age respondents illustrate that 12.5% were less than 25 years of age, 28% were between 25-35, 20% were between 35-45, and 39.5% were above 45years.

Table 1. Demographic characteristics of Respondents

Variables	Description	Number of respondents	Percent (%)
Sex	Male	164	82
	Female	36	18
Total		200	100
Age	<25	25	12.5
	25-35	56	28
	35-45	40	20
	Above 45	79	39.5
Total		200	100
Educational level	No formal	34	17
	Primary	92	46
	Secondary	53	26.5
	Tertiary	21	10.5
Total		200	100
Marital status	Single	56	28
	Married	144	72
Total		200	100
Farm size	<1 acre	98	49
	2-5 acres	77	38.5
	Above 5 acres	25	12.5
Total		200	100
Farming type	Mixed cropping	102	51
	Mono cropping	98	49
Total		200	100

The educational status of respondents showed that 17% had no formal education, 46% had primary education, 26.5% had secondary education, and 21% had tertiary education. Most respondents (72%) were married, while 28% were single. On the farm size respondents,49% farm on <1 acre of land, 38.5% farm on 2-5 acres of land, and 12.5 of the respondent's farm on above 5 acres of land. The respondents' type of farming revealed that 51% of the respondents practiced the mixed cropping system while the remaining 49% practiced the mono-cropping system.

Farmers' perception of the adoption of agroforestry practices
Table 2 shows the analytical view in terms of farmers' perception of the adoption of agroforestry practices in the study area. Total weightage score analysis was done, followed by the ranking.

Table 2. Small-scale farmers' perception of agroforestry adoption

Statement	SA	A	D	SD	N	TWS*	Rank
Increase farm income via diversification	115(57.5)	35(17.5)	25(12.5)	15(7.5)	10(5)	830	3rd
Protect the crops against wind and wild animals	76 (38)	58(29)	28 (14)	26 (13)	12(6)	760	5th
Risk minimization	102 (51)	68(34)	15(7.5)	10(5)	5 (2.5)	852	2nd
Increase self-sufficiency	85(42.5)	40(20)	35(17.5)	28(14)	12(6)	758	7th
Competition between trees and crops	90(45)	85(42.5)	10(5)	10(5)	5(2.5)	737	8th
Improvement in soil fertility	98(49) **	78(39)	10(5)	8(4)	6(3)	854	1st
Easily accessible markets for tree crops	74(37)	65(32.5)	34(17)	23(11.5)	4(2)	782	6th
The problem of fuel wood fodder and timber availability will be solved through agroforestry	80(40)	40(20)	33(16.5)	29(14.5)	18(9)	735	9th
Input cost for the adoption of agroforestry is less	76(38)	64(32)	48(24)	8(4)	4(2)	800	4th

TWS-Total weighted score, Figure in parentheses represents percentages of the total responses
SA (Strongly agree), A (Agree), D (Disagree), SD (Strongly disagree), N (Neutral)

The study revealed that 49% of respondents placed at 1st rank with the highest (854) total weighted score which shows the strong agreement among the respondents regarding improvement in soil fertility through agroforestry adoption in the study area, "risk minimization" by the adoption of agroforestry scored 2nd rank and increase farm income via diversification scored 3rd rank. It was observed that the lowest TWS (735) was given the 9th rank. These findings corroborate with the findings of Abukari (2019) who indicated that most farmers adopt agroforestry practices to increase soil fertility levels.

Factors of motivation influencing the adoption of agroforestry practices among farmers

Crop diversification, high returns and accessibility to the market for produce were the major motivational factors among the respondents to adopt the agroforestry practices in the study area (Table 3).

Table 3. Motivational factors influencing small-scale farmers' adoption of agroforestry

Statement	SA	A	D	SD	N	TWS*	Rank
Availability of incentives	98(49)	42(21)	22(11)	36(18)	2(1)	798	5th
Availability of fuelwood, fodder and timber	70 (35)	62(31)	30(15)	28 (14)	10(5)	754	7th
Risk minimization	86 (43)	72(36)	28(14)	12(6)	2 (1)	828	4th
Proper land-use	79(39.5)	63(31.5)	36(18)	19(9.5)	3(1.5)	796	6th
High returns	109(45)	55(42.5)	22(5)	11(5)	3(2.5)	856	2nd
Accessibility to the market for produce	95(47.5)	80(40)	8(4)	15(7.5)	2(1)	851	3rd
Crop diversification	120(60) **	63(31.5)	10(5)	5(2.5)	2(1)	900	1st

TWS-Total weighted score, Figure in parentheses represents percentages of the total responses SA(Strongly agree), A(Agree), D(Disagree), SD(Strongly disagree), N(Neutral)

Further, it was observed from the study that proper availability of market and incentives for the agroforestry produce will lead to the higher adoption of agroforestry practices and will enhance their farm income. These findings are consistent with the findings of Pathania et al. (2020), who indicated that crop diversity and high financial returns are the primary motivators affecting agroforestry practice adoption.

Problems faced by small-scale farmers in the adoption of agroforestry practices

The most important problem perceived by the farmers was small landholding size with the highest TWS score (934), followed by lack of planting materials (TWS; 879), lack of awareness and poor knowledge (TWS; 871), the high initial cost of input for agroforestry practices (TWS; 851), lack of credit facilities (TWS; 858), the Longer gestation period of tree crop (857), lack of subsidy (TWS; 847), poor market accessibility(TWS; 835) and lack of incentives with the TWS score of 801 were ranked 1to 9, respectively by respondents in the study area (Table 4). Gara et al. (2020) made a similar discovery, stating that farmers are willing to adopt an agroforestry system suitable for their locations but are unable to do so because of landholder size.

Table 4. Problems faced by small-scale farmers in the adoption of agroforestry practices

Statement	SA	A	D	SD	N	TWS*	Rank
Lack of awareness and poor knowledge	120(60)	40(20)	33(16.5)	5(2.5)	2(1)	871	3rd
Lack of incentives	79 (39.5)	66(33)	33 (16.5)	21 (10.5)	1(0.5)	801	9th
Poor market accessibility	99 (49.5)	60(30)	23(11.5)	13(6.5)	5(2.5)	835	8th
Lack of subsidy	89(44.5)	78(39)	26(13)	5(2.5)	2(1)	847	7th
Lack of credit facilities	90(45)	86(43)	17(8.5)	6(3)	1(0.5)	858	4th
Lack of planting material	97(48.5)	90(45)	9(4.5)	3(1.5)	1(0.5)	879	2nd
High initial cost of inputs for agroforestry practices	89(44.5)	83(41.5)	20(10)	6(3)	2(1)	851	6th
Longer period for tree growth	95(47.5)	80(40)	15(7.5)	7(3.5)	3(1.5)	857	5th
Small land size	150(75)	35(17.5)	8(4)	5(2.5)	2(1)	934	1st

TWS-Total weighted score, Figure in parentheses represents percentages to the total responses
SA (Strongly agree), A (Agree), D (Disagree), SD (Strongly disagree), 5(Neutral)

Conclusion

The results from the study showed that most small-scale farmers had a positive perception of the adopted agroforestry practices. They perceived that the adoption of agroforestry can improve their farm productivity, minimise the risk and enhance their overall income in comparison to practicing monoculture. The study also revealed that crop diversification and high financial returns are the key motivational factors influencing the adoption of agroforestry practices in the area. The main problems faced by the farmers related to the agroforestry adoption were small landholding size, lack of awareness and people's knowledge about agroforestry, lack of incentives, poor market accessibility and lack of planting material. Therefore, it is concluded that the adoption level of agroforestry may be increased in the study area by considering these determinant factors at the time of designing a good agroforestry system for better productivity, sustainability and adoptability. Lack of capital with the farmers restricts the adoption of agroforestry practices thus, the credit agencies must provide necessary incentives in the form of lowering the cost of credit to the farmers to encourage the adoption of agroforestry practices. Moreover, proper marketing strategies can be formulated for better disposal of tree products by developing the producers-industry linkages.

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ID:519

Molecular Assessment Of Air Pollution Impact On Genomorphic Characteristics Of Mimusops Elengi L. Planted Along The Road Side Of Lahore City, Pakistan

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Abstract

Mimusops elengi L.is an evergreen, ornamental plant that is famous for its medicinal values. It is planted along the road side of Lahore city to provide the shade, due to its vast canopy. Automobile exhaust releases different types of pollutants such as carbon-monooxide, sulfer oxide, nitrogen oxides, hydrocarbons, and particulate matters that effect the physiochemical nature and genomorphic characteristics of this plant.

In the present study, we compared the physiochemical and genomorphic characteristics of *Mimusops elengi* L. that is planted along the road side of Lahore with control, where the vehicular exhaust are less.

The physiochemical analysis of both sites were performed to determine the air pollution tolerance index. For molecular analysis, CTAB method is used for DNA extraction. PCR product was analyzed by using the primers of GRF5 genes.

The result showed that higher values of APTI were seen in Canal Road samples then in Mall Road. Normal values of APTI were seen in experimental site. The molecular analysis showed that the expression of GRF5 genes in experimental sites are recessive as compared to control site which can negatively affect the development and normal growth of plants.

Automobile exhaust, constructional projects, planned or unplanned industrialization and urbanization causes combine effect in production of air pollution. The activity of man, careless technology, lack of awareness and casual attitude may lead to air pollution. The plants in city of gardens are facing tremendous stress of environmental pollution.

The plantation of higher tolerant plant on road side has great importance to execute the reduction in air pollutions.

Keywords: *Autimobile exhaust, APTI, Mimusops elengi L., Molecular analysis, Physiochemical analysis*

ID: 520

Genotoxic And Physio-Chemical Deterioration Of Eichhornia Crassipes (Mart.) Solm Growing In Paper Mill Effluents

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Abstract

Eichhornia crassipes (Mart.) Solms is a freely floating and ubiquitous invasive aquatic weed. There is tremendous trouble of water pollution worldwide due to anthropogenic activities in which increment of industrialism is a major contributor. For treating industrial effluent that contain potentially toxic elements, before disposal, several physical and chemical protocols have been applied that are highly expensive and cannot be practiced regularly. Cost-effective and eco-friendly techniques are bioremediation and phytoremediation. Solms is a menace but a promising phytoremediator. It is renowned for its potential of rectifying wastewater and eloquent tolerance against heavy metals. Despite of its competence, pollutants impart deleterious impacts on it. While recycling polluted water, heavy metals culminate phytotoxicity. The present study aims to determine genotoxicity and physiochemical deterioration in water hyacinth that grows in paper mill effluents. Water analysis of polluted site showed acidic pH, high electrical conductivity (1.857 ± 0.73456S/m), turbidity (339 ± 43.4319NTU), salinity > 0.5 (1.03 ± 0.35119ppt), TDS (1.343 ± 0.40869g/L) to dangerous level. Soil analysis revealed metals Cu, Ni, Pb in order Cu>Ni>Pb 3.577>1.336>-0.786mg/L respectively. Reduction in leaves' number, leaf area, roots length and relative water content were observed. Biochemical profile of water hyacinth growing in adulterated aqueous ecosystem manifested inauspicious ramifications on total chlorophyll content up to 0.03836 ± 0.05 mg/g. Toxins curtailed optimum cellular pH. Ascorbic acid elevated (0.014 ± 0.05mg/g, 0.032 ± 0.05mg/g, 0.0127 ± 0.05mg/g). Lead, Cadmium and Nickel were detected in wastewater plants in order Cd>Ni>Pb. Mean of Cd and Ni was (-0.0057 ± 0.00153ppm), (0.005ppm) respectively and Pb was absent. Molecular analysis was done to determine genotoxicity, DNA was extracted by a modified CTAB. İndustrial effluents effect the physiochemical nature and genomorphic characteristics of Eichhornia crassipes (Mart.) Solms.

Keywords: *Bioremediation, Genotoxicity, Heavy metals, Phytoremediation, Wastewater*

ID:521

Antiviral Effects of a Natural Disinfectant Formulation on Enteric FCV, MNV Viruses

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Abstract

Disinfectants have wide usage area from food to wastewater treatments. So, they have become ecological and health problems with possible by-products and resistant-microorganisms. Todays, natural products are becoming popular to use while increasing human awareness on nature. During Coronavirus disease (COVID-19) pandemic, disinfectant usage increased significantly and ecological problems became visible with especially Mucilage crises in Marmara Sea, Turkey. Natural disinfectant solutions can be a good and eco-friendly alternative to chemical disinfectant for food industry which an important polluter. This study aimed to investigate antiviral activity of a natural disinfectant formula, Naturdisinfect which includes Epigallocathechine gallate-EGCG and borax, on enteric viruses Feline Calicivirus-FCV and Murine norovirus-MNV viruses which can be isolated from food, food-related surfaces and food-related wastewaters. They are important foodborne enteric Ribonucleic acid-RNA viruses, like also a RNA virus Severe Acute Respiratory Syndrome-Coronavirus 2-SARS-CoV-2. Enteric FCV and MNV viruses which can transmit by foods are important factors for gastroenteritis and meningitis. In this study, an important antiviral activity, 99 % inhibition ratio, was determined by 1h Naturdisinfect application against both FCV and MNV. It was determined that substance EGCG increased the antiviral effect of the formula.

Key Words: *Natural Disinfectant, FCV, MNV, Antiviral, EGCG, SARS-CoV-2*

ID:522

Infiltration Characteristics of Soils of Some Selected Sites in Federal University Gashua, Yobe State, Nigeria

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Abstract

Infiltration studies is very important in efficient soil and water management as well as in managing problems like erosion and flooding. Therefore a research was conducted in three experimental site of Federal University Gashua, Yobe State to evaluate the infiltration characteristics of soils of the selected sites. The sites are Biological Garden (BG), Teaching and Research farm (T&R Farm) and a reserved forested area behind Centre for Irrigation and Desertification Studies (CIDS). Infiltration studies were carried out using double rings infiltrometer at randomly chosen three points within each site. Composite soil samples were collected from the sites and analyzed for some physical and chemical properties using standard procedures. The results indicated that the soils of T&R farm and CIDS are sandy loam while that of BG is loamy sand in texture with very low organic matter content 0.52, 0.43 and 0.38% and moderately high bulk densities of 1.58, 1.62 and 1.56gcm^{-3} respectively. The result indicated low quasi-steady infiltration rates for T&R farm and CIDS (13.0 and 3.50 mm/hr respectively), while that of the BG has a little rapid steady infiltration rate of 50.00 mm/hr. The results further showed highly significant difference in steady infiltration rates among the land uses with very low coefficient of variation 1.37%. It is recommended therefore that management practices like incorporation of organic manure, minimum tillage and other soil conservation methods be adopted to check potential flooding problem in BG soils.

Key Words: *Infiltration, land use, Gashua, flooding*

Introduction

The needs of growing populations and developing national economies, demand intensification of land and water use for the purpose of increasing and stabilizing agricultural production. These needs are most acute in the arid and semi-arid regions, where, the water requirements of crops are greatest even while the supplies by rainfall are the least (Engida *et al.*, 2000). The information regarding moisture intake and retention characteristics of the soil is required for planning an efficient soil and water management system. This will contribute in the promotion of moisture water retention characteristics techniques being followed in arid and semi-arid zones (Sallan *et al.*, 2004). Based on soil intake and retention characteristics a suitable management practice could be adopted to minimize the risk the crop failure (Rao and Prasadni, 2001). Another advantage of determining soil moisture characteristics and hydrological properties will be to compute the water balance for planning cropping patterns, supplementary irrigation requirement and special precautionary measure needed to manage surplus water (Lal, 2006).

The infiltration rate is not constant over time, but generally decreases during an irrigation or rainfall episode. If the soil is quite dry, when infiltration begins, all the macro pores open to the surface will be available to conduct water into the soil. Consequently, the infiltration rate declines sharply at first then tends to level off, and remains fairly constant thereafter (Brady and Weil, 2002).

Water intake and infiltration problem most especially during rainy season is a known phenomenon in Federal University Gashua and the surrounding community. Infiltration depends upon the physicochemical condition of the soils and the hydraulic characteristics of the water in those soils both of which may change with time. The infiltration rate is affected by the soil texture and structure, the condition of the soil surface, the distribution of soil moisture or soil-moisture tension, the chemical and physical nature of the water, the head of the applied water, the depth to ground water, the length of time of application of water, biological activity, the temperature of the water and the soil, the percentage of entrapped air in the sediments, the atmospheric pressure, and the type of equipment or method used (Mohamadi, 2015).

Within the University places are mostly flooded and water logged during rainy season which makes human and vehicular movement very difficult or even impossible in most part of the university. This research will try to find information on the water intake characteristics of the soils of the study area with a view of finding solution to the problem. The study was carried with the objectives to determine the physico-chemical properties and the steady infiltration rates of the soils of selected sites in Federal University Gashua.

Materials and Methods

The Study Area

The University is located approximately on latitudes 12^0 52'5"N north of Greenwich and Longitudes $11^0$2'47"E east of the equator, in one of the principal towns in Yobe State, Nigeria called Gashua. The climate of Gashua is usually hot and dry for the greater part of the year reaching its peak between March and April with temperature ranges of between 38 to 42 degree Celsius and the rainy season is between June to September with temperature falling to 23 to 28 degree Celsius and an average annual rainfall of 400 to 500mm (NEAZDP, 2015).

Gashua is located in the Sahel Savannah Agro ecological zone, in the northern part of Yobe State of North Eastern Nigeria. Gashua is a predominantly farming and fishing community. Despite the unfavorable climatic condition of the place, and even though average annual rainfall is low, it is important to know that most of the soil in Gashua are very fertile and suitable for cultivation of many variety of crops such as; cereal, legumes, fruits, and vegetable which include both leafy and fruity vegetables (Alhassan *et al*., 2018). The topography and relief of Gashua can be described as generally flat, and the most important geographical feature of the Gashua is its famous River Yobe which usually flood the area and empty into the main river which itself empty into the great Lake Chad **(**Harrod, 1975**).**

Field Studies

The research work was conducted in three sites; these are: Teaching and Research Farm (T&R) generally cultivated annually for crop production; Biological Garden (BG) which is mostly grassland and behind the Centre for Irrigation and Desertification studies (CIDS) which is a reserved area dominated by Desert date trees (*Balanites aegytiaca*) all within the premises of Federal University Gashua, Nigeria.

Soil samples were collected from five randomly chosen point within each site from the top 0-20cm depth and composite. The samples were then thoroughly mixed separately and passed through 2 mm sieve for laboratory analysis for laboratory analysis. Five core samples were also collected with core samplers for soil bulk density and porosity determination.

Infiltrometer tests were carried out on each site in three replicate using double ring infiltrometer with inner ring diameter of 30cm and outer ring diameter of 55cm and a height of 30cm to determine steady infiltration rate of the site as described in Bertrand (1965). The infiltration rings were gently driven into the soil and soil around the inside ring were gently firm to avoid any gaps. The inner ring was line with plastic sheet and water was gently pour into plastic-lined rings which was gently pull away to allow the water infiltrate into the soil. Time taken for water to infiltrate was recorded with stop watch, repeated several time at times interval until it reach steady state infiltration in a cumulative time of two hours.

Soil Analysis

Particle size was determined by the hydrometer method and textural classes determined from textural triangle, organic carbon (OC) content was determined according to the Walkley-Black wet oxidation method and converted to organic matter by multiplying it with a factor of 1.72 while, bulk density (Db) was determined using undisturbed core sampler method using volumetric cylinder and calculated by dividing the oven dry mass at 105°C (Estefan et al., 2013).

$$\text{Bulk density (Db)} = \frac{\text{Ms}}{\text{Vt}} \quad \text{(Eq.1)}$$

Where: Ms = is the oven- dried soil mass, Vt = volume of the soil core sampler

The total porosity (TP) was estimated as described in Estefan et al. (2013) as:

$$TP\ (\%) = \ [\,1 - \left(\frac{\text{Db}}{\rho\text{s}}\right)] \text{ x } 100 \quad \text{(Eq.2)}$$

In equation Eq.2; TP = total porosity, ρb = bulk density, ρs = particle density (average value of 2.65 g cm^{-3} is used as particle density).

Data Analysis

Infiltration data were analyzed using STAR software (2013) and MS excel Spreadsheet was used for graphical presentations

Results and Discussion

The results of the soil analysis in table 1 showed that was 56, 58 and 79%; silt was 28, 15 and 24% which day was 16, 06 and 18% at Teaching and Research Farm, CIDS and Biological Garden respectively. The soil textual class at T & R and CIDS was sandy loam while at BG was loamy sand. The organic matter content were 0.52, 0.43 and 0.38%, bulk density was 1.58, 1.62 and 1.52g/cm^3 while porosity was 40.38, 38.87 and 42.64% at T & R, CIDS and BG respectively. Sandy loam and loamy sand textural class with high percentage of sand particles, low organic matter content and slightly high bulk density were in conformity with findings of Alhassan et al. (2018) for soils of Gashua and for soils in the Sahel Savanna zone of Nigeria.

Table 1. Physicochemical Properties of the Soils of the Study Sites

Soil Properties	T & R	CIDS	BG
Sand (%)	56	58	79
Silt (%)	28	24	15
Clay (%)	16	18	06
Textural Class	Sandy Loam	Sandy Loam	Loamy Sand
Organic Matter (%)	0.52	0.43	0.38
Bulk Density (g cm^{-3})	1.58	1.62	1.52
Porosity (%)	40.38	38.87	42.64

T& R (Teaching and research farm), BG (Biological Garden) and CIDS (Centre of irrigation and desertification)

Average Infiltration Rates at Teaching and Research Farm

Table 2 presents results of infiltration studies from Teaching and Research Farm. The average infiltration rate was rapid at the initial stage which could be attributed to the low soil moisture content considering the period the test was conducted which is the dry season and it decreases as the time increases which indicates increases in moisture content that is approaching saturation level. The quasi-steady infiltration rate of 13 mm/hr recorded was in agreement with Uloma et al. (2013) who reported not much different rates for some soils in Abia State.

Generally low infiltration rate was recorded at the T & R Farm could be due to high presence of fine grain silt and sand that can cause blockage of pore spaces thus, impeding early water infiltration and presence of hard layers beneath the soil surface and soil sealing commonly noticed in the area could be other reason for low infiltration rate.

Table 2. Average Infiltration Rates at Teaching and Research Farm

Time (min)	Cumulative Time (min)	Infiltration Rate (mm/min)	Infiltration Rate (mm/hr)
1	1	1.67	100.00
5	6	0.67	40.00
10	16	0.46	28.00
15	31	0.31	18.60
20	51	0.25	15.00
25	76	0.21	12.80
30	106	0.23	13.80
30	136	0.22	13.00

Average Infiltration Rate of the Soils of CIDS

A very low quasi-steady infiltration rate was recorded at CIDS (Table 3) which could be due the clay and low organic matter content of the soils of the sites. These could lead to low aggregate stability and the soils can be easily disperse causing internal slumping and capping at the surface. Crust and surface sealing noticed in this study site could be another factor in reducing infiltration rates in the soil. This agree with the report that surface sealing and crust reduced infiltration rates of soils (Morin, 1993)

Table 3. Average Infiltration Rates at CIDS

Time (min)	Cumulative Time (min)	Infiltration Rate (mm/min)	Infiltration Rate (mm/hr)
1	1	1.66	100.00
5	6	0.53	32.00
10	16	0.30	18.00
15	31	0.17	10.60
20	51	0.20	12.00
25	76	0.16	9.60
30	106	0.11	6.54
30	136	0.07	3.50

Average Infiltration Rates at Biological Garden

There was a sharp and rapid drop in infiltration rate at 1minutes to 6 minutes at Biological Garden (Table 4), this could be attributed to the high level of porosity in the site which is also related to sandy nature of the soils of the site. It was reported that sandy soils have high infiltration rates ranging from 40-250 mm/hr (Mohammed and Ali, 2013). High infiltration rates recorded at this site could be a cause of concern because there could be water losses and high irrigation cost.

Table 4. Average Infiltration Rates at Biological Garden

Time (min)	Cumulative Time (min)	Infiltration Rate (mm/min)	Infiltration Rate (mm/hr)
1	1	11.60	700.00
5	6	9.13	182.60
10	16	6.10	122.00
15	31	1.58	96.20
20	51	1.39	83.60
25	76	1.19	71.60
30	106	0.97	58.60
30	136	0.83	50.00

The infiltration rates as plotted against time for the study sites as shown on Figure 1showed that infiltration rate at BG was very high at the beginning of the experiment and decreased rapidly within a short time than those at CIDS and T & R sites which decrease slowly until they reached a steady state.

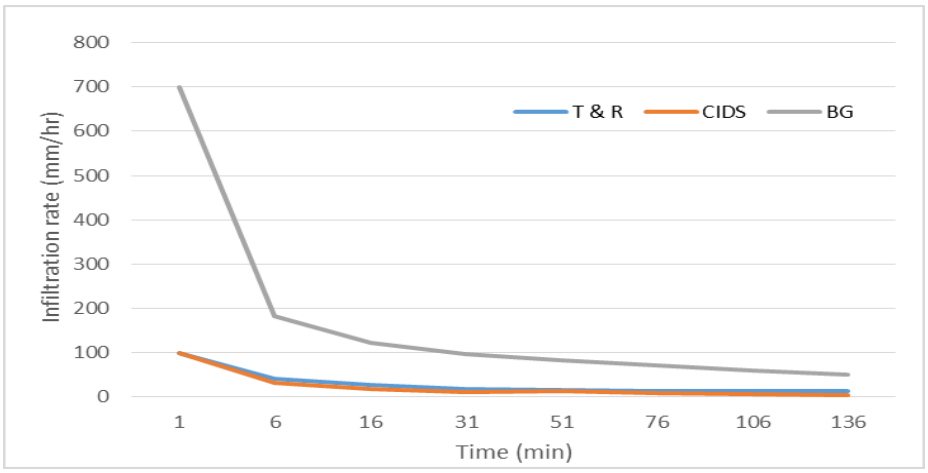

Figure 1. Infiltration rates (mm/hr.) at the land uses and the time (min)

Table 5 indicated highly significant difference ($p = 0.0001$) in the mean steady infiltration rates within the land uses, but with a very low coefficient of variation (1.37%). The highly significant difference could be attributed to the differences in soil texture and bulk densities within the land use types (Table 1).

Table 5. Mean Steady Infiltration Rates within the Land Uses

Land use	Steady Infiltration rates (mm/hr.)
BG	49.99a
CIDS	3.50c
T & R	13.00b
Pr (> F)	*0.0001*
CV (%)	1.37

BG (Biological Garden), CIDS (Centre of irrigation and desertification), and T& R (Teaching and research farm)

Conclusion

The maximum infiltration at start was higher at Biological Garden followed by Teaching and Research Farm and was low at CIDS and similarly final quasi-steady infiltration was also higher at Biological Garden then T & R and lower at CIDS. This study has provided an estimate and basic knowledge of the local soil infiltration rates and its variability within the university environment and has revealed that soil texture and bulk density play greater roles in infiltration rates.

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Antiviral and Antibacterial Effects of Anatolian Folk Medicinal Plants *Sideritis Trojana Ehrend* and *Hypericum perforatum* Extracts via Ethanolic and Ultrasound

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Abstract

In this study, we aimed to determine antiviral activities on human noroviruses (NoVs) and antibacterial activities on resistant bacteria of Sideritis Trojana Ehrend (S) and Hypericum perforatum (HP) extracts which are known as Anatolian medicinal folk medicines. Extractions were done by ethanolic (EE) (40 %) and ultrasound assisted extraction (UAE). Cytotoxicity of extracts were determined by MTT studies. Phenolic amount, total phenolic and antioxidant activity of extracts were investigated HPLC and UV-Vis spectrophotometer. Both UAE and EE extracts of 5 mg/L HP showed 1-2 log reduction on MNV; however only UAE extract of S observed 1-2 log reduction at overnight. On FCV viruses, both UAE and EE extracts of 5 mg/L plants showed >2 log reduction at overnight. 0,5 mg/L EE extracts reduced FCV infectivity at >2 log level at overnight incubation. Antibacterial activities of both plants UAE extracts were higher than EE extracts. None of extracts were defined as cytotoxic. UAE application increased total phenolic amounts nearly 3-4 times. Trolox equlavalent antioxidant capacity (TEAC) amounts of plants' extracts increased nearly 2 times by ultrasound application. Same phenolic compounds were defined by EE and UAE extracts of both plants, but phenolic compounds amounts were determined higher by ultrasound application. UAE application increased antimicrobial, antioxidant and phenolic amounts of both medicinal plants; also cytotoxicity of extracts decrease by this application.

Key Words: *Natural Extracts, Antiviral, Antibacterial, Cytotoxicity, Ultrasound, Phenolic Amounts*

ID: 524

Sanitizing Stainless Steel Process surfaces by New Natural Disinfectant Formula

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Abstract

The aim of this study is to provide a natural disinfectant solution which is natural, environmentally friendly, enabling fast cleaning and reducing purification costs. Natural disinfectant solution which comprises epigallocatechin gallate extract, borax extract and ethylenediaminetetraacetic acid were applied on biofilm formed food process line stainless steel surfaces. Effects of formulation were searched on real process line isolated Enterobacter cloacea and Bacillus coagulans by using SS 316 L coupons and UHT milk. Corrosion effects of these formula was determined by SEM-EDX analysis and also, compared to CIP, peracetic acid and other formula which comprises borax extract and ethylenediaminetetraacetic acid applications. The formula can reduce the microbial load (sessile and biofilm formable cell numbers) on SS 316 L surfaces that are used frequently in particularly food production by 6 logarithmic values following 5 minutes of application. This activity value was equal to 15 min peracetic acid application. Peracetic acid was determined as corrosive on SS 316 L, when formulas were not corrosive by SEM-EDX analyses. As a natural solution, it can be effective on biofilms that are already present on surfaces; and due to its quorum quenching feature it can inhibit the medium perception systems of microorganisms and prevent them from biofilm formation.

Key Words: *Natural Disinfectant formula, Sanitize, Biofilm, Quorum Quenching*

ID: 528

Removal of Methyl Red Dye From Aqueous Solution by Bacterial Consortium

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Abstract
Coloured industrial effluents are the most important problem of water pollution and its discharge into the environment in decades. Scientists have reported that many microorganisms belonging to different taxonomic groups of bacteria, fungi, and algae have the ability to remove and decolourize dyes. Some research has shown that mixed microorganisms were better to remove dyes from water. The aim of this research is to investigate the ability of two bacterial consortia from Akkaya lake (Niğde-Turkey) to decolourise methyl red dye under light conditions with or without acetate as a co-substrate. One of two consortia is gMR which grows under the presence of Methyl Red (100 mg/L) and the absence of acetate and, another one is gMRa which grows under the presence of Methyl Red (100 mg/L) and acetate (1.0 g/L). Determination of decolourization and growth of the consortia were performed spectrophotometrically. However, FT-IR analysis and metagenomic analysis were conducted at the end of the experimental period. We have found some differences between the two consortia in terms of bacterial diversity and decolourization. We have shown that consortium gMR consists of 73 species of bacteria while gMRa of 79 species. Both types of consortia have been used for the removal of Methyl Red dye. The microbial consortium gMR has shown a high decolorizing percentage for Methyl Red, 97.7% within 30 days, meanwhile, gMRa also shows a high percentage of decolorizing 94.27 within 5 days. According to FTIR analysis, the dye not only decolourization but also has been degraded by the two consortia. On the other hand from metagenomic analyzes, it was confirmed that in both bacterial consortia gMR and gMRa the species with the highest abundance were: *Proteiniphilum acetatigenes, Prevotella copri, Bellilinea caldifistulae Phenylobacterium lituiforme, Blastochloris sulfoviridis, Rhodoplanes oryzae, Lactobacillus delbrueckii, Phenylobacterium lituiforme, Phyllobacterium brassicacearum, Roseomonas soli, Thauera linaloolentis, Thiocapsa bogorovii, Aminiphilus circumscriptus, Aminivibrio pyruvatiphilus.* Results have demonstrated that the microbial consortia have better than the pure culture in the treatment of the dye and, the role of co-substrate acetate has been the favorable factor in terms of microbial diversity. Photosynthetic nonsulphur bacteria have been dominated by using acetate in the media.
According to the FT-IR analysis at the end of the experimental period, it was determined that the dye was degraded and used as substrates by the consortia.
Keywords: *bacteria, dye, consortium, matagenomic analysis, acetate.*

ID: 529

Expression Level Of Mydgf (Myeloid-derived growth factor) In Liver Fibrosis

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Abstract

Liver fibrosis is a wound-healing response generated against an insult to the liver. Following the injury there is accumulation of ECM protein that alters the liver architecture by forming fibrous scarring. Consequently, regenerating hepatocytes nodules lead to hepatic cirrhosis; causing destruction of hepatocytes, portal hypertension and ultimately liver failure.

The objective of this study is to evaluate the expression level of Myeloid-derived growth factor *(MYDGF)* gene and the hepatoprotective role of *Bellis perennis* after inducing liver fibrosis by carbon tetrachloride (CCl_4) in the rat model.

In the current study, liver fibrosis was induced in rats by use of CCl_4 intra-peritoneal (1ml/kg BW) and the rats were allocated in 3 groups; Negative control fed on standard diet; Positive control received 1ml/kg/body weight carbon tetrachloride injection mixed with olive oil intraperitonially. Treatment group received CCl_4 injection along with oral administration of 200mg/kg/body weight of *Bellis perennis* (BP) for three weeks. After each week decapitation was done; blood samples and liver tissues were procured for further analyses. Parameters like hematology, biochemical assays, Oxidative stress markers, were analyzed. In addition, RNA extraction for purpose of gene expression analysis of selected gene using qRT-PCR was done on each preserved tissue sample. For statistical analysis, data was then be subjected to Two-way ANOVA by using Statistical Software.

Serum total oxidative status (TOS), malondialdehyde (MDA), total cholesterol, triglycerides, low-density lipoprotein, total protein, bilirubin, ALT, AST, ALP, CRP, TSH, WBCs, platelet count were significantly increased in positive control. However, BP significantly ($p \leq 0.05$) lowered the raised levels of these parameters as compared to the untreated group. The level of *MYDGF* was up regulated in positive control as compared to treatment group. Liver histology showed improvement in architectural integrity in treatment group.

Based on these findings it is concluded that BP may possesses hepatoprotective activity by upregulating levels of *MYDGF*.

Keywords: *Hepatotoxicity, Carbon Tetrachloride (CCL_4), Bellis perennis, Hepatoprotection, Antioxidant, Myeloid-derived growth factor (Mydgf).*

ID:530

Microplastics as a Threat to Meat Consumption, Review

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Abstract
The world population increasingly consumes about 300million tonnes of meat up to 2018. As this trend continues due to the increasing world population, plastic becomes necessary to preserve meat, required to meet its corresponding demands. Plastics in the meat industry were of immense benefits that have turned into an environmental burden. This is because they protect meat and other products from spoilage but contain many contaminants in the form of microplastics (MPs) additives and trapped carbons. These contaminants significantly contribute to the health risks meat pose and other global environmental concerns. A further concern is that consumers may likely not be aware of the safety risks of these MPs and their additives. Educating the meat consumers through proper labeling of the plastic packaging with straightforward and understandable terms for MPs migratory possibilities rather than industrial terminologies may likely guide the consumer against MPs consumption.
Key Words: *Microplastics, Safety, Health risks, Concerns, Meat, Packaging*

1.0 Introduction

Large polymer plastics degrade due to weathering and other environmental impacts such as shearing, attrition, UV-radiation, erosion, chemicals, and burning after their end-use into smaller plastics (Gewert, 2015). These plastics with sizes less than 5mm are microplastics (MPs) according to Kim et al. (2020). Other authors such as Andrady (2017), GESAMP (2015), and Hartmann et al. (2019) also reported MPs as plastics with particle sizes up to 5mm. These MPs are found in waterbodies and farmlands (Horton et al., 2017; Xu, 2020). Microplastics cause several environmental burdens by leaching into the groundwater, affecting plants and humans, and animals ingest them during feeding. Animals such as buffalo, camels, pigs, cows, rabbits, cavia, etc., are processed globally into meat to meet human nutritional demand. These are wild and domesticated animals that produce meat when processed and produce milk, and eggs when alive (Suman and McMillint, 2014; Garnett, 2014). Meat plays a key role in global food security as livestock contributes 13% to the global energy required from nutrients (Smith et al., 2013). However, the products from these animals are not very safe from MPs contamination as they get into farms through sludge application, plastic soil cover (plastic mulching), compost and bio-waste, tyres from busy roads, and stormwater (Cole et al., 2011; Khan and Strand, 2018; Knight et al., 2020). Many other authors have also tried to evaluate the quantity and abundance of these MPs on land, air, and water bodies. They also tried to develop and estimate these MPs' abundance from different global regions as well as MPs' sampling methods, identification, and characterization (Yu et al., 2018; Fuller and Gautam, 2016; Cole et al., 2011; Herath et al., 2022; Abaroa-Pére et al., 2021; Pagter et al., 2018). Furthermore, humans, plants, and or animals through adsorption, inhalation, absorption, ingestion, migration, and leaching consume these MPs before they find their ways back into the environment in an endless cycle (Domenech and Marcos, 2021; Ivar do Sul and Costa, 2014). Figure 1 is a summary figure, which describes microplastics' path into the meat. This also shows a partial 'microplastic-meat-environment' relationship (MME). This relationship highlights how MPs get into the meat consumed via animals, crops, and human activities before going into MP forms.

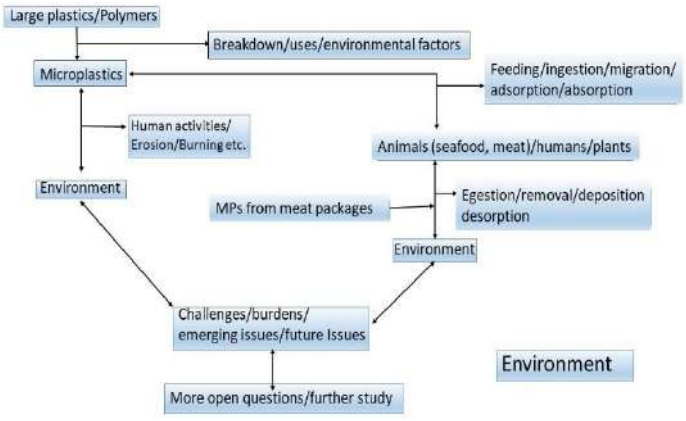

Figure 1: Microplastic paths to meat consumption

1.2 Plastic packages in the meat industry

Meat consumption as of 2018 has increased globally by above 300 million tonnes on average. Meat is a source of essential nutrients and a nutritional alternative for non-vegetarians (Parlasa and Qaim, 2022). As the demand for meat consumption increases, so also the need for reduction in meat spoilage and better packaging materials like plastics.

Plastics are cheap, easily used to transport meat, extend its shelf life and protect it from environmental impacts (Andrady and Neal, 2009). Plastics are forms of controlled atmosphere for meat by providing protection against moisture, microbial communities, and atmospheric oxygen (Alessandroni et al., 2022). They protect meat and meat products from becoming waste and consequently prevent greenhouse gases that would arise from this waste (Billiet and Trenor, 2020). However, most meat packaging is from petrochemical, containing additives that are toxic and can leach out of the plastics (Barrick et al., 2021). These plastic packages can take the desired shape under thermal treatment. They also contain high carbon content. Such include polyvinyl chloride (PVC), polyamide (PA), polyvinylidene chloride polypropylene, and polyethylene (PE) considered for their strength and durability (Guerreiro et al., 2018; Marsh and Bugusu, 2007). Katsara et al. (2022) discussed other properties of why these plastics are in use in the meat industry. However, these plastics are not very environmentally friendly and contain high carbon. Already, around 57% of the total global GHG emissions are from meat products as of 2010 (Xu et al., 2021). Moreover, it is possible that GHG from plastics to transcend 56000MT by 2050 (Shen et al., 2020). Although, concerns are some of the carbons temporarily held by meat plastic packages will escape into the environment if not properly processed at the end of their lifecycle. Already study shows that the more plastics are produced the more the significant possibility of an increase in CO_2 emission in the environment (Oktavilia et al., 2020). These are mostly high-volume single-used plastics discarded due to bloodstains and concern about microbial contamination during reuse (Taufik et al., 2020; Nemat et al., 2022). Plastics used for extending bacon shelf life for example have more carbon trapped in them than regular plastic packaging. They are multilayer plastic packaging that prevents bacon thawing and reliantly provides oxygen and puncture-free requirements during handling and sales. Table 1 shows some meat packaging used in extending its shelf life. It is troubling that most meat producers sacrifice plastic packaging circularity for meat shelf life (Pauer et al., 2020; Dong et al., 2014).

Most plastics used in the meat industry are of petrochemical origins and are mostly non-degradable, and have a lasting effect on the environment. So, most consumers and concerned stakeholders in a bid to mitigate these effects are delving more into bio-based plastics and edible-films-derived plastics for meat packaging (Bishop et al., 2021). Bioplastics are environmentally friendly alternatives to petrochemical plastic packaging. However, they have challenges of lesser duration and strength compared the petrochemical plastics. Ruban (2009) reported some of these bioplastics' classifications, their derivation, and their applications. Song et al. (2021) explained the chemistry and the production processes of these edible films and their different applications in processing meat. An important note in this review is that plastic films get into the layers of packaged meat in smaller plastic forms or MPs. Although, they have no nutritional purpose and are alien to meat's nutritional composition. Some might not necessarily be toxic but pose a nutritional conflict of interest between consumers and meat producers. Reports and studies show that they are edible, but the concern remains that consumers eat MPs and their derivatives due to standard meat industry practices (Ruban, 2009). The contention is if it will pose a health risk to the consumer or if the consumer would wish to eat such meat if they knew bio-based polymers means they have to eat 'edible-plastic or films. Regardless of the importance claimed by meat processors. More so, Puscaselu et al. (2020) believe that edible films are not food and have no nutritional or physicochemical properties that describe them as food even if some industrial standards regard them as food. Cenci-Goga et al. (2020) categorized the extent of use of these plastic packaging for meat according to their uses. None of these classifications shows edible films as nutrients rather they serve protection purposes even if they were from organic sources that their way into the human diet.

Research show that petrochemical plastics pose a health risk. While edible films such as sodium alginate may pose no health risk, consumers of protein polymers may experience allergies (Anderson et al., 1991; Tolouie et al., 2017). Plasticizers are another group of additives that make plastic to be easy to shape. They can migrate into the meat through plastic packaging. Hahladakis et al. (2018) in their review extensively reported more than eight (8) other plasticizers, additives, heavy metals, volatile organic compounds, and other organic compounds from other authors and their migration rate into meat and other food items. All these compounds pose a serious threat to meat consumers via packaging. Plasticizers can be cancerous and disrupt the regular function of the body system. Additives or plasticizers, like phthalates, diphthalates, and benzene alcohol from plastics have been found to affect animals' immune systems and cause hormonal imbalance and the possibility of asthma in humans. In addition, the prolonged PVC-MPs exposure during its use to package meat caused respiratory issues such as breathing difficulty, cough, and asthma (Jaakkola and Knight, 2008).

Table1: The effects of plastic packaging on meat

Packaging	Meat	Effects	References
PVC	Cured meat	Extend shelf life	Marsh and Bugusu (2017)
Low-density polyethylene (LDPE) coated with bacteriocin	Oyster, Beef	Shelf-life extension up to approximately two weeks. Reduce microbial loads	Kim et al. (2002)
Polylactic acid	Pork	Reduced *L. monocytogenes by almost 29% for about 12 days*	Yang and Song (2016)
Polybutylene succinate	Chicken	Microbial reduction, Colour stability	Yusof et al. (2021)
Etin-vinyl-acetate, PE bags	Goat	Tenderness, pH and redness preservation, microbial preservation	Fernandes et al. (2013), Sabow et al. (2016)
PE, LDPE	Bacon, Salami, Mortadella	Extend shelf life	Katsara et al. (2022)

1.3 Microplastic in meats, seafood, and health concerns

Microplastics can get into living animals from the environment and their derived products during their processing into consumable meat products via plastic packages. Katsara et al. (2022) found LDPE MPs in bacon, salami, and mortadella in a study. LDPE in these samples via migration appeared after 9 days and continued until their 28days study. These LDPE MPs migrated into the meat samples even at 4°C. Polystyrene from 6.4µm-104µm has been found to leach out of meat trays and other food containers made with PS (Ajaj et al., 2021). Polystyrene poses a health risk. Extruded polystyrene MPs fiber of a range of 300–450 µm were found in chicken (Cverenkárová et al., 2021). Similarly, according to Siddique et al. (2021), bisphenol A (BPA) MPs were found to leach into beef and chicken (between 9µg/kg to 10µg/kg and, 4 µg/kg respectively). They reported BPA to have migrated from the inner layer of plastic packaging into the meat. Dioctylphthalate and dioctyladipate (from PVC) in the range 0.12 mg/dm^2-4.8 mg/dm^2 after a week were detected ground meat (Kondyli et al., 1992). Stojanović et al. (2019) also reported beef goulash and meatballs to have contained BPA in the range 3.2-64.8 µgkg^{-1} and 21.3-31.2 µgkg^{-1} respectively. Microplastics also have the tendency of adsorbing other pollutants like polybrominated diphenyl ether (PBDE) thereby increasing their bioaccumulation and toxicity in meat (Brennecke et al., 2016). Sometimes, an extra agent such as pediocin and nisin is added to regular plastic bags for packaging meat. These extra additives added to plastic that industrially contains plasticizers already, pose more health risks. The question of whether such meat should reach consumers is a regulatory issue in different countries (Quintavalla and Vicini, 2002; Ming et al., 1997). As it is of concern, it may have adverse effects like the release of antibiotics and food poisoning in humans. Already these MPs have been found in human feces (50-500 µm) and placenta (5-10 µm) (Ragusa et al., 2021; Cverenkárová et al., 2021). De-la-Torre's (2020) study review also reported that MPs (<150 µm) can get into the human circulatory system. While MPs of size less than 20µm might get into some other organs causing cytoxicity or inflammation. Polyester, polyurethane, and chlorinated PE (in the range 44.67-210.64µm) were found in the human sputum. While PS, PE, PVC, and PE terephthalate according to Tan et al. (2020) affects the human gastrointestinal system by inhibiting nutrient assimilation. It is worth noting that meat itself carries some potential health risks for humans like obesity and heavy metal accumulation (Grosso et al., 2017; Shaheen et al., 2016). Therefore, MPs' migration into meat may further increase the potential health damage likely caused by meat. These MPs have the possibility of introducing microorganisms into the body and damaging human organs such as the kidney, spleen, intestinal tract, and liver (Wright and Kelly, 2017; Katsara, 2022). They can cause oxidative stress in human cells after exposure (e.g., PE, PS, and other MPs) in the range10ng/ml-10µg/ml (Schirinzi et al., 2017). Authors like Wright and Kelly (2017) reported their migratory mechanisms, effects, and environmental supporting factors into the human organs, blood, and body tissues and their role in harboring microbes and their consequential immune system damages. Some of the other food processing factors aiding this easy migration of MPs into the meat during processing and handling are the meat fat, temperature, and exposure duration (Katsara et al., 2022; Petersen et al., 2004; Ajaj et al., 2021).

Aside from meats, almost all seafood consumed by every family around the world contains MPs. Mostly these MPs resulted from human activities, which are currently a burden on all life forms. Of these MPs consumed by marine organisms, humans consume about 53,864 of these particles yearly (Nicole, 2021). Microplastic additives contaminate and greatly accumulate in animal body tissues when ingested. Triclosan, nonylphenol in PVC, and phenanthrene affect the feeding pattern, and oxygen intake, and more than 55% death rate in lugworms (Browne et al., 2013). Franceschini et al. (2021), suggest results that MPs ingestion affects the mortality rate, biodiversity, and feeding pattern of *N. norvegicus.* Microplastic threatens humans via marine bodies. This is because larger fishes ingest more microplastics up to 2.79mm and some of which end up in humans. Other marine life like *M. edulis*, mussels, *Calonectris leucomelas, Puffinus tenuirostris, carcinus maenas, Dosidicus gigas*, barnacles, and Holothuria, etc. at certain period ingested MPs as reported in various studies. Microplastics ingested were from

high-density polyethylene (HDPE), PVC, polychlorinated biphenyls (PCBs), and polybrominated diphenyl ethers among others. These MPs caused challenges such as feeding and breathing difficulties and eventual death (Ivar do Sul and Costa, 2014). Smith et al. (2018) also elaborated more on these MPs found in the marine environment. Table 2 shows these MPs and their environmental effects. In addition, seafood reared in monitored and controlled farms is not safe from MPs contamination (Lu et al., 2019; Feng et al., 2019). Lv et al. (2020) reported MPs ingestion by Asian swamp eels raised in a controlled environment from fertilizer and animal feed. The death of these organisms means the deposition of their carcasses. Either humans or animals continuing the chain of microplastic environmental threats eat these carcasses.

Table 2: The effect of plastic packages on the environment

Plastics packages	Microplastic contaminants	Environmental Impact	References
Conventional/Petroleum-based (Meat packaging)	Phthalic Anhydride, Stearamide, Diisooctyl phthalate, Polyethylene glycol, PVC, etc.	Persistent, GHG emission, toxic, aquatic biodiversification depletion and death, etc.	Guerreiro et al. (2018); Bishop et al. (2021)
Biobase/Edible films (Meat packaging)	Sodium alginate, cellulose, agars, starch, carrageenan, chitosan, pectin gum, plasticizers, and collagen, etc.	Biodegradable, low toxicity or non-toxic, GHG emission, etc.	Ruban (2009); Puscaselu et al. (2020); Song et al. (2021)
Meat and Non-meat packages (Others)	PS, PP, PE, PET, etc.	Chemical toxicity, carbon emission, gut clogging, digestive stress in the animal, organism weight loss and aquatic, death, etc.	Weis (2020); Ivar do Sul and Costa (2014); Guerreiro et al. (2018)

1.4 Consumer Awareness

Consumers' understanding of meat packaging goes a long way in how consumers view meat safety (Liana et al., 2010). Therefore, educating consumers on meat handling and consumption can also help in controlling MPs' intake during meat consumption. Regulations such as the EC 852/2004 in the EU are also in place around the world to mitigate challenges posed by additives and external factors to meat quality. Autio et al. (2018) explained some of these directives in detail. Some of these regulations do not compel meat processors to reveal every packaging material involved in meat production as they are voluntary labeling. This is a moral conflict of interest between producers and consumers. In a study by Mehlenbacher et al. (2011), commercially package raw meat for pets had *Salmonella* contamination without packaging warnings of this possibility. So that consumer can be well informed of processing options to eliminate such food threats. In addition, these labeling packages have bioplastic or recyclable logos on them (Kadellis et al., 2021). Data on the extent of consumer warning about labels on commercial meat packaging about MPs' migration are not available. However, most consumers are concerned more about moral obligations regarding animal welfare and information about the animals such as the meat source and rearing system. Others are concerned about expiration dates, freshness, nutritional attributes, price, and other attributes associated with meat quality (Barone and Aschemann-Witzel, 2022; Lagerkvist, 2013; Bernués et al., 2003). While some consumers of packaged meat do not totally consider the information on meat, packages and some consider them too much information (Stranieri and Banterle, 2015). According to Stranieri and Banterle (2015), of 999 consumers researched, 41%, 18%, and 6/% do not check for traceable labels, origins, and feeding systems of cattle processed into meat respectively. As regards consumers' awareness of edible packaging films, most consumers are not aware of these edible films, their safety risks, benefits, or if they are edible or not (Wan et al., 2006).

1.5 Conclusion

There is a moral need to report plastic composition on meat packages in easily understandable language by consumers and not through industry terminologies. If there is a need to process or handle meat with plastics, it is advisable to process lean meat or low-fat meat with plastic packaging to reduce the migratory effects of MPs into such products. Stakeholders should carry out more research on the extent of public awareness available about meat MPs migration. Stakeholders should also research how much of the allowable additives or edible films recommended by regulation, consumers are willing to allow in their diets.

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The use of natural products in preventive medicine and healthy life

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Abstract
Natural products, which have evolved over millions of years, have a unique chemical diversity, which results in diversity in their biological activities and drug-like properties. Natural products have a wide range of diversity of multi-dimensional chemical structures; in the meantime, the utility of natural products as biological function modifiers has also won considerable attention. As the global use of natural medicinal products continues to grow and many more new products are introduced into the market, public health issues, and concerns surrounding their safety are also increasingly recognized. Those products have become one of the most important resources for developing new lead compounds and scaffolds. Natural products will undergo continual use toward meeting the urgent need to develop effective and beneficial drugs, and they will play a leading role in the discovery of drugs for treating human diseases, especially critical diseases. The application of natural products in preclinical researches and clinical trials across the world. Besides what is stated, there are natural products applications for other chronic inflammation associated diseases such as atherosclerosis and ischemia. Hopefully, this work will provide an important knowledge for therapeutic or preventative utilities of natural products in chronic infammatory diseases.
Keywords: *Natural products, Health, Preventive medicine*.

1. Introduction

Traditional medicines make use of natural products and are of great importance. Natural products, which have evolved over millions of years, have a unique chemical diversity, which results in diversity in their biological activities and drug-like properties. Natural products have a wide range of diversity of multi-dimensional chemical structures; in the meantime, the utility of natural products as biological function modifiers has also won considerable attention.

The use of natural medicines and phytonutrients continues to expand rapidly across the world with many people nowadays resorting to these products for treatment of some health challenges in various national healthcare settings. As the global use of natural medicinal products continues to grow and many more new products are introduced into the market, public health issues, and concerns surrounding their safety are also increasingly recognized.

Natural products from the herbal remedy, medicinal plants, functional foods, and their constituent have been used for the treatment of various diseases including cancer from ancient time to recent days; increasing emphasis has been focused on the research on traditional medicine. Those products have become one of the most important resources for developing new lead compounds and scaffolds. Natural products will undergo continual use toward meeting the urgent need to develop effective and beneficial drugs, and they will play a leading role in the discovery of drugs for treating human diseases, especially critical diseases.

The application of natural products in preclinical researches and clinical trials across the world. Besides what is stated, there are natural products applications for other chronic infammation associated diseases such as atherosclerosis and ischemia.

This work presents an important information about therapeutic or preventative utilities of natural products in chronic infammatory diseases.

1.1. Natural Products

The natural products, which have evolved over millions of years, have a unique chemical diversity, which results in diversity in their biological activities and drug-like properties. Those products have become one of the most important resources for developing new lead compounds. Natural products will undergo continual use toward meeting the investigation need to develop effective medical drugs, and they will play a leading role in the discovery of medicines for treating human diseases, especially chronical diseases.

1.2. Natural Products in The Medicine

The development of new drugs relying purely on modern technology appears to be reaching something of a limit. In developing new drugs, the pharmaceutical industry has tended to adopt many throughput synthesis. But the effective efforts made in this direction have not resulted in the expected drug productivity. Various pharmaceutical companies are facing great challenges to develop new products. In the past times, increasing attention has

accordingly been paid to the natural products in the search for modern drugs in combination with novel technology, such as great throughput selection. Therefore, to promote the development of modern medical research on natural products, humans have to many efforts. Providers of medicines, such as physicians, nurses, and pharmacists, often have little training in and understanding of how herbal medicines affect the health of their patients. Most of them are also poorly informed about these products and how they are being used. Adequate training is now very essential since most patients are almost often on other types of prescription or non-prescription medicines. For this to be effective, it would be essential to create a mediumof trust to facilitate adequate sharing of knowledge about the use and safety of herbal medicines. In fact, the education of healthcare professionals, providers of herbal medicines, and patients and consumers is vital for the prevention of potentially serious risks from misuse of herbal medicines.

The natural products from the herbal remedy, medicinal plants, functional foods, and their constituent have been used to cure of different diseases including cancer from ancient time to recent times, increasing emphasis has been focused on the study on the traditional medicine such as many herbs and medicinal plants. This developing on this field requires new approaches to overcome infammation mediated diseases and these natural products could be effective sources for prevention and treatment of some diseases.

2. Conclusion

In conclusion, this great topic provides an important knowledge of the application of the natural products in preclinical researches and clinical trials in the world. In addition to, there are natural products applications for other chronic infammation associated diseases such as atherosclerosis and ischemia in the issue. Finally, this paper presented an important information for therapeutic or preventative utilities of the natural products in chronic infammatory diseases and many human diseases.

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Rural development and food security through homestead vegetable production: A case study

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Abstract

Cumilla Sadar Dakshin region is highly diverse in respect to land types, topography, agro-ecology, land-use pattern, cropping systems and crop variability & variety. systems and crop variability & variety. Agricultural development of the region largely depends on the reliable and comprehensive statistics of the existing cropping cultivation and its related system adopted by the farmers. To investigate the homestead vegetable production and its impact on family nutrition, food security, income generation as well as involvement of female members a survey study was conducted at Cumilla members a survey study was conducted at Cumilla Sadar Dakshin during 2019. A total of 150 selected homesteads were surveyed for this purpose through developed questionnaire and focus group discussion. Both primary and secondary data has been collected from different sources to fulfill the objectives of the study. The results of this study indicated that the farmer's age, marital status, education level, farm size, source of income, women participation etc. Farmer's knowledge and farming experiences, perception and attitude differs on different demographic conditions like: age, sex, education, farm size, training which significantly influence the adoption of modern technologies provided by different organizations. The results also showed that women contribution in homestead vegetable production is high in medium farmer's category 41.67% and low in small farmers 36.36% respectively. The highest number of total vegetables was produced by the medium farmer (63,732 kg/year) followed by small (39,445 kg/year) and marginal farmer (25,514 kg/year). This study provides some recommendation which might impacts on betterment of farmers' occupational and socio-economic condition by establishing proper policy and legislation both in local and national level administration as well as agricultural extension.

Key Words: *Food security, rural development, women empowerment, nutrition, homestead vegetable production.*

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Valproic Acid Prevents Oxidative Spleen Damage Due To Spinal Cord Injury By Regulating Antioxidant Enzymes In Rats

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Abstract
Spinal cord injury (SCI) is a process that damages many organs due to the occurrence of related events such as oxidative stress. Studies on finding suitable treatment drugs for this type of damage are quite scarce. Therefore, in our study, we planned to investigate the effect of secondary damage caused by spinal cord injury on spleen tissue and whether valproic acid (VPA) could have a protective role in this damage. Sixteen Wistar albino rats were divided into two equal groups. The rats in group 1 were created with SCI after laminectomy and were not treated. In the rats in group 2, SCI was created, as in group 1 and treatment of VPA (single dose 300 mg / kg intraperitoneally) was started. After decapitation of rats, the tissues taken were malondialdehid (MDA) and glutathione (GSH) levels and catalase (CAT) activities were examined as markers of oxidative stress. In order to determine the role of VPA in SCI-induced spleen tissue damage, oxidative stress and enzyme levels were examined biochemically and histologically. VPA treatment, increased GSH levels, and CAT, activities but decreased MDA levels, indicating that it improved increased oxidative damage and impaired enzymatic antioxidant levels in SCI-damaged spleen tissue homogenate. We have observed that VPA, one of the neuroprotective agents, has a significant healing effect on damaged spleen tissue induced by SCI, and this effect is associated with an improvement in the oxidant / antioxidant balance.
Keywords: Splenic, Valproic acid, CAT, MDA, GSH

Valproik Asit Sıçanlarda Antioksidan Enzimleri Düzenleyerek Omurilik Yaralanmasına Bağlı Oksidatif Dalak Hasarını Önler

Özet
Omurilik yaralanması (SCI), oksidatif stres gibi ilgili olayların ortaya çıkması nedeniyle birçok organa zarar veren bir süreçtir. Bu tür hasarlar için uygun tedavi ilaçları bulma çalışmaları oldukça azdır. Bu nedenle çalışmamızda omurilik yaralanmasının neden olduğu sekonder hasarın dalak dokusu üzerindeki etkisini ve bu hasarda valproik asidin (VPA) koruyucu bir rolü olup olamayacağını araştırmayı planladık. On altı Wistar albino sıçanı iki eşit gruba ayrıldı. Grup 1'deki sıçanlar laminektomi sonrası SCI ile oluşturuldu ve tedavi edilmedi. Grup 2'deki sıçanlarda grup 1'deki gibi SCI oluşturuldu ve VPA (intraperitoneal olarak tek doz 300 mg / kg) tedavisine başlandı. Sıçanların başını kestikten sonra alınan dokuların, oksidatif belirteç olarak malondiadehid (MDA) ve glutatyon (GSH) düzeyleri ile katalaz (CAT) aktiviteleri incelendi. VPA'nın SCI kaynaklı dalak doku hasarındaki rolünü belirlemek amacıyla lipid peroksidasyonu ve enzim düzeyleri biyokimyasal ve histolojik olarak incelendi. VPA tedavisi, GSH düzeylerini, ve CAT aktivitelerini arttırdı, ancak MDA seviyelerini düşürdü, bu da SCI hasar görmüş dalak dokusu homojenatında artmış oksidatif hasarı ve bozulmuş enzimatik antioksidan seviyelerini iyileştirdiğini gösterdi. Nöroprotektif ajanlardan biri olan VPA'nın, SCI tarafından indüklenen hasarlı dalak dokusu üzerinde önemli bir iyileştirici etkiye sahip olduğunu ve bu etkinin oksidan/antioksidan dengesinde bir iyileşme ile ilişkili olduğunu gözlemledik.
Anahtar kelimeler: Dalak, Valproik asit, CCAT, MDA, GSH

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Bioactive compound profiling and in-vitro antimicrobial study of ginger (*Zingiber officinale*) extract against pneumococcal bacteria

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Abstract

High morbidity and mortality rate associated with pneumococcal infection globally is of major concern most especially among infant. This burden is equally worsened by multidrug resistance strains due to indiscriminate consumption of antibiotic. Hence, need for constant search for cheap and effective bioactive compounds as alternative antimicrobials for the treatment of pneumococcal infection. Bioactive compound profiling and *in-vitro* antibacterial activity of ginger crude methanol extract against two predominant pneumococcal agents; *Streptococcus pneumonia* and *Haemophilus influenza* were investigated. Gas Chromatography Mass Spectroscopy (GC-MS) was used for the identification and quantification of bioactive compounds in the ginger crude methanol extract. The antibacterial activity and Minimum Inhibitory Concentration (MIC) of the extract was determined using Agar well diffusion. Twenty-seven (27) matched bioactive compounds were detected in the sample. Zingerone (17.70%), α-zingiberene (13.30%), (6)-shogaol (10.84%), α-Farnesene (6.26%), β-Funebrene (5.61%), 6-gingerol (5.18%), α-curcumene (4.15%) were the major compounds present. All other identified compounds had less than 4% composition by peak area each. The antibacterial activity of the ginger crude methanol extract against *S. pneumonia* and *H. influenza* were 2.33 mm and 9.33 mm. MIC of the extract against the isolates was 10%. In conclusion ginger crude methanol extract contain an array of bioactive compounds and the extract exhibited antibacterial activity against predominant pneumococcal agents. Ginger extract can be harnessed for the production of new antimicrobials to combat pneumococcal infection.

ID:537

Green synthesis, Characterization and Antimicrobial potential of Selenium Nanoparticles from *Ocimum gratissimum*

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Abstract

Ocimum gratissimum is a perennial herbaceous plant used in the treatment of fungal and bacterial infections. Green synthesis has provided cost effective, environment friendly procedure and raising safe strategies for the synthesis of nanoparticles. This study was aimed at investigating the potential of *O. gratissimum* for the synthesis of selenium nanoparticles (SeNPs) and their antimicrobial activities. Phytochemical screening on aqueous extract was carried out using standard procedures. Selenium nanoparticles was biosynthesized by *O. gratissimum* and characterized using Visual detection, UV-Visible spectroscopy, Scanning Electron Microscope, Transmission Electron Microscope, Energy dispersive X-ray, Fourier Transform Infra-red spectroscopy and X-ray diffraction spectroscopy. Antimicrobial activity of the biosynthesized selenium nanoparticles by *O. gratissimum* was done using agar well diffusion method. Saponins, tannins, cardiac glycosides, terpenoids and phenols were present. The biosynthesized SeNPs had a strong plasmon resonance band at 300 nm, changes in colour from dark brown to ruby red. The SeNPs were spherical and aggregated with varying shapes and size ranged from 20 – 50 nm. Strong signal of selenium element was observed. Hydroxyl, esters, aldehyde, alkane and amine are present and responsible for the efficient stabilization and bioreduction of Selenium nanoparticle. Furthermore, biosynthesized SeNPs by *O. gratissimum* (OGSeNPs) exhibited higher antimicrobial activity against both Gram positive and Gram negative bacteria. Green synthesis of nanoparticles is a promising method in the biomedical field, due to its high bioactive components.

Keywords: *Ocimum gratissimum*, Selenium nanoparticles, phytochemical screening, Inhibitory effect, Green synthesis

ID:538

Ultrasound Assisted Extraction and Optimization of Pectin From Pumpkin Peels

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Abstract

In this study, pectin was produced from pumpkin peels by ultrasound assisted extraction method and the physicochemical properties of the produced pectin were compared with the pectin produced by the classical extraction (KE) method. Ultrasound assisted extraction (UAE) was optimized by the response surface method for the pectin yield. The optimum extraction conditions for ultrasound assisted extraction (UAE) were determined as 10.6 ml/g liquid/solid ratio, 33.42 minutes and pH 1.04 and the pectin yield obtained at these optimum conditions was determined as 9.02%. It was determined that the structure of the pectin was similar to pectin ontained by KE method as results of the FTIR analysis. In addition, pectins obtained by both methods were determined to be high methoxyl pectin (DE>50). The solubility, emulsion activity and stability of pectin produced by the UDE method were found to be higher than the pectin produced by the KE method. The foam capacity and stability of pectin produced with KE were found to be higher than pectin produced by UAE method. This study showed that pumpkin peels can be used as a raw material for pectin and UAE method can be used effectively in the isolation of pectin from pumpkin peels.

Key Words: *Pectin, Extraction, Ultrasound, Pumpkin Peel, Waste*

Bal Kabağı Kabuklarından Ultrason Destekli Yöntem ile Pektin Ekstraksiyonu ve Optimizasyonu

Özet

Bu çalışmada, bal kabağı kabuklarından ultrason destekli ekstraksiyon yöntemi ile pektin üretilmiş ve üretilen pektinin fizikokimyasal özellikleri klasik ekstraksiyon yöntemi ile üretilen pektinle karşılaştırılmıştır. Ultrason destekli ekstraksiyon (UDE) pektin verimi için yanıt yüzey yöntemi ile optimize edilmiştir ve optimum ekstraksiyon koşulları, 10.6 ml/g sıvı/katı oranı, 33.42 dakika, 1.04 pH olarak belirlenmiştir. Bu koşullarda elde edilen pektin verimi, %9.02 olarak tespit edilmiştir. FTIR analizi sonucunda pektinin yapısının KE yöntemi ile elde edilen pektine benzer olduğu belirlendi. Ayrıca iki yöntemle de elde edilen pektinlerin yüksek metoksilli pektin (DE>50) olduğu belirlenmiştir. UDE yöntemi ile üretilen pektinin çözünürlüğü, emülsiyon aktivitesi ve stabilitesi KE yöntemi ile üretilen pektine göre daha yüksek bulunmuştur. KE ile üretilen pektinin köpük kapasitesi ve stabilitesi, UDE yöntemi ile üretilen pektine göre daha yüksek olduğu tespit edilmiştir. Bu çalışma bal kabağı kabuklarının pektin için hammadde olarak ve UDE yönteminin de balkabağı kabuklarından pektin izolasyonunda etkili bir şekilde kullanılabileceğini göstermiştir.

Anahtar Kelimeler: *Pektin, Ekstraksiyon, Ultrason, Bal kabağı kabuğu, Atık*

ID: 539

Potential Antifungal Effects of Cumin Seed Oil on *Fusarium graminearum*

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Abstract
Fusarium graminearum is one of the most important phytopathogens worldwide. It causes head blight disease in cereals. Plant derived essential oils have been used in fight against phytopathogenic fungi in recent years. In this study, antifungal effect of cumin seed oil was tested on *F. graminearum*. For this purpose; (i) minimum inhibitory concentration (MIC) and half maximum inhibitory (IC_{50}) values were detected by agar dilution technique, (ii) genomic/epigenomic alterations were evaluated by coupled restriction enzyme digestion-random amplification (CRED-RA) method, (iii) oxidative stress and deoxynivalenol synthesis were investigated by *cat* and *tri6* gene expression assays. Firstly, MIC and IC_{50} values were detected as 0.5 and 0.25 mg mL^{-1} cumin seed oil treatment, respectively. In CRED-RA assays, genomic template stability (GTS) and % polymorphism for *Hap*II/*Msp*I values were 96.49% and 24.3/35.8%, respectively. In gene expression analysis, fold changes in *cat* and *tri6* genes expression were recorded as 5.29±0.74 and 0.66±0.06. According to our findings, cumin seed oil has strong antifungal effect by causing growth inhibition, decreased GTS, epigenomic alterations, oxidative stress increase and deoxynivalenol decrease on *F. graminearum*. Further studies could include apoptotic and autophagy effects of cumin seed oil on *F. graminearum* and related fungi.
Key Words: *Cumin seed oil, Fusarium graminearum, Gene Expression, Oxidative stress, Polymorphism*

Kimyon Tohum Yağının *Fusarium graminearum* Üzerindeki Potansiyel Antifungal Etkileri

Özet
Fusarium graminearum dünyadaki en önemli bitki patojenlerinden birisidir. Tahıllarda başak yanıklığı hastalığına yol açmaktadır. Bitki türevli esensiyal yağlar son yıllarda fitopatojenik funguslarla mücadelede kullanılmaktadır. Mevcut çalışmada kimyon tohum yağının *F. graminearum* üzerindeki antifungal etkisi test edilmiştir. Bu amaçla; (i) minimum inhibitor konsantrasyonu (MİK) ve yarı inhibitor konsantrasyon (IC_{50}) değerleri agar dilüsyon tekniği ile saptandı, (ii) genomik/epigenomik değişimler çift restriksiyon enzimi kesimi ve rastgele çoğaltım (CRED-RA) metodu ile değerlendirildi, (iii) oksidatif stres ve deoksinivalenol sentezi *cat* ve *tri6* gen anlatımı analizleri ile irdelendi. İlk olarak, MİK ve IC_{50} değerleri, sırasıyla, 0.5 ve 0.25 mg mL^{-1} kimyon tohum yağı uygulaması olarak belirlendi. CRED-RA analizlerinde, genomik kalıp stabilitesi (GKS) ve *Hap*II/*Msp*I % polimorfizm değerleri, sırasıyla, %96.49 ve %24.3/35.8 olarak belirlendi. Gen anlatım analizlerinde *cat* ve *tri6* gen anlatımlarının oransal değişimleri 5.29±0.74 ve 0.66±0.06 olarak belirlendi. Bulgularımıza göre, kimyon tohum yağı *F. graminearum* üzerinde kuvvetli bir antifungal etki göstermiştir ki bu da üremenin baskılanması, düşmüş GKS, epigenomik değişimler, oksidatif stres artışı ve deoksinivalenol azalması ile olmuştur. İlerde yapılması hedeflenen çalışmalar *F. graminearum* ve ilişkili mantarlarda kimyon tohum yağının apoptoz ve otofaji etkilerini içerebilir.
Anahtar Kelimeler: *Kimyon tohum yağı, Fusarium graminearum, Gen anlatımı, Oksidatif stres, Polimorfizm*

ID: 540

Genetic characterisation of *Fusarium culmorum* isolates from Çanakkale

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Abstract
Fusarium culmorum is the predominant causal agent of fusarium head blight (FHB) in many Mediterranean regions. In this study, a detailed genetic characterisation of *F. culmorum* isolates obtained from wheat samples collected from the Çanakkale province (Turkey) in the year 2021, was carried out. A total of 45 monosporic cultures were obtained and identified at species level by morphological characteristics. *Tef1-α* sequencing was also carried out to confirm the identification at species level. For this purpose, gDNA was extracted from 7-d-old potato dextrose agar (PDA) cultures. A portion of the *Tef1-α* gene was amplified and sequenced from all isolates. The sequences were subjected to BlastN analysis. In linear growth rate (LGR) analysis, 4th and 7th day of PDA cultures were used in calculation the radial growth. LGR results showed that isolates were clustered in single groups as 10<x<20 mm/day. Minimum and maximum mean LGR values were recorded as 11.51 and 16.32 mm/day, respectively. All 45 monosporic isolates, obtained from Sutlucekoy and Bayirkoy regions (Çanakkale Province), were identified as *F. culmorum*. Class B chemotype assays were also carried out in *F. culmorum* isolates by PCR assay. The *TRI12* gene was amplified to distinguish isolates as 3-acetyldeoxinivalenol (3-ADON) or nivalenol (NIV) producers. All isolates belonged to 3-ADON chemotype and to *MAT1-2* idiomorph. Further studies will be extended to a larger number of isolates from different regions in order to provide a comprehensive set of data on the *Fusarium* populations causing FHB in this area.
Key Words: *Çanakkale, Fusarium culmorum, Fusarium head blight, PCR, TRI12*

Çanakkale kökenli *Fusarium culmorum* izolatlarının genetik karakterizasyonu

Özet
Fusarium culmorum, birçok Akdeniz bölgesinde fusarium baş yanıklığının (FHB) baskın hastalık etmenidir. Bu çalışmada, 2021 yılında Çanakkale ilinden (Türkiye) toplanan buğday örneklerinden elde edilen *F. culmorum* izolatlarının detaylı genetik karakterizasyonu yapılmıştır. Toplam 45 monosporik kültür elde edilmiş ve tür düzeyinde morfolojik özelliklere göre tanımlanmıştır. Ayrıca *Tef1-α* sekans analizi ile tür düzeyinde tanımlama doğrulandı. Bu amaçla, 7 günlük patates dekstroz agar (PDA) kültürlerinden gDNA ekstrakte edildi. Tüm izolatlardan *Tef1-a* geninin bir kısmı çoğaltıldı ve sekanslandı. Diziler BlastN analizine tabi tutuldu. Lineer büyüme oranı (LGR) analizinde radyal büyümenin hesaplanmasında 4. ve 7. gün PDA kültürleri kullanıldı. LGR sonuçları, izolatların 10<x<20 mm/gün olarak tek grup halinde kümelendiğini göstermiştir. Minimum ve maksimum ortalama LGR değerleri sırasıyla 11.51 ve 16.32 mm/gün olarak kaydedildi. Sütlüceköy ve Bayırköy bölgelerinden (Çanakkale İli) elde edilen 45 monosporik izolatın tamamı *F. culmorum* olarak tanımlandı. *F. culmorum* izolatlarında PCR aracılığı ile B sınıfı kemotip analizleri de gerçekleştirilmiştir. *TRI12* geni, izolatları 3-asetildeoksinivalenol (3-ADON) veya nivalenol (NIV) üreticileri olarak ayırt etmek için çoğaltıldı. Tüm izolatların 3-ADON kemotipi ve MAT1-2 idiomorfuna ait oldukları belirlendi. Bu alanda FHB'ye neden olan *Fusarium* popülasyonları hakkında kapsamlı bir veri seti sağlamak için farklı bölgelerden daha fazla sayıda izolata yönelik ileri çalışmalar genişletilecektir.
Anahtar Kelimeler: *Çanakkale, Fusarium culmorum, Fusarium başak yanıklığı, PCR, TRI12*

ID: 541

Environmental effects of food production systems and dietary models

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Abstract

Environmental health is one of the factors affecting human health. In addition to the increase in fuel oil, water and agricultural land use due to common dietary habits, some critical environmental problems such as the decrease in biodiversity caused by climate change are on the global agenda. There is a risk that all these problems will lead to depletion of water and food resources, food insecurity and inequalities in access to food sources. The dietary models widely consumed by communities and changing dietary habits lead to negative developments in terms of both human and environmental health. It is emphasized that these widely consumed nutrition models and food production systems are not sustainable for future generations. With the global population growth, environmental problems caused by climate change and the increase in the consumption of animal-derived foods reveal the importance of the need for sustainable nutrition models. For this reason, the contribution of the transition to sustainable nutrition models that protect environmental health on a global scale is very important for the protection of environmental health and the prevention of climate change. Sustainable nutrition models contribute to food safety and security as they have lower negative environmental impacts and support a healthier life for individuals. In order to lead to a positive transformation in nutrition models, it is important to raise awareness of consumers as well as politicians and food producers about sustainable nutrition.

Key Words: *Dietary models, climate change, greenhouse gas emissions, sustainable nutrition*

Besin üretim sistemleri ve beslenme modellerinin çevresel etkileri

Özet

Çevre sağlığı insan sağlığını etkileyen faktörlerden birisidir. Yaygın beslenme alışkanlıkları nedeniyle petrol, su ve tarım arazisi kullanımının artmasının yanı sıra, iklim değişikliğinin neden olduğu biyolojik çeşitliliğin azalması gibi bazı kritik çevre sorunları dünya gündemindedir. Tüm bu sorunların su ve besin kaynaklarının tükenmesine, besin güvencesizliğine ve besin kaynaklarına ulaşmada eşitsizliklerin yaşanmasına neden olması riski söz konusudur. Toplumların yaygın olarak tükettiği beslenme modelleri ve değişen beslenme alışkanlıkları hem insan hem de çevre sağlığı açısından olumsuz gelişmelere yol açmaktadır. Yaygın olarak tüketilen bu beslenme modellerinin ve besin üretim sistemlerinin gelecek nesiller için sürdürülebilir olmadığı vurgulanmaktadır. Küresel nüfus artışı ile birlikte iklim değişikliğinin ortaya çıkardığı çevre sorunları ve hayvansal kaynaklı besinlerin tüketiminin artması, toplumların sürdürülebilir beslenme modellerine duyduğu ihtiyacın önemini ortaya çıkarmaktadır. Bu nedenle, küresel boyutta çevre sağlığını koruyan sürdürülebilir beslenme modellerine geçişin çevre sağlığının korunması ve iklim değişikliğinin önlenmesine katkısı oldukça önemlidir. Sürdürülebilir beslenme modelleri, olumsuz çevresel etkilerinin daha düşük olması ve bireyler için daha sağlıklı bir yaşamı desteklemesi nedeniyle, besin güvenliği ve güvencesine katkıda bulunmaktadır. Beslenme modellerinde olumlu bir dönüşüme yol açabilmek için tüketicilerin yanı sıra, politikacılar ve besin üreticilerinin de sürdürülebilir beslenme ile ilgili farkındalıklarını sağlamak önemlidir.

Anahtar Kelimeler: *Beslenme modelleri, iklim değişikliği, sera gazı salınımı, sürdürülebilir beslenme*

Giriş

Mevcut küresel besin üretim sistemleri, dünyanın doğal kaynaklarının tüketimine ve önemli miktarda sera gazı salınımına neden olmaktadır. Toplumların yaygın olarak tükettiği beslenme modelleri ve değişen beslenme alışkanlıkları hem insan hem de çevre sağlığı açısından olumsuz gelişmelere yol açmaktadır(Garnett, 2011; Harris et al., 2020; Johnston et al., 2014; Vermeulen et al., 2012). Besin üretim sistemleri sera gazı salınımı, tatlı su kaynaklarının tüketimi, petrol ve tarım arazilerinin kullanımının artmasına yol açtığı için çevre sağlığı üzerinde olumsuz etkileri olduğu bilinmektedir (Marlow et al., 2009; Tobler et al., 2011; Tukker & Jansen, 2006).

Toplumların tükettiği beslenme modelleri, sürdürülebilir beslenmeyi etkileyen önemli bir bileşen olup; toplumlar besin seçimleriyle çevre sağlığını önemli düzeyde etkilemektedir (Tobler et al., 2011; Willett et al., 2019). Günümüzde toplumların yaygın olarak tükettiği, çevre üzerinde olumsuz etkileri olan beslenme modelleri ve değişen beslenme alışkanlıkları çevre sağlığını ciddi boyutta tehdit etmektedir (Garnett, 2011; Harris et al., 2020; Johnston et al., 2014; Vermeulen et al., 2012). Yaygın olarak tüketilen bu beslenme modellerinin ve besin üretim sistemlerinin gelecek nesiller için sürdürülebilir olmadığı öngörülmektedir (van Dooren et al., 2014).

Beslenme modellerinin insan sağlığı üzerindeki etkileri daha kolay açıklanabilirken, çevre sağlığı üzerindeki etkilerini analiz etmek daha karmaşıktır. Bu nedenle, çeşitli beslenme modellerinin sürdürülebilir beslenmenin sağlanmasına katkısının ölçülmesi oldukça önemlidir (Garnett, 2011; Harris et al., 2020; Vermeulen et al., 2012).

Daha sağlıklı beslenme modellerine geçişin, sera gazı salınımı ve su ayak izinin azaltılması da dâhil olmak üzere birçok çevresel fayda sağlayabileceği vurgulanmaktadır (Vanham et al., 2018). Bunun için atılması gereken en önemli adım özellikle tüketiciler başta olmak üzere, politikacılar ve besin üreticilerinin de sürdürülebilir beslenme ile ilgili farkındalıklarını sağlamaktır.

Besin Üretim Sistemlerinin Çevresel Etkileri

Endüstriyel faaliyetlerin yanı sıra, toplumun beslenme alışkanlıkları tarımsal ürünlerin üretimi ve yetiştirilmesine ilişkin tüm süreçler ile pişirme ve atık yönetimi önemli düzeyde çevresel etkilere sahiptir (González-García et al., 2018). Bir ürünün ya da faaliyetin üretiminden başlayarak taşıma, kullanım ve yok edilmesi de dâhil yaşam döngüsünün tüm aşamalarında ortaya çıkan ve biriken CO2 emisyonunun ölçümüne "karbon ayak izi" adı verilmektedir (Mancini et al., 2016). Karbon ayak izi, tipik olarak karbondioksit eşdeğeri (CO2e) olarak ifade edilen ve CO2, CH4 ile N2O emisyonları dâhil olmak üzere sera gazı emisyonlarının miktarını açıklamaktadır (Wiedmann & Minx, 2007) "Su ayak izi" üretilen veya tüketilen her ürün ya da alınan hizmet için gerekli olan su miktarı olarak tanımlanmaktadır. Başka bir ifade ile üretimde tedarik zinciri boyunca kullanılan ve kirletilen suyu ifade etmektedir (Egan, 2011; Lovarelli et al., 2016). Su ayak izi genellikle "mavi", "yeşil" ve "gri su ayak izi" olmak üzere üç bileşene ayrılmaktadır (Egan, 2011; Lovarelli et al., 2016). "Mavi su ayak izi", bir ürünün üretimi için yüzey ve yer altı su kaynaklarından kullanılan tatlı su miktarını ifade etmektedir. "Yeşil su ayak izi", bir ürün üretmek için topraktan buharlaşan, köklerden emilen ve ürün tarafından kullanılan yağmur suyu miktarını ifade etmektedir. "Gri su ayak izi" ise, yerel su kalitesi standartlarını sağlamak için belirli bir faaliyetle ilişkili kirleticilerin azaltılması veya bertaraf edilmesinde kullanılan tatlı su miktarını ifade etmektedir (Egan, 2011; Lovarelli et al., 2016).

Tarımsal üretim, iklim değişikliğini ele alan ve artan küresel nüfus için gıda güvenliğini sağlama girişimlerini hedefleyen önemli bir sektör haline gelmiştir(Loboguerrero et al., 2019) Besin zincirinde yer alan bir ürünün üretimi, dağıtımı, depolanması, hazırlaması, pişirilmesi ve atıkların bertaraf edilmesine kadar her süreçte sera gazı salınımı oluşmaktadır (Elferink et al., 2008). Sera gazı, dünyanın yüzeyindeki, atmosfer ve bulutlar tarafından yayılan kızılötesi radyasyon spektrumu dâhilinde belirli dalga boylarındaki radyasyonu emen ve yayan, atmosferin hem doğal hem de antropojenik gaz halindeki bileşenleridir (Batlle-Bayer et al., 2019). Su buharı, karbondioksit, nitröz oksit, metan ve ozon başlıca sera gazlarıdır. Sera gazlarının atmosferdeki miktarı sera gazı salınımını ifade etmektedir. Küresel sera gazı salınımını azaltmak için daha fazla önlem alınmazsa, küresel ısınmanın sanayileşme öncesi seviyelerin yaklaşık 2oC üzerinde olacağı hesaplanmıştır. Böyle bir gelişmenin dünyanın kara ve deniz seviyeleri üzerinde büyük bir etkiye sahip olacağı ve dünyadaki her ülkenin ekonomik ve sosyal gelişimini etkileyeceği ön görülmektedir (Zheng et al., 2019).

Gıda ve Tarım Örgütü (Food and Agriculture Organization, FAO) raporuna göre dünya nüfusunun 2050 yılında kadar yaklaşık 9.7 milyar civarında olması beklenmektedir. Bu senaryoda, gelecekteki küresel nüfusun beslenme ihtiyaçlarını karşılamak için mevcut tarımsal üretim kapasitesinin yaklaşık olarak %60 oranında artırılması gerektiği bildirilmiştir (Food and Agriculture Organization, 2012). Ancak, mevcut tarımsal üretim dünya genelinde sera gazı salınımının yaklaşık %20'sinden ve tatlı su kaynaklarının tüketiminin yaklaşık %70'inden sorumludur (Food and Agriculture Organization, 2017a). Bu durumda, tarımsal üretimin artması dünyanın tatlı su kaynaklarını azaltarak, atmosfere sera gazı salınımını arttıracaktır (Food and Agriculture Organization, 2017b). Bu nedenle, küresel nüfus artışı ile birlikte iklim değişikliğinin ortaya çıkardığı çevre sorunları ve hayvansal kaynaklı besinlerin tüketiminin artması, toplumların sürdürülebilir beslenme modellerine duyduğu ihtiyacın önemini ortaya çıkarmaktadır (Food and Agriculture Organization, 2019; Harris et al., 2020; Willett et al., 2019).

Birleşmiş Milletler Çevre Programı (United Nations Environment Programme, UNEP) tarafından yayınlanan bir raporda, "yeşil ekonomi; birtakım çevresel riskleri ve ekolojik kıtlıkları azaltırken, aynı zamanda toplum refahını da sağlayan ekonomik bir model" olarak tanımlanmaktadır. Bu bağlamda, yeşil ve döngüsel bir ekonomi gerek yatırımlar gerekse büyüme stratejileri belirlenirken sera gazı emisyonlarının azaltılması ile enerji ve kaynak verimliliğinin artırılmasının gözetilmesini gerektirmektedir. Yeşil ve döngüsel ekonomi hedeflerinin bir arada ele alınması ve bu kapsamda geliştirilecek faaliyetlerin hem üretici hem de tüketicileri kapsayan bütüncül bir yaklaşımla hayata geçirilmesi önem arz etmektedir. Bu alanda Avrupa Birliği (AB) tarafından açıklanan hedefler, Yeşil Mutabakat hedefleri ve Yeni Sanayi Stratejisi doğrultusunda 11 Mart 2020 tarihinde "Döngüsel Ekonomi Eylem Planı" ile raporlanmıştır. Yeşil Mutabakat hedefleri doğrultusunda, sürdürülebilir tüketim ve üretimin geliştirilmesini desteklemede, çevrenin bir bütün olarak korunması amacıyla sürdürülebilir tüketim ve üretim eylem planının hazırlanması önem teşkil etmektedir (Ticaret Bakanlığı, 2021).

Beslenme Modellerinin Çevresel Etkileri

Çevre ve insan sağlığı birbirilerini doğrudan etkilemektedir (Marlow et al., 2009; Tobler et al., 2011; Tukker & Jansen, 2006). Mevcut doğal kaynaklardaki sınırlılık ile birlikte küresel nüfus artışının görülmesi, sürdürülebilir diyet modellerine geçişin önemini artırmaktadır (Garnett et al., 2013). Ekosistemdeki bozulmanın en önemli sorumlusunun günümüzdeki besin üretim sistemleri ve beslenme modelleri olduğu bilinmektedir. Batı ülkelerindeki besin tüketiminin dünyadaki toplam çevresel etkinin yaklaşık olarak %20-30'undan sorumlu olduğu

bildirilmiştir (Garnett, 2011; Tukker & Jansen, 2006). Bu nedenle, özellikle Batı ülkelerde et tüketiminin azaltılması ve bitki bazlı diyetlere geçişin; iklim hedeflerine ulaşmak, halk sağlığı sorunlarını ele almak ve hayvan refahını korumak için çok önemli olduğu vurgulanmaktadır (Kwasny et al., 2022).

Besin gruplarının küresel ısınmaya katkıları değerlendirildiğinde; et ve et ürünlerinin en yüksek küresel ısınma katkısına, tahıl, meyve ve sebze gruplarının ise en düşük küresel ısınma katkısına sahip olduğu gösterilmiştir (Meier et al., 2022). Günümüzde tüketicilerden gelen taleplerin artması nedeniyle, besin üretim sistemlerinde et ve et ürünlerinin üretiminde giderek artış olduğu bilinmektedir (Kwasny et al., 2022). Gelişmiş bir ülkedeki bir tüketicinin et ve et ürünleri temelli bir diyetten bitkisel ürün temelli bir diyete geçtiğinde, su ayak izinin ortalama %36 oranında azalabileceği belirlenmiştir (Colombo et al., 2021). Ayrıca, besin üretim sektöründe zamanla biyolojik çeşitlilik kaybına neden olan sera gazı emisyonları ve su tüketimi açısından da et ve et ürünlerinin üretiminin ön planda olduğu bilinmektedir (Marlow ve ark., 2009). Pimentel ve ark. (2003) nüfus artışına ve temelde hayvansal kaynaklı besinlere dayalı diyetlerin dünyanın doğal kaynaklarının sürdürülebilir kullanımını açıkça tehdit ettiğini bildirmiştir. Bu çalışmalar et tüketim miktarındaki azalmayla hem halk sağlığı hem de çevresel etki açısından fayda sağlanabileceğine işaret etmektedir(Laestadius et al., 2013) .

Tarım ve hayvancılık faaliyetleri sırasında oluşan sera gazı emisyonlarının nedeni, doğal gübreleme ve azotlu suni gübreleme uygulamalarından kaynaklanan nitröz oksit (N_2O) ile geviş getiren hayvanların bağırsaklarında gerçekleşen fermantasyon ve anaerobik gübreleme sırasında salınan metan gazıdır (CH_4) (Kumar et al., 2022). Nitröz oksit ve metan gazının küresel ısınma potansiyeli karbondioksitten daha fazladır (Elin Röös, 2013). Hayvansal ürünlere yönelik artan tüketici taleplerinden dolayı, ormanlık arazilerin tarımsal ve hayvansal ürün üretimi için kullanımı, besin üretim sisteminden kaynaklanan sera gazı emisyonlarının artışının en temel nedenidir (Clark & Tilman, 2017).

Diyet modellerinin değişimi ile daha sağlıklı bir gezegen

Sürdürülebilir besin sistemleri ile sürdürülebilir beslenmenin yaygınlaştırılmasını sağlamak, küresel besin sistemini dönüştürmek için büyük ölçekli ve koordineli çabaları içeren bilimsel kanıtlara ihtiyacın olduğu vurgulanmaktadır (Willett et al., 2019). Bu nedenle, 2019 yılında, 16 ülkeden 19 komisyon üyesi ve 18 bilim insanı; sağlıklı beslenme ve sürdürülebilir besin üretimini sağlamak ve yaygınlaştırmak için, bilimsel kanıtlara dayalı olan küresel hedefler geliştirmek adına bir araya gelerek, "EAT-Lancet" adı altında bir komisyon oluşturmuşlardır (Willett et al., 2019). Birleşmiş Milletler (BM) Sürdürülebilir Kalkınma ve Paris İklim Anlaşması Hedeflerine ulaşmak için toplumda sağlıklı ve sürdürülebilir besin üretim sistemleri ile beslenme modellerine dönüşüm gereklidir. Bu nedenle, "Büyük Besin Dönüşümü (Great Food Transformation)" olarak vurgulanan sağlıklı ve sürdürülebilir beslenme modelleri ve besin üretim sistemleri için bilimsel kanıtlara ihtiyaç vardır (Willett et al., 2019).

EAT-Lancet Komisyonunun önerdiği bilimsel hedeflerden birisi; "Sürdürülebilir besin üretim sistemleri ile sağlıklı ve sürdürülebilir beslenme modellerine yönelik bilimsel hedeflere ulaşmak, aile planlaması ve sağlıklı beslenme eğitimini bütünleştiren yüksek kaliteli birinci basamak sağlık hizmetlerini sağlamaya bağlı olacaktır." şekilde beyan edilmiştir (Willett et al., 2019). Bu nedenle, toplumda beslenme sorunlarının saptanması ve bunlara çözüm önerileri geliştirebilme konusunda özellikle öncül meslek mensuplarının mezuniyet öncesinde eğitim müfredatına sürdürülebilir beslenme eğitiminin eklenmesi önemlidir. Ayrıca, besin üretim endüstrisi besinleri işleme sürecindeki kayıplar, besin israfı ve besin paketlemenin oluşturduğu olumsuz çevresel etkiler ile ilgili olarak düzenlemeler yapmalıdır (Aylin Alsaffar, 2015)

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ID: 543

Effects of Land, Use Land Cover and Slope Gradients on Soil Fertility at Kori Sub-Watershed, East Wollega, Ethiopia

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Abstract

The complex nature of the relationship and interaction between land use land cover (LULC) and slope gradients resulted in a decrease in soil fertility parameters, exacerbating the reduction in sustainable productivity in Ethiopia in general and the study area in particular. The purpose of this research was to assess the effects of land use, land cover, and slope classes on the physicochemical properties of soil. With three replications, a total of 27 composite soil samples were collected from 0-20 cm depth under three dominant adjacent land use types across three slopes. Soil samples were collected and analyzed for selected soil properties. The mean differences were tested using two-way ANOVA.

SOC, TN, AvP, CEC, exchangeable bases (Ca^{2+} Mg^{2+}, K^{+}, and Na^{+}), PBS, and clay contents percentage of cultivated soil and steep slope gradient (15-30%) were lower and significantly different ($P \leq 0.05$) from forest and grazing soils on the same slope gradient. In comparison to the others, the gentle slope (3-8 percent) classes of the forest lands had the lowest BD and the highest TP.

The steep slope gradient (15-30%) of cultivated soil has a worse overall soil fertility condition than the other, and cultivating the steep slope is the cause of productivity loss in the research sub-watershed. As a result, efficient land-use planning and the implementation of an integrated soil management strategy result in increased production and improved soil productiveness status.

Keywords*: Land-use, land cover, slope gradients, soil properties, sub-watershed.*

ID:544

Productivity, forage quality and capacity of Trifolieta-Thymusetum-Festucosum formation in the territory of Lerik district

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Abstract

The change of the multi-year average productivity of the *Trifolieta-Thymusetum-Festucosum* formation (On the territory of Lerik region, the summer pasture No. 12, which is not grazed, the area "Chaparlanan" spreads on grassy mountain-meadow lands**)** during the years 2019-2020-2021 (in the summer season) was determined to be 9.4-12.4 s/ha (table 1).

It can be seen from the table that the drying coefficient of the phytomass in determining the productivity of the formation is equal to 2.3-2.8.

In the first year (2019) of the study, the wet mass was 28.6 s/ha - *Poaceae*11.4 s/ha (39.9%), *Fabaceae* 9.2 s/ha (32.2%), *Herboseta* 8.0 s/ha (27.9%); dry mass was 5.4 s/ha (43.5%), *Poaceae* 3.7 s/ha (29.9%) *Fabaceae* , and 3.3 s/ha (26.6%) *Herboseta*.

Thus, in July of that year (according to the multi-year data of the meteorological station of the region), the average monthly air temperature rose to 30-370C and the average annual amount of precipitation was 640 mm.

In 2020, the average annual productivity of the formation in terms of dry edible mass is set at 9.4 s/ha; 5.2 s/ha (55.3%) of *Poaceae*, 2.8 s/ha (29.8%) of *Fabaceae* and 1.4 s/ha (14.9%) of *Herboseta* were recorded.

Table 1

The average annual productivity of the *Trifolieta-Thymusetum-Festucosum* formation spread in the “Gizyurdu” summer pasture area No. 12 in the territory of Lerik region.

Years nd months	Botanical herb groups	Dry mass		Dry edible mass	
		With s/ha	With %	With s/ha	With %
2019 (July 10-15)	Poaceae	11,4	39,9	5,4	43,5
	Fabaceae	9,2	32,2	3,7	29,9
	Herboseta	8,0	27,9	3,3	26,6
	Average annual productivity	28,6	100,0	12,4	100,0
2020 (July 15-20)	Poaceae	12,5	55,4	5,2	55,3
	Fabaceae	6,7	29,6	2,8	29,8
	Herboseta	3,4	15,0	1,4	14,9
	Average annual productivity	22,6	100,0	9,4	100,0
2021 (July 20-25)	Poaceae	12,7	42,1	4,9	45,4
	Fabaceae	7,7	25,5	2,4	22,2
	Herboseta	9,8	32,4	3,5	32,4
	Average annual productivity	30,2	100,0	10,8	100,0

In the third (2021) year of the study (July 20-25), it has a higher yield (in dry edible mass) (10.8 s/ha) in the same phytocenosis (table 1). Among them, 4.9 s/ha (45.4%) of *Poaceae*, 2.4 s/ha (22.2%) of *Fabaceae* and 3.5 s/ha (32.4%) of *Herboseta* were also designated.

It is possible to determine the capacity (1154 heads of small horned cattle) of the pasture area (on 296 ha) in the summer pasture "Gizyurdu" (No. 12) with the calculation of 3.9 heads, on the condition that the three-year average productivity of the Trifolieta-Thymusetum-Festucosum formation are accepted as (10.9 s/ha), feed unit accepted as (55.3 kg), as well as the period of use of phytocenosis (120 days) and the daily feed rate of cattle accepted as 1.3 fodder units.

In general, taking into account the average annual productivity of the corresponding formation, the capacity per hectare of fodder quality, this phytocenosis can be attributed to the good quality pasture group. First of all, effective use of vegetation and implementation of surface improvement measures is appropriate.

ID: 545

Comparative study on the prevalence of parthenocarpic embryos development in fruit formation between olive cultivars

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Abstract
Parthenocarpic fruits reduce olive ((*Olea europaea L*.) productivity significantly. Instead of the development of a single functioning ovule in normal fertilized ovaries, the start of parthenocarpic embryos is resulting from the expansion of more than one ovule. This study was carried out to evaluate parthenocarpic incidence among seven olive cultivars in Mediterranean basin. Thirty inflorescences per olive cultivar were collected during the 8th week after anthesis, and fixed in a combination of formalin (2cc), Acetic acid (2cc), and 70% ethanol (10cc) for 1 hour. A light microscope (Leica, DM750 P) was used to make structural observations on transverse slices, and their images captured using a high-resolution digital camera placed in the microscope system. Data recorded on the number of parthenocarpic embryos were subjected to ANOVA and mean comparison was performed by Duncan multiple range test at 5%. As shown by microscope images, at blooming the ovary is composed of four ovules; after anthesis, the pistil development may continue with the selection and expansion of one functional ovule, or more ovules can expand, resulting into a single or multiple functioning ovules. Normal ovaries formation was found to be significantly higher in sikikita Pikual and toska cultivars; whereas parthenocarpic ovaries formation was significantly higher in koronaki and abrosona cultivars. Almost, a half of the ovaries investigated in this study may generate parthenocarpic embryos, and the majority of parthenocarpic ovaries have two ovules per ovary, whereas the percentage of ovaries with three or four developed ovules is fairly low, suggesting that ovaries with three or four developed ovules are quite occasional.
Key words: Anthesis, fertilization, *Olea europaea*, olive inflorescence, ovary, ovule, parthenocarpic embryos

1.Introduction

In olive trees, the final fruit count is decided during a brief, intensive phase of flower and fruit abscission during the first 5 to 7 weeks after full bloom **(Ayerza & Coates, 2004)**. The huge proportions of ovaries that abscise, as well as the diversity across flowers in postanthesis abscission, make studying the phenomenon more difficult the time of anthesis and the subsequent growth of flowers **(Rapoport et Rallo, 1991; Orlandi et *al*,2005).** Between 5 and 7 weeks following anthesis, the flower and fruit population begins to decline dramatically. Shedding of staminate flowers begins shortly after full bloom and partially overlaps the abscission of unfertilized perfect flowers induced by pollination and/or fertilization of neighboring flowers, which occurs in the days after petal drop **(Rosati et *al*, 2011).** Olive fruit development is a series of biochemical and physiological activities that are tightly controlled by genetics and impacted by a variety of environmental factors **(Connor & Fereres, 2005).** It lasts 4–5 months and consists of five major stages: I) fertilization and fruit set, which are characterized by fast early cell division, which promote embryo development. II) seed development, a phase of fast fruit growth caused by intensive cell division and expansion, including mostly endocarp growth and development and minimal mesocarp development, III) pit hardening, when fruit growth stops as endocarp cells stop dividing and become sclerified, IV) mesocarp development, which is characterized by the enlargement of preexisting meat cells and strong oil buildup **(Wu, et *al*, 2002; Conde et *al*, 2008).** The presence of parthenocarpic fruitlets known as shotberries reduces olive productivity. In contrast to the selection and growth of a single functional ovule in normal fertilized ovaries, parthenocarpic growth is accompanied with the enlargement of all four ovules (**Rapoport and Rallo, 1989; Bagheri et *al*, 2017**). Olive shotberries are tiny, seedless fruits with quantitative parthenocarpy expression. They either abscise before harvest or have no commercial use if harvested. As a result, increasing shotberry incidence has a detrimental influence on fruit and oil output, and can significantly damage olive orchard economic yield self-pollination and poor pollination **(Cuevas et *al*, 2009)** have all been suggested as variables that promote shotberry development in olive trees. **Koubouris et *al* (2010)** reported that shotberry development was genotype-dependent, with Leccino olive cultivar being more susceptible than the other cultivars examined. Contemporary oliviculture necessitates the adoption of new cultivars produced either from traditional or modern genetic improvement technology, or from selection among the Mediterranean Basin's various genotypes, which are believed to number over 4000 between cultivars and accessions **(Pérez-Barranco et *al*, 2009).** The goal of this work is to describe assess and compare parthenocarpic embryos prevalence between olive cultivars using a light microscope in Mediterranean environmental conditions.

2. Material and Methods

Research site: The investigation was carried out at the European University of Lefke (EUL) grove in Northern Cyprus,with the following seven olive Cultivar : Abrosona, Arbekuina, Koronaki, Toska, Pikual, Sikitita, and Yerli**.** At the EUL experimental farm, trees were twenty-five years old and planted at a normal density of 270 trees ha^{-1}. That is, there were seven blocks in the orchard, each with 20 plants. The trees were cultivated under the same uniform Mediterranean circumstances and over the past five years have been receiving the same cultural practices and treatments, namely fertilization, weeding, pruning and irrigation.

Fruitlet inflorescence samples collection: Inflorescence samples for the present study were collected at the 8th week post-anthesis**.** Three trees /cultivar in the same light gradient were identified and chosen at blooming stage.

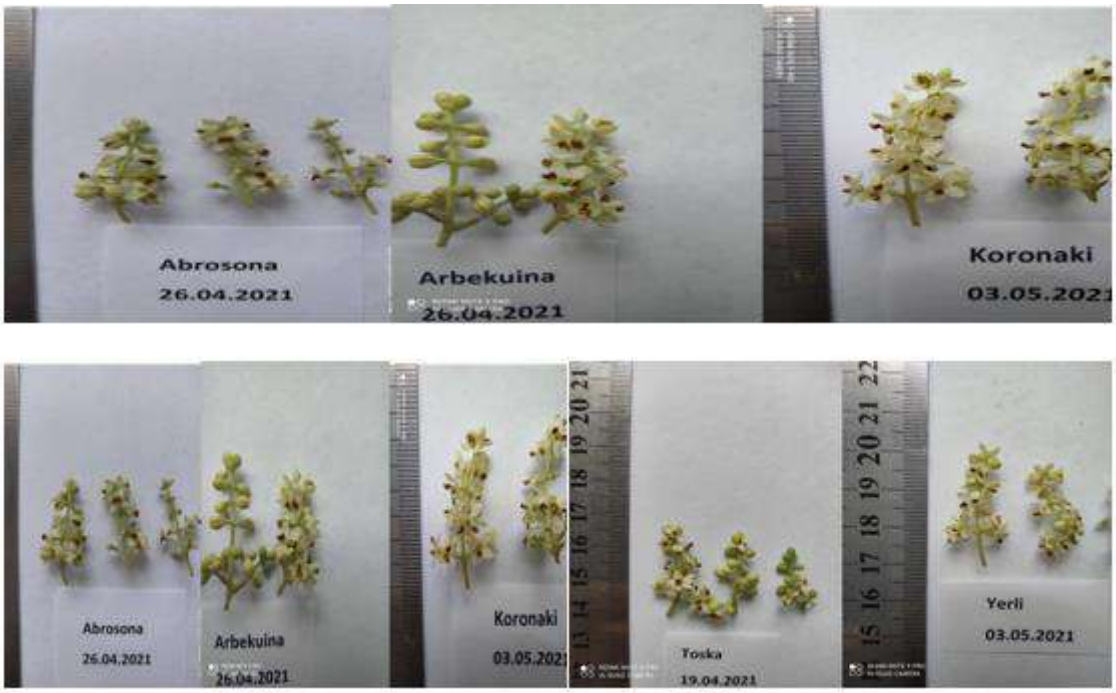

Figure 11 : Olive cultivars at anthesis stage

Thirty inflorescences per olive (*Olea europaea L.*) cultivar (ten per each of three trees) were taken from the 25 year-old trees. Inflorescences were harvested randomly from the top, middle and at the base of the canopy. The anthesis was fixed when at least 60% of the flowers **(Alcalá & Barranco, 1992; Cuevas et al, 2009)** on the selected trees were open as shown in figure1. The samples were then brought to the laboratory in ice bags for examination.

Parthenocarpic embryos analysis

At the 8th week post-anthesis, the collected 30 fruitlets per cultivars were fixed in fixative solution which was a mixture of formalin (2cc), acetic acid (2cc) and 70% ethanol (10cc) for 1 hour in marked perforated cassettes. The solution of Formal-aldehyde (formalin) was employed to preserve the samples' bio-morphological features, structural linkages, and chemical contents.

To avoid denaturation of the samples, they were submerged in a volume of solution four times bigger than the volume of the samples and then maintained at room temperature; the tissues were thus stable for analysis. After, using a sharp knife preferably a bistoury, the cross sections were prepared from ovaries of the fixed fruitlets to prepare slides for light microscope observations. The structural observations were made on transverse slices at the site of largest fruit diameter, a light microscope (Leica, DM750 P, made from Germany) and photographed using a high-resolution digital camera installed in the microscope system.

Data analysis

Fruitlet inflorescences were sampled using a completely randomized block design (CRBD). The experiment was set up as CRBD with three replications (trees) per cultivar, with each replication's value being the average of the values obtained for ten fruitlets. Seven varieties of olive trees (*O. europaea L.*) were utilized in the trials. The quantitative data recorded from the light microscope images were analyzed using statistical analysis system (SAS) for factorial Variance analysis (ANOVA) with two factors: 7 varieties and the number of embryos developed (from one to four embryos).Group mean comparison analyzed by Duncan's Multiple Range of Test (DMRT) at 0.5% level.



Figure 12: olive inflorescence samples at 8 weeks after anthesis in 2021

3. Results and discussion

As shown by the light microscopic images, at blooming the ovary is composed of four ovules. After anthesis, the pistil development may continue with an expansion of the all four ovules or one or more ovules can expand the growth that may lead to single or more functional ovule. After ovule fertilization, fruitlets grow faster from the ovary in the first 7 week post anthesis, following pollen and petal fall. The fruitlet is composed of epicarpe, mesocarpe and endocarpe which are clearly identified very early by their nature of tissues.

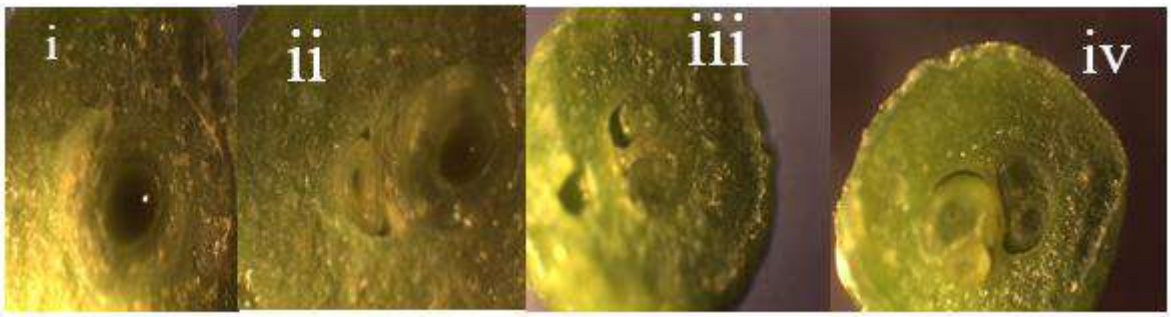

Figure13: Ovaries with different number ovules developed at 8 weeks after anthesis: ovary with one ovule cavity (i), ovary with two ovule cavities (ii), ovary with three ovule cavities and ovary with four ovule cavities (iv)

The presence of parthenocarpic fruitlets known as shotberries typically reduces olive productivity. Fruits produced by parthenocarpic embryos are economically worthless (Spinardi & Bassi, 2012). Normal and parthenocarpic ovaries from the cultivars have different ovule development and structural features. However, Shotberry production does not appear to be a result of abnormal ovule development, such as inadequate embryo sac formation. In contrast to the selection and growth of a single functioning ovule in normal fertilized ovaries, the beginning of parthenocarpic growth is accompanied by the enlargement of more than one ovule, sometimes up to all the four ovules (figure 3). The percentage of the parthenocarpic ovules susceptible to produce parthenocarpic embryos compare to normal embryos is presented on figure 4 below. It was distinguished that regardless of the cultivars, only up to 51% of the ovaries can expand one selected functioning ovule to produce normal embryos, while the 49% remaining ovaries are susceptible to produce parthenocarpic embryos. However, the higher percentage of parthenocarpic embryos is likely to appear in ovaries with two ovules developed. In other words the majority of parthenocarpic ovaries present two ovules per ovary, while the percentage of ovaries with three or four ovules developed are significantly low which implies less chances to happen in olive production. It was shown that, independent of cultivar, only up to 51% of ovaries can grow one functional ovule to generate normal embryos, whilst the remaining 49% of ovaries are prone to producing parthenocarpic embryos.

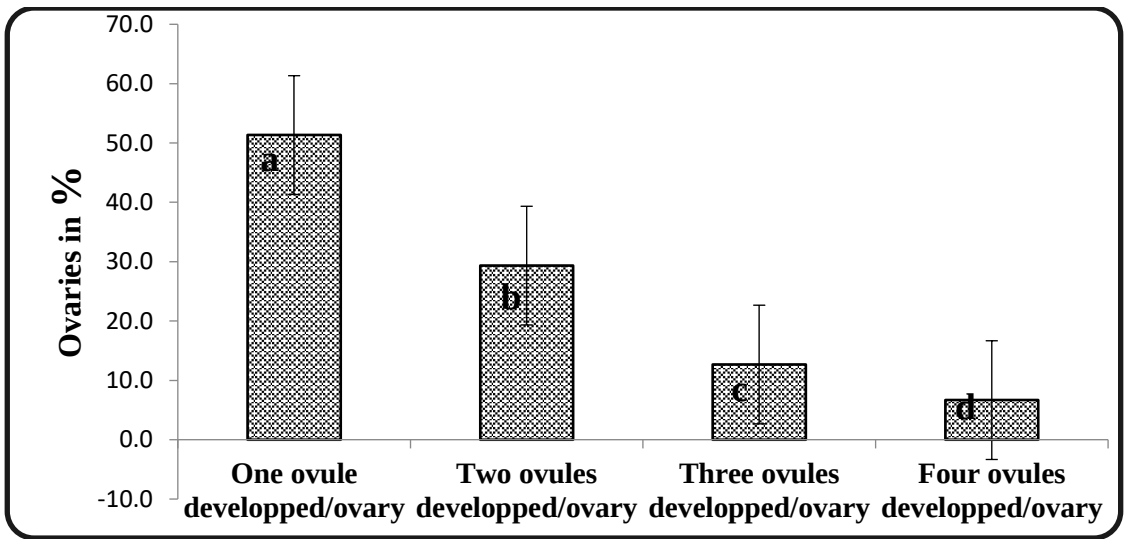

Figure 14 : Percentage of ovaries with various numbers of ovules developed at 8 weeks post-anthesis
Data labels with the same letter are not statistically significant at P<5%, DMRT= 1.253

In fact, the presence of parthenocarpic fruitlets known as shotberries reduces olive productivity significantly. The normal and parthenocarpic ovaries of the cultivars were investigated for ovule development and morphological features**.** Olive shotberries are tiny, seedless fruits that show quantitative parthenocarpy expression. They abscise before harvest or have little commercial use if harvested (Rapport, 1998). As a result, increasing shotberry incidence has a detrimental influence on fruit and oil output, and can significantly impair olive orchard economic yield. The above researcher also reported that shotberry production does not appear to be caused by abnormal ovule development, such as inadequate embryo sac formation (Rapoport et al, 20016). Indeed, the number of blooms, the number of fruit set, and the quantity of fruit during harvest time are all factors that influence a tree's fertility. As a result, increasing shotberry incidence has a detrimental influence on fruit and oil output, and can significantly impair olive orchard economic yield. On the otherhand, normal and parthenocarpic ovaries were studied for ovule development and morphological features. Shotberry production does not appear to be caused by abnormal ovule development, such as inadequate embryo sac formation (Koubouris et al, 2010).
Considering the number of ovules developed into embryos at 8 weeks post- anthesis, the table 1 shows the prevalence of parthenocarpic ovaries among olive cultivars. The two way- ANOVA analysis has revealed that the number of ovule developed per ovaries is not significantly different between cultivars, however, the variability of the number of ovule developed per ovaries is significant influenced by the type of cultivar. Thus, as it is shown from the table 1 above, the occurrence of parthenocarpic ovaries as well as normal ovaries is influenced significantly by the cultivars at a given extent. The higher signicant rate of normal ovaries formation was respectively observed for Sikikita, Pikual and Toska cultivars; in contrast the high rate of parthenocarpic ovaries formation was respectively observed for Koronaki and Abrosona cultivars.

Table 3: Occurrence of parthenocarpie among olive cultivars at 8 weeks post-anthesis

	Abrosona	**Arbekuina**	**Koronaki**	**Pikual**	**Sikitita**	**Toska**	**Yerli**
One ovule developed/ovary	12.3 cd	15.0 bc	9.0 ef	18.0 ab	20.3 a	18.0 ab	15.3 bc
Two ovules developed/ovary	11.7 cde	9.3 def	13 cd	5.0 ghi	6.0 fg	4.7 ghi	11.7 cde
Three ovules developed/ovary	4.7 ghi	4.3 ghi	4.3	4.7 ghi	1.3	5.3 gh	2.0 hi
Four ovules developed/ovary	11.7 i	9.3 i	13.0	5.0 hi	6.0 ghi	4.7 hi	11.7 i

Data labels with the same letter (s) are not statistically significant at P<5%, DMRT= 3.315

Previous research revealed that the influence of cultivars to parthenocarpic embryos formation may be related to the amount of pollen production and/or to the stigma receptivity and pollen germination capacity. Indeed, when mature anthers dehisce, a phenomenon in which climatic variables have a direct role, it happens. The amount of pollen produced, however, appears to be a varietal trait. On the otherhand, Olive stigmas have been reported to stay responsive until 3-4 days following anthesis (Strømme & Hildrum, 2019). The period of receptivity is shortened by a premature drying of the stigma, possibly related to the time of olive tree blossoming (May-June).

Additionnaly, the pollen grain's germination medium is highly specific: a suitable variety's receptive stigma. An extensive output of the donor cultivar can improve the efficiency of movement during the mobile phase.
Different studies indicated that when circumstances are adverse, the pistil development is usually the first to fail. During the pistil development stage, competition for assimilates between flowers and between flowers and actively developing shoots appears to be the cause of pistil abortion. However, due to abundant flowering, in most situations, pistil abortion has little effect on the olive tree's ability to produce fruit (Singh, 2006; Rosati et al, 2011). In contrast, it was reported, parthernocarpie may occur for several reasons but the most important is lack of pollination for different reasons like self- incompatibility. For the pollination to happen successfully, the pollen tube must travel the journey from the stigma to the inside of the embryonic sack, where fertilization will occur, giving rise to the future seed and, with it, the flower's conversion to fruit (Sayyad-Amin et al, 2015).
Nonethless, it is important to pursue research on number of parthenocarpic fruits or shotberries and how to control them. In attempt to reduce the shortberies in olive orchards, A research conducted by Bagheri et al (2017) on 25-year-old olive trees in Iran (2014 and 2015), to investigate polyamine alterations in connection to the development of the olive mesocarp and seed. The effects of polyamines, putrescine, and spermidine on parthenocarpic fruits (shotberries), as well as olive fruit set, were investigated. When polyamines were sprayed at full bloom, the findings revealed that putrescine was highly successful in reducing the proportion of shotberries and raising the percentage of regular fruits.

4.Conclusion

In contrast to the selection and growth of a single functioning ovule in normal fertilized ovaries, the start of parthenocarpic development is marked by the expansion of more than one ovule, occasionally all four ovules. For the present study in meditteranean bassin, almost the half of the ovaries examined can produce parthenocarpic embryos. The majority of parthenocarpic ovaries have two ovules per ovary, whereas the percentage of ovaries with three or four ovules formed is quite low, implying that ovaries with three or four developed ovules are relatively less likely to occur. Further research should investigate driving factors for parhenorcapic embryos formation and possible treatments to control it. Further research should investigate the occurrence of other types of biological abnormalities and disorders mostly incomplete Pistil development as well as incomplete embryo sac formation.

Acknowledgement

Special appreciation to all European University of Lefke (EUL) academic personnel and to the field technicians at the EUL research farm for their valuable assistance. Speciall Thanks also to University of Rwanda, for a study leave and financial support during the stay at EUL.

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ID: 546

Analysis of organic compounds in industrial effluents and surface water

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Abstract
Organic compounds are classes of chemical compounds which evaporate easily from water into the air and they contain carbon. This research examined the analysis of organic compounds in industrial and effluent water of Asa River, Ilorin, Nigeria and the purpose is to ascertain that raw materials used in production have a link to the pollution of surface water, and it was carried out using Fourier Transform Infra red Spectroscopy from eight sampling locations. Findings showed that detergent company effluent and its surface water (EW-GS-1 & GS/SW1) presents peaks 3447.7-3454.2 cm^{-1} which can be ascribed to primary amines of –N-H- distends; Pharmaceutical companies A&B (EW-TP-1&KC-GS-TP/SW1 with EW-KC-3&KC/SW1 respectively) shows the band at 750.07cm^{-1} for effluent waters and 754.97cm^{-1} for surface water were assigned to –C-C stretching of mononuclear aromatic hydrocarbons which is benzene while, battery company (EW-FB-4&FB/SW1) reveals energetic alp at 1271cm^{-1} assigned to –C-O-C distends indicative of alkyl aryl ether because of strong dipole moment. This research reveals that surface water is most times polluted with organics and it has to be controlled to ensure safe water for drinking.

Key words: *Organic compounds, Peaks, Surface water, Industrial effluent, Dipole moment*

ID: 547

Data Mining Methods Used in Livestock and an Application

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Abstract

Data mining enables the discovery of necessary and applicable knowledge from vast amounts of information in the information industry and society. Although many data mining methods have been used, some methods applied to offer a solution to complex problems in animal husbandry have come to the fore in recent studies.

In this study, some of the data mining methods (such as artificial neural networks, Bayesian classifiers, k-means, k-nearest neighbor, decision trees) are explained and an application of data mining in the field of livestock is given.

Key words: *Data mining, Artificial neural networks, Bayesian classifiers, K-means, K-nearest neighbor*

ID: 548

Evaluation of Studies on the Use of Biotechnological Developments in Agricultural and Animal Production

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Abstract

The term biotechnology was first used by Karl Ereky in 1919 as "processes by which raw materials are converted into new products through biological systems" and developments in biology and technology have expanded the scope of this term. Biotechnology provides benefits in solving some important problems in agriculture that can not be solved through traditional breeding techniques. It has been observed that biotechnological methods, especially molecular techniques, which have made significant developments recently, provide significant advantages in increasing agricultural production. It is seen that these technologies, which are called biotechnology, ranging from classical biotechnology to modern biotechnological methods and whose level of complexity is increasing, are used in agriculture in different ways (such as gene transfer to a large part of cultural plants), taking into account the development levels of countries in science and technology. Biotechnology in animal production has focused on the isolation and characterization of growth hormone genes from some animal species. There are many innovations regarding the use of biotechnology in the field of animal husbandry. For example, the development of a recombinant form (rBST) of a natural hormone (bovine somatotropin) that increases milk production in cows by 10-15% and the transfer of resistance genes to various diseases in different fish species.

It is clear that biotechnology has important benefits in agriculture and animal husbandry. In this study, the studies on the use of biotechnological developments in agricultural and animal production areas are evaluated and the fact that the developments in this field will progress by gaining new perspectives is mentioned.

Key words: *Biotechnology, Agriculture, Livestock, Agricultural production, Animal production*

ID: 549

A Study on Applications of Deep Learning Network Architectures in Animal Husbandry

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Abstract

Deep learning is an approach that includes machine learning algorithms that enable classification and analysis for unknown data by creating a model with many layers of artificial neural networks on previously known data. This approach has emerged as a result of the increase in the applicability of artificial intelligence technology and studies have begun to increase. Deep learning is a branch of machine learning. In the process from the beginning of machine learning to the present, the interest in artificial intelligence has increased gradually and has led to the emergence of deep learning architectures, which are the most used artificial intelligence algorithms today. Deep learning architectures produce smart solutions in the field of livestock as well as in many other fields. Livestock farming is a sub-branch of agriculture that has been going on for generations and enables human beings to meet their basic food needs. Cattle, ovine, poultry and beekeeping are included in the scope of animal husbandry. Basically, it is aimed to meet the food needs of people by meeting their needs such as care and feeding of animals. Providing the needs of animals in animal farms established to meet these needs is based on human power. However, today, with the development of technology, machines are replacing human power. Therefore, it has become possible to find more comprehensive solutions to the problems encountered.

In this study, the history of deep learning, deep learning network architectures (such as Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN), Restricted Boltzmann Machines (RBM)) and models (such as LeNet, AlexNet, GoogleNet) are examined and its applications in the field of animal husbandry are given in the light of studies in the literature.

Key words: *Deep learning, Artificial neural networks, Convolutional neural networks, Recurrent neural networks, Animal husbandry*

ID: 550

The Effects of Using Safflower Seed Flour on Quality Characteristics of Cupcakes

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Abstract
The demand for healthier and more functional products is accelerating product development efforts. In a world where global food shortages are occurring due to global climate change, droughts, and wars, the search for alternative products is accelerating. This study is a product development study aimed at reducing the use of wheat flour and making products more functional. In the study, safflower flour, one of the raw materials used in the edible oil industry, was used as a substitute for wheat flour, and cupcakes were made from the flour mixture obtained. In this context, safflower seed flours was added to wheat flour in 5 different ratios (5, 10, 15, 20, and 30%) and cupcakes were prepared. The structural properties (volume index, symmetry index, uniformity index, upper shrinkage value, lower shrinkage value and total volume index), chemical properties, color values and texture properties of the cupcakes were determined. The results show that the addition of safflower seed flour increases the protein content and functional properties of the cupcakes. While the addition of safflower seed flour at 15% improved the structural properties of the cupcakes, negative effects occurred at higher addition levels. As a result, it was found that the safflower seed flour can be used in the production of cupcakes. It increases the functionality of the products to which it is added.
Key Words: *Functional Foods, Safflower, Cupcake*

Introduction

Safflower (*Carthamus tinctorius* L.) is a member of the family Compositae or Asteraceae. It is an annual herbaceous plant, cultivated mainly for its seed which is used for the production of edible oil and bird seed (Malakian et al. 2011). Safflower contains pigments (cardamom), lignans, polysaccharides, essential oils and fatty acids (arachidonic acid, linoleic acid, linolenic acid, palmitic acid and stearic acid). The nutritional value is associated with a high content of proteins, essential and balanced amino acid contents (Polushkin, 2007). The use of its seeds is an interesting and promising area for the processing branches of the food industry. Although studies on safflower have mainly focused on safflower oil, there are some studies on the production of healthy drinks with high antioxidant activity (Kim et al. 2022), breads enriched with functional components (Kutsenkova et al. 2019), and cookies with increased protein content (Kutsenkova et al. 2020) using safflower seeds.
Cakes, of which there are many different types and recipes in the industrial sense, are divided into 6 classes according to their shape: Ball, Slice, Stick, Shape, Cake base and Stick (Mercan and Boyacıoğlu, 1999). The standard TS 13375 ready-made cake (plain, flavored and filled) defines ready-made cake as "a packaged product prepared by mixing wheat flour or cereal flour and/or mixtures, white sugar, edible vegetable oil, eggs, salt, raising agents, flavorings, fillers and other additives with the addition of water, and then processed, shaped and baked and offered for consumption." Most of the cakes available on the market are baton and ball cakes. The fact that cupcakes can be served in one portion, are easy to eat and affordable, leads them to be consumed more frequently. In order to increase the variety of cakes and improve the functionality of cakes, studies are currently being conducted on the addition of alternative products to cakes. In the production of cake, brown rice flour and peanut butter (Asimah et al. 2016), inulin (Majzoobi et al. 2020), pregelatinized sweet potato flour (Chittrakorn and Bora, 2021), xylitol and oligofructose (Nourmohammadi and Peighambardoust, 2016), guar and xanthan gum (Zambrano et al. 2004), apple (*Musa Pumila*), banana (*Musa Sapientum*), pineapple (*Ananas Comosus*) (Offia-Olua and Ekwunife, 2015), grapefruit peel powder (Ukom et al. 2022), rapeseed press cake (Szydłowska-Czerniak et al. 2021). In this study, safflower flour, which remains after oil extraction from safflower seeds and is a raw material for the edible oil industry, was used to make cupcakes. The literature search did not find any study on the use of safflower seed in the production of cupcakes.

Materials and Methods

Materials

Wheat flour ($0.7 < \%\ \text{ash} \leq 0.8$) were obtained from Birsan Birlik Gıda San. A.Ş. in Tokat, Turkey, and stored at 4°C. Safflower seed flours were purchased from Hempium Gıda in Amasya, Turkey and stored at 4 °C.

Preparation of cupcake samples

The cupcake recipe produced in the study is shown in Table 1. To prepare the cake samples, egg and sugar are whipped in the mixer (kitchen aid) until it turns into white cream (3 min). Then water and sunflower oil is added, mixed for 3 min and after adding other ingredients, it is mixed for another 1 min to obtain a homogeneous batter. The cake batters were baked at 180°C for 20 min in the oven (Kromlux). Then, the cupcakes were removed from the pan and allowed to cool for 30 min. After cooling, the cakes were packed in sealed bags until analysis.

Table 1. Formulation used in cupcake production

Ingredients	Amount (g)
Flours	100
Sugar	75
Egg	60
Safflower oil	60
Water	40
Skim milk powder	10
Baking powder	3
Salt	0.5
Vanillin	0.06
Safflower Seed Flour	Safflower seed flour was added to the cupcake samples at 5%, 10%, 15%, 20% and 30% according to the principle of substitution of special wheat flour.

Analytical methods

The dry matter and ash content of the flours were determined by the gravimetric method (AOAC, 2000). The total carbohydrate content of the samples was determined by the phenol-sulfuric acid method (Geater and Fehr, 2000). The micro-Kjeldahl (Gerhardt KB8, Königswinter, Germany) method was used to analyze the nitrogen content of the samples (AOAC, 2000) the crude protein contents of the samples were estimated using a conversion factor of 5.75. Total fat were determined with Ankom Fat Analyser (Ankom Technology Corp., Macedon, NY, USA), following the Ankom Technology Method.

Total phenolic substance and antioxidant capacity analysis

The phenolic substance of the sample was extracted by mixing 20 ml of acidified methanol (HCl/methanol/water, 1:80:10) and 1 g of sample, and the mixture was kept in a water bath (Memmert, Germany) at 25 °C for 2 hours. It was then centrifuged at 3000 rpm for 10 minutes. The clear fraction was removed and stored at -18 °C until analysis (Beta et al. 2005). **Determination of total phenolic compounds:** Analysis with 2 N Folin-Ciocalteu phenol reagent was performed according to the method described by Singleton et al. (Singleton et al. 1965). The results were calculated as "gallic acid equivalent" **Determination of antioxidant capacity by the method FRAP:** It was performed according to the method described by Benzie and Strain (Benzie and Strain, 1996), and the results were calculated as "Trolox equivalents". **DPPH radical scavenging activity:** Antioxidant capacity was determined by the DPPH (2,2 diphenyl-1-picrylhydrazil) method described by Brand-Williams et al. (1995).

Cupcake properties

The volume, symmetry and uniformity index, upper shrinkage value, lower shrinkage value and total volume index of the samples were determined according to AACC Method (10–91). Figure 1 was used to determine the structural properties and the values were calculated using the following equations.

Volume index (mm) = |BB'|+|CC'|+|DD'| Symmetry index (mm) = 2 × |CC'| - |BB'| - |DD'| Uniformity index (mm) = |BB'| - |DD'| Upper shrinkage value (mm) = Upper diameter of the cake pan (65 mm) - Upper diameter of the cake (|A'E'|) Lower shrinkage value (mm) = lower diameter of the cake pan (42 mm) - lower diameter of the cake (|AE|) Total volume index (mm) = |AA'| + |BB'| + |CC'| + |DD'| + |EE'| + |AE| + |A'E'|

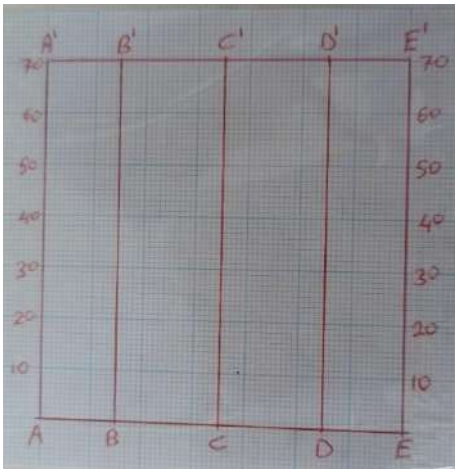

Figure 1. Measurement template for structural analysis of cupcakes

Color analysis

Hunter Lab Color Minolta CR-400 (Minolta Camera, Co., Ltd.) device was used to determine the color of the cupcake samples.

Texture profile analysis

The texture measurements of the cupcakes were performed at 0, 24, 48 and 72 hours after the production of cupcakes. The hardness measurements of the cupcakes were determined in Newton/cm2 according to Aydın and Öğüt (1991) using a texture analyzer (a round head of 2 cm diameter and at a pressure of 10 mm) (Zwick Z0.5, Germany) at different time intervals. Texture measurements was performed (Vtest: 35 mm/min, Vreturn: 500 mm/min, Vpos1: 500 mm/min, Vpos2: 10 mm/min, Lmax: 10 mm, Fv: 0.1N).

Results and Discussion

Safflower seeds left after oil production were ground into flour. The results of chemical and functional analysis of the obtained safflower seed flours (SSF) are shown in Table 1. SSF is characterised by a high protein (35.27%) and ash (13.12%) content, and also draws attention for its functional components.

Table 2. Chemical and functional properties of safflower seed flour

	Safflower Seed Flour
Moisture (%)	5.14±0.16
Protein (g/100 g of dry weight)	35.27±0.96
Fat (g/100 g of dry weight)	6.12±0.46
T. Carbohydrate (g/100 g of dry weight)	45.49±1.28
Ash (g/100 g of dry weight)	13.12±0.71
Total Phenolic Substance (µg GAE/g)	4762±38.46
Total Antioxidant Activity (DPPH) (µM TE/100g)	68.12±0.88
Total Antioxidant Activity (FRAP) (µM TE/100g)	65.72±0.75

One of the most important criteria in the evaluation of cakes is the assessment of their structural properties. In the production of cakes, the values for volume index and total volume index do not measure the actual volume of the cake, but give an impression of the volume values of the cake. In cake manufacturing, the symmetry index is used to determine the surface appearance of the tops of the cakes. A negative (-) symmetry index value means that the cake is sunken (curved inward), a value close to zero means that the surface of the cake is flat (no curvature), and a positive (+) symmetry index value means that the surface of the cake is curved. The uniformity index is used to determine the lateral symmetry of the cake. It is desirable that the uniformity index of the cakes is zero. The lower shrinkage value of the cakes is used to express the reduction of the diameter of the base of the dough filled into the mould; the upper shrinkage value is used to express the reduction of the upper diameter of the dough (Dizlek et al. 2008).

The structural properties of the cakes with safflower seed flour are shown in Table 3. The symmetry index values of all cupcakes prepared were positive. This means that the superstructures of the cupcakes were curved. It was found that the cake sample with the highest symmetry index value was 15% SSF. The uniformity indices of the samples were close to zero, indicating that the lateral symmetry of the samples was not disturbed. Examination of the shrinkage values on the bottom and top surfaces shows that the addition of safflower seed flour does not reduce the diameter of the bottom and top surfaces of the cupcake.

Table 3. Structural properties of cupcake with safflower seed flour

	Volume Index (mm)	Symmetry Index (mm)	Uniformity Index (mm)	Upper Shrinkage Value (mm)	Lower Shrinkage Value (mm)	Total Volume Index (mm)
Control	119.6±2.2	13.9±0.9	1.1±0.1	2.9±0.7	2.1±0.5	291.0±4.2
% 5 SSF	121.3±3.3	15.9±1.4	1.4±0.2	3.5±0.2	2.5±0.2	289.3±5.1
% 10 SSF	123.7±3.1	16.1±0.9	0.5±0.3	3.3±0.8	2.5±0.6	290.2±3.0
% 15 SSF	126.0±1.8	16.4±1.2	0.2±0.1	2.8±0.6	2.3±0.5	294.7±2.7
% 20 SSF	117.2±4.4	15.1±1.3	1.2±0.2	2.9±1.2	1.8±0.4	286.2±6.3
% 30 SSF	108.7±2.1	12.4±1.2	0.8±0.2	2.0±0.4	1.2±0.2	278.8±5.1

SSF: Safflower Seed Flour

The most important reason consumers prefer a product is its color. The desired and familiar color of a food product is an effective factor in the preference for that product. The color values of the SSF-infused cupcakes are shown in Table 4. The use of SSF in cupcake production resulted in a decrease in the L values of the cupcakes. The more SSF was added, the more the L-value also decreased, and it was found that the product acquired a darker texture. The images of the cupcakes produced can be seen in Figure 2.

Table 4. Color values of cupcakes with safflower seed flour additive

	L	*a*	*b*
Control	61.4±1.1	-1.1±0.1	25.2±0.9
% 5 SSF	58.9±0.6	1.2±0.2	23.6±1.2
% 10 SSF	56.1±1.3	2.2±0.3	23.8±1.3
% 15 SSF	53.5±1.2	3.0±0.4	22.0±0.6
% 20 SSF	48.6±0.9	4.1±0.2	20.0±0.8
% 30 SSF	41.4±0.5	4.6±0.4	18.5±0.8

SSF: Safflower Seed Flour

The L values of the samples ranged from 41.4 to 61.4, the a values ranged from -1.1 to 4.6, and the b values ranged from 18.5 to 25.2. The samples were found to be darker and more red-yellow in color due to the addition of SSF.

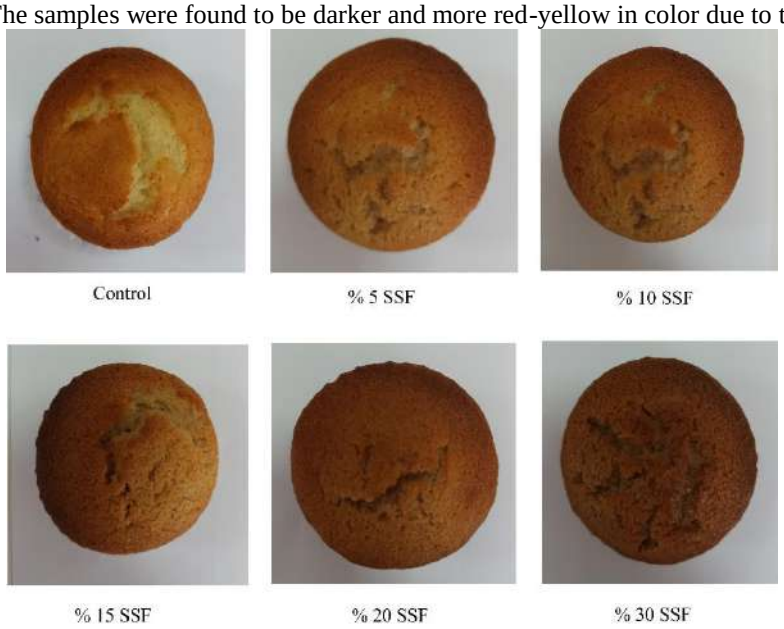

Figure 2. Pictures of cupcakes made by adding safflower seed flour in various proportions

Just as important as color to a food's preference is the reason that the texture properties of that food meet the desired level. For cupcakes, a soft, non-crumbly and spongy texture is desired. It is desirable for companies that the texture properties of the product remain constant and do not deteriorate during the shelf life. The hardness values of the cooled cupcake samples were determined in Nm after 24, 48 and 72 hours. The changes in the hardness values of the SSF-added cupcakes with time are shown in Figure 3. They were found to vary between 4.86-6.19 Nm for the control sample, 5.26-5.53 Nm at 5% SSF, 4.66-5.08 Nm at 10% SSF, 4.66-5.13 Nm at 15% SSF, 4.54-5.39 Nm at 20% SSF, and 4.89-5.57 Nm at 30% SSF.

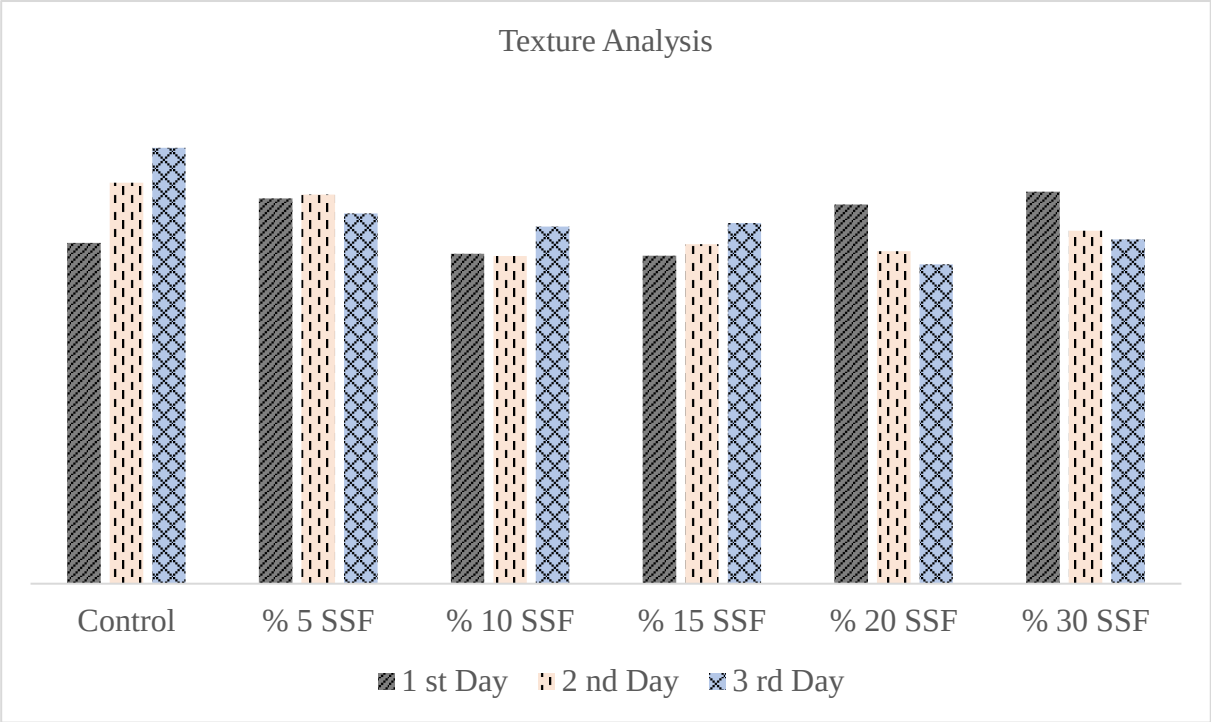

Figure 3. Texture analysis of cupcake with safflower seed flour

Conclusion

Various cereals, psedocereals, and alternative wastes are added to foods to increase food functionality, enhance consumer appreciation, and provide a more functional product. During the literature search, no study was found that tested safflower seed flour in the production of cakes. This study shows that up to 15% safflower flour can be used in the production of cupcakes. Safflower flour, which improves the structural properties of cupcakes due to its high protein content, also increases the functionality of the product thanks to its high content of functional compounds. This study has shown that safflower seed flour can be used to improve the functional and nutritional content of cakes without compromising their structural properties. It also provides preliminary information for future studies.

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Dietary Influence Of Monosodium Glutamate On Serum Electrolytes And Antioxidant Status Of Laying Hens

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Abstract

This study assessed the serum electrolytes and antioxidant status of laying hens fed different inclusion levels of dietary monosodium glutamate. A total of 300 16-week old Isa Brown point-of-lay pullets were randomly allotted to six experimental diets containing 0.00, 0.25, 0.50, 0.75, 1.00, and 1.25 g/kg MSG respectively in an experiment that lasted twelve weeks. The experimental birds were fed *ad–libitum* with clean water provided regularly throughout the period. At end of the twelfth week, five birds per replicate were randomly isolated from feeding overnight for blood collection through the wing veins. Serum electrolytes {sodium (Na^+), potassium (K^+) and chloride (Cl-)} and antioxidant enzymes {total antioxidant capacity (T-OAC), superoxide dismutase (SOD), and glutathione peroxidase (GSH-Px)} activities as well as oxidative status indicator {malondialdehyde (MDA)} were determined using standard procedures. Data collected were subjected to analysis of variance at $\alpha = 0.05$. The results showed that MSG inclusion at 1.00 and 1.25 g/kg diet significantly ($P<0.05$) increased the serum Na^+ concentrations of the pullets while the serum K^+ was reduced ($P<0.05$) at 1.25 g/kg diet when compared with birds on the control diet, whereas, the serum Cl^- concentration significantly ($P<0.05$) decreased from 0.50 g MSG/kg diet inclusion level. On the other hand, MSG inclusion level at 0.75 g/kg diet and above increased the MDA concentration while serum SOD, GSH-Px and T-AOC concentrations significantly ($P<0.05$) reduced respectively at this inclusion level. Therefore, inclusion of MSG above 0.50 g/kg diet could adversely predispose laying hens to oxidative stress and other physiological imbalance.

Keywords

ID: 553

The Efficiency of Different Methods in Acceptance Queen Bees to Queenless Colonies

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Abstract
In honey bee colonies, queen bees are responsible for brood production and the management of worker bees' activities. It is known that the young and healthy queen bee is very important in terms of yield. The problem of the colonies not accepting the queen is quite common in the regeneration of the queen bee by beekeepers. In this study, the effectiveness of mated queen bees to enter the colonies with different methods was investigated. Artificial swarms were obtained with two framed bee-covered and sealed broods, and mated queens were given at the same time. Acceptance efficiency of queen bees, without any application outside the cage, honey, drone larvae, mixture of honey and drone larvae and lemongrass (*Cymbopogon flexuosus*) oil application, respectively; It was determined as 70%, 70%, 100%, 100% and 90%.
Key Words: *Queen Bee, Acceptance, Cage, Artificial Swarm, Renewal*

Anasız Kolonilere Ana Arı Kabulünde Farklı Yöntemlerin Etkinliği

Özet
Bal arısı kolonilerinde yavru üretimi ve işçi arıların aktivitelerinin yönetiminden kraliçe arılar sorumludur. Ana arının genç ve sağlıklı olması verim açısından oldukça önemli olduğu bilinmektedir. Arıcılar tarafından ana arının yenilenmesinde kolonilerin ana arıyı kabül etmemesi sorunu oldukça yaygındır. Bu çalışmada, çiftleşmiş ana arıların farklı yöntemler ile kolonilere kabül etkinliği araştırılmıştır. Yapay oğullar iki çerçeve arı kaplı ve kapalı yavruya sahip olarak elde edilmiş ve aynı anda çiftleşmiş kraliçe arılar verilmiştir. Tüm kraliçe arılar, kafes içerisinde hiçbir işçi arı olmadan kolonilere verilmiştir. Kraliçe arıların kabül etkinliği, kafes dışına hiçbir uygulama yapılmadan, bal, ezilmiş erkek arı larva sıvısı, bal ve erkek arı larvası karışımı ve limon otu (*Cymbopogon flexuosus*) yağı sürme uygulamalarında sırasıyla; %70, %70, %100, %100 ve %90 olarak belirlenmiştir.
Anahtar Kelimeler: *Kraliçe Arı, Kabül, Kafes, Yapay Oğul, Yenileme*

Giriş

Türkiye, arıcılık açısından gerek coğrafi yapısı gerekse çok farklı genotipte bal arılarına sahip olması nedeniyle önemli bir konuma sahiptir (Güneşdoğdu ve Şekeroğlu, 2020). Arı yetiştiriciliğinde, arıcıların bilinçsiz olması, kalitesiz ana kullanımı, zirai ilaçlama ve diğer faktörlerden kaynaklı arı ölümleri ve hastalıklar ve sağlık korumadaki yetersizliklerden dolayı, koloni başına ortalama bal verimi oldukça düşüktür. Oysa Türkiye'nin coğrafik yapısı, ekolojisi ve bitki potansiyeli koloni başına verimi 2-3 katına çıkarma potansiyeline sahiptir (Güneşdoğdu ve Akyol, 2019). Anatomik, fizyolojik, davranışsal ve kolonideki işlevleri nedeniyle kraliçe arı kolonideki en önemli bireydir (Lee ve ark., 2019). Sağlıklı ve kaliteli bal arısı kraliçesi kolonide tek yumurta üreten dişi arıdır. Çoğunlukla yumurta üretimi ve kolonin devamlılığı ile ilişkilendirilse de, arı ürünleri üretimi, hastalıklara karşı direnç ve kışlama yeteneği üzerinde hayati öneme sahiptir (Winston, 1991). Bu nedenle, etkin ve verimli bir arı yetiştiriciliği açısından yüksek kaliteli ana arıları korumak ve üretmek önemlidir (Güneşdoğdu ve Şekeroğlu, 2020). Teknik arıcılıkta, doğal oğul ve ana arı yüksükleri ile koloni çoğaltımı veya ana arı yenileme önerilmemektedir. İstenilen özellik bakımından arı kolonilerinin geliştirilmesi kaliteli ana arı üretimi ile mümkün olmaktadır. Gerek sabit arıcılıkta gerekse göçer arıcılık sisteminde ana arıların yılda bir kez genç ana arı ile değişmesi gerekmektedir (Laidlaw ve Page, 1997).
Ana arının kaliteli bir şekilde yetiştirmenin önemi kadar çiftleşmiş olarak bu ana arıların yeni kolonilere kabülü oldukça önem arz etmektedir. Bu çalışmada, farklı yöntemlerin yeni kolonilere çiftleşmiş genç anarı kabülünü belirlemek üzere yürütülmüştür.

2. Materyal ve Metod

2.1. Materyal

2.1.1 Çalışma Sahası

Çalışma, Türkiye'nin Muş (38°46'10"N 41°25'38"E) ilinde Haziran ayı içerisinde yürütülmüştür. Muş, denize uzak ve rakımın (1308 m) değişken olmasından dolayı sert karasal iklime sahip bir ildir (Anonim, 2022).

2.1.2. Arı Materyali

Çalışmada, ırkı bilinmeyen arılı kolonilerden yaklaşık olarak kapalı yavru alanı ve ergin arı popülasyonu eşit olan 2 çerçeveli yapay oğul olarak oluşturulan arılı koloniler kullanılmıştır. Ana arıları Kafkas arısı (*Apis mellifera caucasica*) Posof ekotipi damızlık materyalden üretilen kız kardeşler kullanılmıştır.

2.2. Metod

2.2.1 Ana Arıların Yetiştirilmesi

Ana arılar, saf Kaskas ırkı damızlık koloniden aynı tarihte yetiştirilmiştir. Ana arı yetiştirmede larva transfer (doolittle) metodu kullanılmıştır (Doolittle, 1915). Yetiştirilen ana arılar çiftleştirme kutularında yaklaşık bir ay yumurtladıktan sonra deneme kolonilerine verilmiştir.

2.2.2 Çiftleşmiş Ana Arıların Kolonilere Verilmesi

Ana arılar, kolonilere verilmek üzere altıgen ana arı kafeslerine yanına hiçbir işçi arı konulmadan toplanmış ve yapay (bölme) oğul kolonileri aynı anda iki çerçeve arı kaplı olarak analı kolonilerden alınarak kafesli ana arılar verilmiştir. Ana arı kafesi dışına bal, ezilmiş erkek arı larvası sıvısı, bal ve ezilmiş erkek arı larvası sıvısı karışımı, limon otu (*Cymbopogon flexuosus)* yağı ve hiçbir uygulama yapılmayan kafesler olarak 5 muamele grubu ve her grupta 10'ar adet olacak şekilde 50 adet kolonide yürütülmüştür. Uygulamada her hangibir ölçü (ml, gr vb.) kullanılmamış ve yalnızca altıgen ana arı kafeslerinin her yüzeyine parmak yardımıyla sıvılar sürülmüştür.

İstatistiki Analiz

Verilerin analizinde ''Microsoft Excel'' programında yüzde (%)) hesaplamaları kullanılmıştır.

3. Bulgular ve Tartışma

3.1. Ana Arı Kabul Oranları

Yürütülen çalışmada, Haziran ayında farklı muamele yöntemi ile yapay (bölme) oğul kolonilerine verilen ana arıların kabul oranına ait veriler Çizelge 3.1'de verilmiştir.

Çizelge 3.1 Muamel Gruplarında Ana Arıların Kabül Oranları (%)

		Muamele	n	Kabul Adedi	Kabul Oranı(%)
25.06.2022	Konum 38°46'10"N 41°25'38"E	Yalnız Ana Arı	10	7	%70
		Bal	10	7	%70
		Erkek Arı Larvası Sıvısı	10	10	%100
		Bal*Erkek Arı Larvası Sıvısı	10	10	%100
		Limon Otu Yağı	10	9	%90
		Toplam	50	43	%86

Kolonilerin ana arıları kabul oranında ortalama %86 başarı sağlanmıştır. Erkek arı larvaları ezilerek elde edilen sıvının sadece yada bal ile karışım olarak ana arı kafesi dışına uygulanması hiçbir ana kaybı olmadan %100 kabul oranı ile sonuç bulmuştur. Ruttner (1983), kolonilerin ana arı kabülünü ana arı özelliği (yaş, feremon, ağırlık), koloni özellikleri (popülasyon, hırçınlık) ve çevre özellikleri (nektar akımı, mevsim) olmak üzere 3 grupta değişim gösterdiğini bildirmiştir. Yapılan çalışmalar genellikle kafes yapısı veya ana arı yaşı ile ilgili kabül üzerene çalışmalardır. Guzman-Novaa ve ark. (1998), alıştırma kafeslerinde kabul oranını %80 olarak bildirmiştir. DeGrandi-Hoffman ve ark. (2007), yaptıkları çalışmada, ana arı yenileme sürecinde ana arılardan en fazla E-B-ocimene bileşiği tespit edildiğini ve sonbaharda kabül oranının yüksek olduğunu bildirmişlerdir. Perez-Sato ve ark. (2008), bakir ve çiftleşmiş ana arı kabülünde duman uygulamasının kabul oranını sırasıyla %31 ve %100 olarak bildirmişlerdir. Masry ve ark. (2015), farklı ağırlıktaki ana arıları sınıflandırmış ve ağır olarak belirlediği sınıfın kabül oranının %79.23 olarak tespit etmiştir.

4. Sonuç

Arıcılıkta, ana arının gençleştirilmesi işlemi verim açısından oldukça önem arz etmektedir. Ana arı gençleştirmede ana arının kabül edeilmemesi hem zaman hem de ekonomik kayıplara sebep olmaktadır. Çalışma sonucuna göre, ezilmiş erkek arı larvası sıvısı ana arı kabülünde yüksek başarı sağladığı sonucuna varılmıştır. Erkek arı larvasında bulunun bir bileşenden kaynaklandığı düşünülmektedir. Bu konu üzerinde daha fazla çalışmalara gereksinim duyulmaktadır.

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ID: 554

A Study on The Response of Triticale to Different Doses of Foliar Epibrassinolide Application

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Abstract

This study was established to determine the effect of different Epibrassinolide (EBR) doses on yield and yield components of triticale. Experiments were carried out in a randomized block design with 3 replications in the vegetation period of 2021-2022. Different doses of EBR (Control, 0.5, 1.0 and 1.5 µM) were applied to the triticale leaves in the tillering period. Plant height, spike length, number of kernel per spike, kernel weight per spike, grain yield, biological yield and harvest index properties of triticale were investigated. Plant height was 76.40-80.00 cm, ear length 6.40-7.00 cm, number of grains per spike 22.80-26.27, grain weight per spike 0.763-0.973 g, grain yield 176.7-203.8 kg da^{-1}, biological yield 690.8-759.3 kg da^{-1}, harvest index varied between 25.08-28.45%. According to the research results; It was determined that foliar EBR application had positive effects on yield and yield components of triticale.

Key Words: *Triticale, Epibrassinolide, Foliar Application, Yield*

Farklı Dozlarda Yapraktan Epibrassinolide Uygulamasına Tritikalenin Tepkisi Üzerine Bir Araştırma

Özet

Bu çalışma farklı Epibrassinolide (EBR) dozlarının tritikalenin verim ve verim ögeleri üzerine etkisini belirlemek amacıyla kurulmuştur. Denemeler 2021-2022 vejetasyon döneminde tesadüf blokları deneme desenine göre 3 tekerrürlü olarak yürütülmüştür. Kardeşlenme dönemindeki tritikale bitkisinin yapraklarına farklı dozlarda (Kontrol, 0.5, 1.0 ve 1.5 µM) EBR uygulanmıştır. Tritikalenin bitki boyu, başak uzunluğu, başakta tane sayısı, başakta tane ağırlığı, tane verimi, biyolojik verim ve hasat indeksi özellikleri incelenmiştir. Başak uzunluğu, başakta tane sayısı, başakta tane ağırlığı, tane verimi, biyolojik verim ve hasat indeksi özelliklerinde EBR dozları arasındaki farklılıklar istatistiksel olarak önemli bulunmuştur. Farklı dozlarda EBR uygulanan tritikalenin bitki boyu 76.40-80.00 cm, başak uzunluğu 6.40-7.00 cm, başakta tane sayısı 22.80-26.27, başakta tane ağırlığı 0.763-0.973 g, tane verimi 176.7-203.8 kg da^{-1}, biyolojik verim 690.8-759.3 kg da^{-1}, hasat indeksi %25.08-28.45 arasında değişim göstermiştir. Araştırma sonuçlarına göre; yapraktan EBR uygulamasının tritikalenin verim ve verim ögeleri üzerine olumlu etkiler gösterdiği belirlenmiştir.

Anahtar Kelimeler: *Tritikale, Epibrassinolide, Yaprak Uygulaması, Verim*

ID: 555

Determination of Quality Characteristics of Local Bean Lines Selected by Selection Breeding Method

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Abstract

This research was conducted to determine the quality characteristics of different bean genotypes. In the study, ISP5, ISP13, ISP18, ISP19, ISP21, ISP22, ISP23, ISP31, ISP32, ISP34, ISP35, BUR14, BUR20, BUR21, ESK3, KON5, MAN1, DEN2, KON16, KON17, ISP72, ISP98 lines, Göynük98 and Önceler98 cultivars were used. Hundred-grain weight, thousand-grain volume, water uptake capacity, water uptake index, swelling capacity, swelling index, grain density, seed coat rate and oil rate properties were investigated. As a result of the study, it was determined that ISP21, ISP18, ISP31, ISP32, KON5, ISP5 and ISP22 in hundred-grain weight, ISP31, ISP21, ISP18 ve ISP5 in thousand-grain volume, ISP31, KON5, ISP22, ISP21, ISP32 and ISP19 in water uptake capacity, DEN2, ESK3, ISP98, ISP22 and ISP35 in water uptake index, KON5 in swelling capacity, DEN2, ISP98 and ISP34 in swelling index, ISP98 in grain density, ISP23 in seed coat rate and ISP34 in oil rate were superior. Result of the correlation analysis; It was determined that thousand-grain volume, water uptake capacity and swelling capacity have a significant positive relationship with hundred-grain weight. There was a significant positive relationship between water uptake capacity and swelling capacity, negative significant relationship with uptake capacity and seed coat rate. Water uptake index have a significant positive relationship with swelling index, grain density and seat coat rate. Also It was determined that there was a negative significant relationship between the seed coat rate and the oil rate.

Key Words: *Bean, Genotype, Line, Seed, Quality*

Seleksiyon Islahı Yöntemiyle Seçilmiş Yerel Fasulye Hatlarının Kalite Özelliklerinin Belirlenmesi

Özet

Bu araştırma, farklı fasulye genotiplerinin kalite özelliklerini belirlemek amacıyla kurulmuştur. Çalışmada ISP5, ISP13, ISP18, ISP19, ISP21, ISP22, ISP23, ISP31, ISP32, ISP34, ISP35, BUR14, BUR20, BUR21, ESK3, KON5, MAN1, DEN2, KON16, KON17, ISP72, ISP98 hatları, Göynük98 ve Önceler98 çeşitlerinin yüz tane ağırlığı, bin tane hacmi, su alma kapasitesi, su alma indeksi, şişme kapasitesi, şişme indeksi, tane yoğunluğu, tohum kabuğu oranı ve yağ oranı özellikleri incelenmiştir. Çalışma sonucunda, yüz tane ağırlığı bakımından ISP21, ISP18, ISP31, ISP32, KON5, ISP5 ve ISP22, bin tane hacmi bakımından ISP31, ISP21, ISP18 ve ISP5, su alma kapasitesi bakımından ISP31, KON5, ISP22, ISP21, ISP32 ve ISP19, su alma indeksi bakımından DEN2, ESK3, ISP98, ISP22ve ISP35, şişme kapasitesi bakımından KON5, şişme indeksi bakımından DEN2, ISP98 ve ISP34, tane yoğunluğu bakımından ISP98, tohum kabuğu oranı bakımından ISP23 ve yağ oranı bakımından ISP34 hatlarının üstün olduğu belirlenmiştir. Korelasyon analizi sonucunda; yüz tane ağırlığı ile bin tane hacmi, su alma kapasitesi ve şişme kapasitesi arasında pozitif önemli, su alma kapasitesi ile şişme kapasitesi arasında pozitif önemli, su alma kapasitesi ile tohum kabuğu oranı arasında negatif önemli, su alma indeksi ile şişme indeksi, tane yoğunluğu ve tohum kabuğu oranı arasında pozitif önemli, tohum kabuğu oranı ile yağ oranı arasında ise negatif önemli ilişki olduğu belirlenmiştir.

Anahtar Kelimeler: *Fasulye, Genotip, Hat, Tohum, Kalite*

ID: 556

Effects of Foliar Plant Growth Regulator Applications on Fruit and Essential Oil Yield of Fennel (*Foeniculum vulgare* Mill)

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Abstract

This study was carried out in order to determine the effects of foliar applications of Gibberellic acid (GA3), Methyl Jasmonate (MJ), Salicylic acid (SA), Abscisic Acid (ABA) and 2,4-D on some yield characteristics and fruit and essential oil yield of fennel (*Foeniculum vulgare* Mill). Different concentrations of GA_3 (50, 100 and 150 ppm), MJ (0.1, 0.5 and 1.0 mM), SA (1 and 5 mM), ABA (50 and 100 µL) and 2,4-D (0.15% and 0.30%) were pulverized to the plant leaves by spraying at the beginning of the flowering period. Depending on the growth regulator applications, the biological yield varied between 401-682 g/plant, fruit yield between 62-145 kg/da, harvest index between 15.6-22.3%, thousand-grain weight between 6.27-10.40 g, essential oil content between 1.83-2.19% and essential oil yield between 1.32-2.80 L/da. The effects of phytohormone applications on plant growth and essential oil content differed according to the application dose. Growth-promoting phytohormones generally affected the parameters examined in the research positively, and although ABA and 2,4-D applications increased the essential oil ratio, they showed a decreasing effect on fruit yield. In the study, it was concluded that 100 ppm GA_3, 0.5 mM MJ and 5 mM salicylic acid applications could increase the fruit and essential oil yield of fennel.

Keywords: *Fennel, plant growth regulators, fruit yield, essential oil content*

Yapraktan Uygulanan Bazı Büyüme Düzenleyicilerinin Rezene (*Foeniculum vulgare* Mill)'de Meyve ve Uçucu Yağ Verimine Etkileri

Özet

Bu çalışma, yapraktan yapılan fitohormon (Giberelik asit (GA_3), Metil Jasmonat (MJ), Salisilik asit (SA), Absisik Asit (ABA) ve 2,4-D) uygulamalarının rezene (*Foeniculum vulgare* Mill) bitkisinde bazı verim özellikleri ile meyve ve uçucu yağ verimine etkilerinin belirlenmesi amacıyla yürütülmüştür. Çalışmada farklı konsantrasyonlarda GA_3 (50, 100 ve 150 ppm), MJ (0.1, 0.5 ve 1.0 mM), SA (1 ve 5 mM), ABA (50 ve 100 µL) ve 2,4-D (% 0.15 ve % 0.30) çiçeklenme dönemi başında bitki yapraklarına püskürtme şeklinde uygulanmıştır. Büyüme düzenleyicisi uygulamalarına bağlı olarak biyolojik verim 401-682 g/bitki, meyve verimi 62-145 kg/da, hasat indeksi % 15.6-22.3, bin dane ağırlığı 6.27-10.40 g, uçucu yağ oranı % 1.83-2.19 ve uçucu yağ verimi 1.32-2.80 L/da arasında değişim göstermiştir. Fitohormon uygulamalarının bitki gelişimi ve uçucu yağ içeriğine etkileri uygulama dozlarına göre farklılık göstermiştir. Büyümeyi teşvik edici fitohormonların araştırmada incelenen parametreleri genellikle olumlu yönde etkilemiş, ABA ve 2,4-D uygulamalarının ise uçucu yağ oranını arttırmalarına rağmen, meyve verimini azaltıcı etki göstermiştir. Çalışmada, 100 ppm GA_3, 0.5 mM MJ ve 5 mM salisilik asit uygulamaları ile rezenede meyve ve uçucu yağ veriminin arttırılabileceği sonucuna varılmıştır.

Anahtar Kelimeler: *Rezene, bitki büyüme düzenleyicisi, meyve verimi, uçucu yağ oranı*

Giriş

Apiaceae familyasına dâhil olan rezene (*Foeniculum vulgare*) doğal olarak Akdeniz iklim kuşağının bitkisi olup, Dünyada en çok Avrupa ülkeleri, Hindistan, Çin, Mısır, Arjantin, Türkiye, Pakistan ve Endonezya'da (Gedik et al., 2019), ülkemizde ise yoğun olarak Burdur, Konya ve Antalya'da yetiştirilmektedir (Anonim, 2021). Rezene gıda sektöründe ekmek, balık, et, turşu, makarna ve salatalarda, kök ve tohumlarından elde edilen sıvı ekstratlar şekerli ürünler, alkolsüz içecekler ve sirkelerde (Arabacı and Bayram, 2005), yapısında bulunan galactagogue sayesinde anne sütü salgılanmasını arttırmada, uyarıcı ve rahatlatıcı etkisiyle sindirim sistemi rahatsızlıklarında kullanılmaktadır. Ayrıca rezene tohumlarının uçucu yağı antibakteriyel, antifungal ve antioksidan özelliklerinden dolayı tıpta antiseptik olarak kullanılmaktadır (Bayaz, 2014).

Abiyotik ve biyotik faktörlerin yanı sıra ontogenetik, diurnal ve morfogenetik varyebiliteler, kültürel uygulamalar ve coğrafik yapı uçucu yağ sentez ve üretimini etkileyen en önemli faktörlerin başında yer almaktadır (Gobbo-Neto and Lopes 2007). Doğal ve sentetik büyüme düzenleyicileri bitkilerin çimlenmesinden hasadına kadar biyokimyasal, fizyolojik ve morfolojik değişimleri etkileyen ve kontrol eden maddelerdir (Basra, 2000). Bitki büyüme düzenleyicilerinin birçok aromatik bitki türünde büyüme, uçucu yağ sentezi, uçucu yağ salgı yapıları ve sentezi ve uçucu yağ verimi ve bileşimi üzerine önemli derecede etki gösterdiği bilinmektedir (Prins et al., 2010; Sharafzadeh and Zare, 2011; Feizbakhsh et al., 2016). Büyüme düzenleyicilerden Metil jasmonat (MJ), kök büyümesi, çiçeklenme, olgunlaşma, yaşlanma, fotosentez, patojenlere ve böcek saldırısına karşı savunma tepkisi gibi fizyolojik süreçlerde önemli rol oynayan (Kim et al., 2009; Warabieda et al., 2010) ve bitkilerin ekolojik şartlara adaptasyonundan sorumlu birçok sekonder metabolitin biyosentezini teşvik eden hücresel

düzenleyicilerdir. Giberellinler (GA), bitki boyu ve kök uzaması, tohum çimlenmesi, çiçeklenme, meyve tutumu ve meye gelişimini düzenleyen ve tarımsal üretimde yaygın olarak kullanılan diterpenlerdir (Spartz and Gray 2008). Salisilik asit (SA), bitkilerde özellikle stres şartlarında birçok metabolik ve fizyolojik reaksiyonu düzenleyen ve dolayısıyla bitki büyüme ve gelişmesini etkileyen (Hayat et al., 2010) ve özellikle patojen saldırılarına karşı bitkilerin savunma mekanizmalarında ve sistemik kazanılmış dirençte önemli rol oynayan (Alverez, 2000) bitki büyüme düzenleyicisidir. Bitkilerde sentezlenen önemli bir büyüme inhibitörü olan ABA, stres anında miktarı artarak stomaların kapanmasına neden olmakta, protein sentezini yavaşlatmakta, genaratif döneme geçişi hızlandırarak tohum olgunluğunu teşvik etmekte ve dormansinin oluşması ve sürdürülmesinde etkili olmaktadır. Oksinlerin fenoksi asetik asit türevi grubunda yer alan 2,4-D, günümüzde tarım alanlarındaki yabancı otların kontrolünde yaygın olarak kullanılmakta olup, bitkilerde besin maddelerinin absorbsiyonu ve floemden taşınımını engellemek suretiyle fotosentez de dahil olmak üzere birçok metabolik süreç üzerine önemli etki göstermektedir (Kaynak and Ersoy, 1997).
Fitohormonlar günümüzde bitki gelişimi, büyüme, çiçeklenme ve meyve tutumunu teşvik ederek verim ve kaliteyi arttırma gibi birçok kullanım alanına sahip olup, kullanımları her geçen gün yaygınlaşmaktadır. Fitohormonların rezene bitkisinde meyve verimi ve uçucu yağ sentezi üzerine etkileri konusunda yapılan çalışma sayısı oldukça sınırlıdır. Bu çalışmada, rezene bitkisinde GA_3, MJ, SA, ABA ve 2,4-D uygulamalarının meyve verimi ve verimi etkileyen özellikler ile uçucu yağ oranı ve verimine etkilerinin belirlenmesi amaçlanmıştır.

Materyal ve Yöntem

Çalışma, 2019 yılında Isparta Uygulamalı Bilimler Üniversitesi Ziraat Fakültesi Eğitim, Araştırma ve Uygulama Çiftliği deneme alanlarında yürütülmüştür. Çalışmada Burdur ilinde 2017 yılı üretim sezonunda üretimi yapılan ve rezene (*Foeniculum vulgare* Mill) tohumları ile Sigma-Aldrich firmasından temin edilen GA_3, Metil Jasmonat, Salisilik asit, Absisik Asit ve 2,4-D materyal olarak kullanılmıştır. Denemenin yürütüldüğü arazinin toprak özellikleri; tınlı, katyon değişim kapasitesi %30, tuz içeriği % 0.023, organik madde % 1.0, alınabilir fosfor miktarı 19.3 mg/kg, potasyum miktarı 183 g/da KO_2, azot içeriği % 0.37, kireç oranı ise % 23'tür. Çalışmanın yürütüldüğü Isparta ilinin bazı iklim verileri Tablo 1'de verilmiştir.

Tablo 1. Isparta ilinin uzun yıllar ve 2019 yılına ait bazı iklim verileri

Aylar	Yağış (mm)		Sıcaklık (ºC)		Nem (%)	
	1950-2018	2019	1950-2018	2019	1950-2018	2019
Mart	57.3	40.3	6.1	7.3	65.6	63.0
Nisan	51.6	50.8	10.7	9.9	60.8	64.4
Mayıs	55.7	34.2	15.2	16.8	58.7	53.4
Haziran	32.6	53.3	19.8	20.7	52.1	59.8
Temmuz	16.5	9.5	23.3	23.3	45.4	44.9
Ağustos	13.4	2.7	23.1	24.4	46.3	43.0
Yağış Top.Sıcaklık-Nem Ort.	227.1	190.8	16.4	17.1	54.8	54.8

Meteoroloji Genel Müdürlüğü

Çalışma Tesadüf Blokları Deneme deseninde 3 tekerrürlü olarak kurulmuştur. Rezene tohumları Mart ayının son haftasında 30 x 5 cm ekim normunda her bir parselde 7 sıra (parsel alanı 12.6 m^2 (2.1 m x 6 m)) olacak şekilde el ile ekilmiştir. Çalışmada farklı konsantrasyonlarda GA_3 (50, 100 ve 150 ppm), Metil Jasmonat (0.1, 0.5 ve 1.0 mM), Salisilik asit (1 ve 5 mM), Absisik asit (50 ve 100 µM) ve 2,4-D (% 0.15 ve % 0.30) ve kontrol (saf su) olmak üzere her blokta 13, toplamda ise 39 parsel oluşturulmuştur. Ekim ile birlikte dekara 6 kg/da saf azot ve 6 kg/da saf fosfor, çiçeklenme döneminde ise 4 kg/da saf azot olacak şekilde gübreleme yapılmıştır. Fitohormon uygulamaları çiçeklenme dönemi başında motorlu sırt pülverizatörü ile (40 L/da normunda) bitki üst aksamına püskürtme şeklinde yapılmıştır. İklim koşullarına bağlı olarak çıkışlardan sonra ve çiçeklenmeden önce olmak üzere iki kez yağmurlama sulama yapılmıştır. Gerek duyulduğu dönemlerde el ile yabancı ot mücadelesi yapılmıştır.
Çalışma sonunda parsel hasadı, bitkilerin hasat olgunlukları dikkate alınarak, ana çiçek dallarındaki meyvelerin kahverengileşmeye başladığı dönemde her parsel ayrı ayrı yapılmıştır. Her parselde kenar sıralar ile parsel baş ve sonlarından 1'er metre kenar tesiri olarak ayrıldıktan sonra geriye kalan alan hasat alanı olarak değerlendirilmiştir. Hasat alanındaki tüm bitkiler biçilerek tarlada kurtulduktan sonra meyveler temizlenmiş ve meyve verimleri hesaplanmıştır. Rezene meyvelerinin uçucu yağ oranları Clevenger tipi hidro-distilasyon cihazında belirlenmiştir. Her bir tekerrürde 100'er g meyve örneği öğütüldükten sonra balon içerisine konulmuş ve 1/3 oranında su eklenerek 3 saat süre ile damıtma yapılmıştır. Damıtma sonunda uçucu yağların miktarı ml olarak ölçülmüş ve % olarak oranları (v/w) hesaplanmıştır (Marotti and Piccaglia 1992).
Araştırmadan elde edilen veriler SAS (2009) istatistik paket programında GLM prosedürü kullanılarak standart varyans analizi tekniğinde (ANOVA) analiz edilmiş ve ortalamalar arasındaki farklılıklar LSD testine göre belirlenmiştir.

Bulgular

Fitohormon uygulamalarının biyolojik verim üzerine etkileri istatistiki olarak önemli (P<0.01) bulunmuş, uygulamalara bağlı olarak biyolojik verim 401-682 g/bitki arasında değişim göstermiştir. Kontrol ile karşılaştırıldığında 0.1 ve 0.5 mM MJ, 100 ve 150 ppm GA_3 ve 5 mM SA uygulamaları biyolojik verimi önemli derecede arttırırken, 100 µM ABA ile her iki dozda da yapılan 2,4-D uygulamaları biyolojik verimin önemli derecede azalmasına neden olmuştur (Tablo 2). Fitohormon uygulamaları ile meyve veriminde önemli değişiklikler meydana gelmiş, bu değişiklikler istatistiki anlamda önemli (P<0.01) bulunmuştur. Yapılan farklı uygulamalara bağlı olarak meyve verim 62-145 kg/da arasında geniş bir varyasyon göstermiştir. Çalışmada 0.5 mM MJ uygulamaları (145 kg/da) kontrole göre (118 kg/da) meyve verimini önemli derecede arttırmış, 0.1 mM MJ, 50 ve 100 ppm GA_3 ve SA uygulamaları meyve verimini arttırmakla birlikte bu artış istatistiki olarak önemli olmamıştır. Diğer taraftan, yüksek dozlarda yapılan ABA (78 kg/da) ve 2,4-D (62 kg/da) uygulamaları meyve veriminin önemli derecede azalmasına neden olmuştur (Tablo 2). Fitohormon uygulamalarına bağlı olarak hasat indeksi değerleri % 15.6 - 22.3 arasında değişim göstermiş, bu değişim istatistiki açıdan önemli (P<0.05) bulunmuştur. Kontrol ile karşılaştırıldığında % 0.30 2,4-D (% 15.6), 100 µM ABA (% 15.8) ve 150 ppm GA_3 (%16.4) uygulamaları kontrole göre (% 21.3) hasat indeksinin azalmasına neden olurken, diğer uygulamalarda hasat indeksi değerleri kontrol ile benzer olarak bulunmuştur (Tablo 2).

Tablo 2. Fitohormon uygulamalarının rezenede bazı verim parametreleri ve uçucu yağ oranı üzerine etkileri

Uygulamalar		Biyolojik Verim (kg/da)	Meyve Verimi (kg/da)	Hasat İndeksi (%)	Bin tane ağırlığı (gr)	Uçucu Yağ Oranı (%)	Uçucu Yağ Verimi (L/da)
GA_3	50 ppm	613bd	136ab	22.3a	9.50be	1.91bc	2.57ac
	100 ppm	666ab	140ab	21.1a	8.93e	1.88c	2.71ab
	150 ppm	662ac	108cd	16.4b	10.40a	1.94bc	2.14cd
MJ	0.1 mM	634ac	134ab	21.1a	9.57be	1.83c	2.45ad
	0.5 mM	682a	145a	21.4a	9.20ce	1.91bc	2.72ab
	1.0 mM	556df	109cd	19.8ab	9.90ad	2.19a	2.35bd
SA	1 mM	606cd	128ac	21.4a	9.77ad	1.91bc	2.48ac
	5 mM	639ac	136ab	21.4a	9.97ac	2.00ac	2.80a
ABA	50 µM	533eg	102d	19.3ab	7.50f	2.07ab	2.02de
	100 µM	496g	78e	15.8b	6.27g	2.18a	1.69ef
2,4-D	% 0.15	507fg	110cd	21.8a	10.30ab	1.88c	2.03de
	% 0.30	401h	62e	15.6b	9.10de	2.18a	1.32f
Kontrol		566de	118bd	21.3a	9.30ce	1.86c	2.21cd
Lsd (0.05)		57.1**	21.0**	4.40*	0.83**	0.19**	0.44**
CV (%)		5.82	10.7	13.1	5.34	5.61	11.6

Fitohormon uygulamalarının bin tane ağırlığı üzerine etkileri istatistiki olarak önemli (p<0.01) olmuş, uygulamalara bağlı olarak meyvelerin bin tane ağırlıkları 6.27-10.40 gr arasında değişim göstermiştir. En yüksek bin tane ağırlığı 150 ppm GA_3 (10.40 g) 1 mM MJ (9.90 g), 1 ve 5 mM SA (9.77-9.97 g) ve % 0.15 2.4 D (10.30 g) uygulamalarından elde edilmiştir. Büyüme inhibitörü olan ABA uygulamaları (6.27-7.50 g) bin tane ağırlığını kontrole göre (9.30 g) önemli derecede düşürmüştür (Tablo 2). Rezene meyvelerinde uçucu yağ oranı fitohormon uygulamalarına bağlı olarak % 1.83 - 2.19 arasında değişmiş, bu değişim istatistiki açıdan önemli (P<0.01) bulunmuştur. Kontrolde % 1.86 olarak belirlenen meyve uçucu yağ oranı 1 mM MJ (% 2.19), 50 ve 100 µM ABA (sırası ile % 2.07 ve % 2.18) ve % 0.30 2.4 D (% 2.18) uygulamaları ile önemli derecede artmış, diğer uygulamalarda uçucu yağ oranları kontrol ile benzer olmuştur. Uygulamaların uçucu yağ verimi üzerine etkileri de istatistiki olarak önemli (P<0.01) olmuş, uygulamalara bağlı olarak uçucu yağ verimleri 1.32 - 2.80 L/da arasında değişim göstermiştir. Meyve uçucu yağ verimleri 100 ppm GA_3 (2.71 L/da), 0.5 mM MJ (2.72 L/da) ve 5 mM SA (2.80 L/da) uygulamaları ile kontrole (2.21 L/da) göre önemli derecede artarken, yüksek dozlarda yapılan ABA (1.69 L/da) ve 2,4-D (1.32 L/da) uygulamaları uçucu yağ veriminin azalmasına neden olmuştur (Tablo 2).

Tartışma ve Sonuç

Çalışmada, fitohormon uygulamalarının rezene bitkisinde verim ve verimi etkileyen bazı parametreler ile uçucu yağ oran ve verimi üzerine etkileri önemli bulunmuştur. Rezene meyve veriminde MJ uygulamaları ile % 22.9, GA_3 uygulamaları ile % 18.6 ve SA uygulamaları ile ise % 15.2'ye varan artış sağlanmıştır. GA_3, SA ve MJ gibi bitki gelişimini teşvik edici özellikte olan fitohormonların bitkilerde özellikle fotosentez, çiçeklenme ve meyve bağlamayı teşvik ederek meyve verimini ve biyolojik verimi arttırdığı düşünülmektedir. Salisilik asit ve jasmonatların patojen veya böcek saldırısı, mekanik yaralanma veya kuraklık, tuzluluk, düşük sıcaklık vb. gibi

abiyotik ve biyotik streslere karşı bitki savunma tepkilerini indükledikleri (Moreira et al., 2012; Fahadet et al., 2015; Farooq et al., 2016) ve bu sayede bitki gelişimi üzerine olumlu etki gösterdikleri bilinmektedir. Gibberellinler ise büyüme noktalarında hücre bölünmesini uyaran ve bitki gelişiminin düzenlenmesinden sorumlu olan bileşikler olarak tanımlanmaktadır (Khan et al., 2016). Yüksek dozda yapılan GA_3 uygulamaları bitkide fazla dal ve çiçek teşekkülüne neden olmuş, bu durum ise meyve bağlama oranını ve dolayısı ile meyve verimini azaltmıştır. Nitekim, 150 ppm GA_3 uygulamalarında biyolojik verimin yüksek olmasına rağmen meyve veriminin düşük olması bu durumu açıklar niteliktedir. MJ, 0.5 mM dozuna kadar bitki gelişimi üzerine olumlu etki gösterirken, yüksek dozda uygulandığında hem biyolojik verim hem de meyve verimini azaltıcı etki göstermiştir. Bu durum, MJ'ın bitkilerde olgunlaşma ve yaşlanma gibi süreçlerin düzenlenmesinden sorumlu olması (Wasternack, 2014) nedeniyle yüksek konsantrasyonda uygulandığında olgunlaşmayı hızlandırması ile açıklanabilir. Yüksek dozda (1.5 mM) yapılan MJ uygulamalarının kimyon bitkisinde bitki gelişimi ve meyve verimini azalttığı Şanlı et al. (2021) tarafından da bildirilmiştir. MJ'ın özellikle abiyotik stres faktörlerine karşı bitki savunma sistemini uyardıkları ve bitki gelişimini olumlu yönde etkiledikleri daha önceki araştırmacılar tarafından da bildirilmiştir (Warabieda et al., 2010; Haokip et al., 2016). Diğer taraftan, büyüme inhibitörü ABA ve oksinlerin fenoksi asetik asit türevi grubunda yer alan 2,4-D uygulamaları bitki gelişimini olumsuz yönde etkilemiş, bu etki yüksek dozda yapılan uygulamalarda daha belirgin olmuştur. Bitki inhibitörleri olgunlaşmadan sorumlu maddeler olup, bitkilerin generatif döneme geçişini hızlandırmaktadır. Oksin türevi olan 2,4-D ise geniş yapraklı bitkiler için yüksek konsantrasyonlarda herbisit etkisi göstermektedir. ABA'in vejetatif gelişme dönemini kısaltması, 2,4-D'nin ise herbisit etkisi hem biyolojik verim hem de meyve veriminin azalmasına neden olmuştur. Fitohormonların bitkilerde düşük konsantrasyonlarda bulunan ve fizyolojik aktiviteleri genellikle yine düşük konsantrasyonlarda ortaya çıkan aktif moleküller olduğu ve fazlalıkları durumunda engelleyici ya da inhibitör aktivite gösterebildikleri bilinmektedir (Nambara and Marion-Poll, 2005; Teale et al., 2006). Bulgularımıza benzer olarak, aromatik bitkilerde farklı konsantrasyonlarda GA_3, SA ve MJ uygulamalarının büyüme parametrelerini, çiçeklenme ve meyve bağlamayı, tohum verimini ve kalite parametrelerini önemli ölçüde etkilediği ve meyve ve uçucu yağ verimini arttırdığı bildirilmiştir (Verma and Sen, 2006; Singh et al., 2012; Haokip et al., 2016; Kusuma et al., 2019; Şanlı et al., 2021).

Rezene meyvelerinde bin tane ağırlığı yüksek dozlarda yapılan GA_3 ve % 0.15 dozunda 2,4-D uygulamaları ile artarken, ABA uygulamaları bin tane ağırlığını azaltıcı etki göstermiştir. Yüksek dozda uygulanan GA_3'in çiçeklenmenin aşırı teşvik edilmesine neden olarak meyve tutumunu azalttığı, düşük konsantrasyonda uygulanan 2,4-D'nin ise çiçeklenmeyi nispeten olumsuz yönde etkilemek suretiyle daha az meyve oluşumuna neden olduğu düşünülmektedir. ABA uygulamaları ile bin tane ağırlığında gerçekleşen azalma ise bu fitohormonun bitki gelişimini olumsuz yönde etkilemesi ile açıklanabilir. Meyve uçucu yağ oranı yüksek dozda yapılan MJ ve 2,4-D ile ABA uygulamalarında önemli derecede artmıştır. Rezene uçucu yağ verimi 100 ppm GA_3, 0.5 mM MJ ve 5 mM SA uygulamaları ile önemli derecede arttırmış, özellikle yüksek dozda ABA ve 2,4-D uygulamaları uçucu yağ verimini azaltmıştır. Birim alan uçucu yağ verimi ise SA, GA_3 ve MJ uygulamaları ile sırası ile % 26.7, % 22.6 ve % 22.5 oranında artış göstermiştir. Uçucu yağ verimi, bitkide meyve verimi ve uçucu yağ oranı ile ilgili bir özellik olup, bu parametreleri olumlu yönde etkileyen uygulamalar aynı zamanda uçucu yağ verimini de arttırmıştır. Uçucu yağ oranını arttırıcı etki gösteren uygulamalar aynı zamanda bitki gelişimini ve meyve verimini olumsuz yönde etkileyen uygulamalardır. Bahsedilen uygulamaların bitki gelişimi olumsuz yönde etkileyerek bitkilerde strese neden oldukları düşünülmektedir. Aromatik bitkilerde uçucu yağ sentezinin özellikle stres şartları altında artış gösterdiği birçok araştırmacı tarafından da bildirilmiştir (Verma and Shukla 2015; Vashisth et al., 2018; Punetha et al., 2022). Fitohormonlar pirimer ve sekonder metabolit üretimi, uçucu yağların salgı ve depo yapıları, uçucu yağların biyosentez, verim ve bileşenleri üzerine farklı etkilere sahip olabilmektedirler (Prins et al., 2010; Sharafzadeh and Zare, 2011). Bulgularımız, MJ uygulamalarının bazı aromatik bitkilerde uçucu yağ oranını arttırdığını bildiren çalışmalar (Kim et al., 2006; Li et al., 2007; Raouf Fard et al., 2012) ile uygum göstermektedir. Fitohormon uygulamalarının bitki gelişimi ve uçucu yağ içeriğine etkileri uygulanan fitohormonlara ve uygulama dozlarına göre önemli farklılıklar göstermiştir. Büyümeyi teşvik edici fitohormonların araştırmada incelenen parametreleri genellikle olumlu yönde etkiledikleri, ABA ve 2,4-D uygulamalarının ise uçucu yağ oranını arttırmalarına rağmen, meyve verimini azaltıcı etki gösterdikleri anlaşılmıştır. Çalışmada, 100 ppm GA_3, 0.5 mM MJ ve 5 mM salisilik asit uygulamaları ile rezenede meyve ve uçucu yağ veriminin arttırılabileceği, bununla birlikte bu uygulamaların etkinliklerinin farklı ekolojilerde de belirlenmesi gerektiği sonucuna varılmıştır.

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A Research on Agricultural Products Storage Warehouses in Van Province

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Abstract

In this research; The current situation and problems of the cold storages in the province of Van have been studied. In this direction, 21 cold storages registered in Directorate of Van Provincial Agriculture and Forestry were visited and on-site investigations were made. The findings obtained as a result of the surveys made with their owners by considering the features of the cold storages such as the structural and mechanization status, the type of stored product have been effective in identifying problems and suggesting solutions. It is used for white meat and eggs 29% of cold storages, 29% for milk and dairy products, 29% for red meat and 13% for fruit and vegetable storage. In addition, there are 17 fruit and vegetable warehouses, 13 of which are unused, that are not registered in Directorate of Van Provincial Agriculture and Forestry, and these were excluded from the research because they were not registered. The most important problems in warehouses were experienced during the pandemic process. Lack of the technical capacity, machinery and equipment, qualified personnel, the marketing problems, maintenance and repair, rent, electricity and water expenses are the main ones. Improvement of its structural properties, modern mechanization device, establishment of unions that will enable warehouse owners to act together, eliminating the lack of qualified personnel with Van Yuzuncu Yil University, one of the most important educational institutions in the region and measures to increase export potential will play an important role in solving the problems.

Key Words: *Agricultural structures, Cold storage, Food preservation issues, Van Province.*

Van İlindeki Tarım Ürünleri Muhafaza Depoları Üzerine Bir Araştırma

Özet

Bu araştırmada; Van ilinde bulunan soğuk hava depolarının mevcut durumları ve sorunları üzerine çalışılmıştır. Bu doğrultuda Van İl Tarım ve Orman Müdürlüğü'nde kayıtlı olan 21 adet soğuk hava deposuna gidilerek yerinde incelemelerde bulunulmuştur. Soğuk hava depolarının yapısal özellikleri, mekanizasyon durumu, depolanan ürün çeşidi gibi özellikleri değerlendirmeye alınarak sahipleri ile yapılan anketler sonucunda elde edilen bulgular sorunların belirlenmesinde ve çözüm önerilerinde etkili olmuştur. Soğuk hava depolarının 6 tanesi beyaz et ve yumurta, 6 tanesi süt ve süt ürünleri, 6 tanesi kırmızı et ve 3 tanesi de meyve ve sebze deposu olarak kullanılmaktadır. Ayrıca Van İl Tarım ve Orman Müdürlüğü'nde kayıtlı olmayan 13 tanesi atıl durumda olan 17 tane meyve ve sebze deposu bulunmakta olup bunlar kayıtlı olmamaları nedeniyle araştırma dışında tutulmuştur. Depolarda en önemli sorunlar pandemi sürecinde yaşanmıştır. Teknik kapasite, makine ve techizat, kalifiye eleman yetersizliği, pazarlama problemleri, bakım ve onarım, kira, elektirik, su giderlerinin karşılanamaması bu sorunlardan başlıcalarıdır. Yapısal özelliklerinin iyileştirilmesi, modern mekanizasyon tertibatı, depo sahiplerinin beraber hareket etmelerini sağlayacak birliklerin kurulması, yörenin en önemli eğitim kurumlarından biri olan Van Yüzüncü Yıl Üniversitesi ile kalifiye eleman eksikliğinin giderilmesi ve ihracat potansiyelini artıracak önlemler sorunların giderilmesinde önemli rol oynayacaktır.

Anahtar Kelimeler: *Tarımsal yapılar, Soğuk hava deposu, Gıda muhafaza sorunları, Van ili.*

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Antifungal Activities of Sulphur Applications against *Rhizoctonia solani* and *Fusarium solani* on Potato

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Abstract

This study was carried out in Isparta, Turkey during 2011 and 2012 crop seasons to determine the antifungal effects of sulphur doses (0, 2, 4, 6, 8 and 10 kg/da) and application methods (S1: application on seedbed during planting, S2: broadcast on soil before planting and S3: foliar application) on *Rhizoctonia solani* and *Fusarium solani* in potatoes. According to the results obtained from the study, application methods, doses and their interactions were found to be statistically significant in both infections. Seedbed S applications showed higher antifungal effects than soil and foliar applications for both infections. The effects of the application methods were different depending on the doses, and 8 kg/da S in seedbed applications, 10 kg/da S in soil applications, and 6 kg/da S in foliar applications were more effective. In terms of *R. solani* infection, infected tuber ratio and the infection severity were 50.7% and 36.0%, respectively in the control tubers, while these rates decreased to 18.8% and 6.0%, respectively with 10 kg/da S soil applications. Infection severity (6.8%) and infected tuber ratio (6.0) with *F. solani* were significantly decreased with 8 kg/da S seedbed applications compared to control tubers (11.4% and 14.3%, respectively). It was concluded that a significant resistance can be created against *R. solani* and *F. Solani* infections with sulphur applications, and the application of sulphur to the soil or seedbed is much more effective than the foliar application, and 6-8 kg/da S applications may be sufficient to control of fungal diseases.

Keywords: *Potato, Solanum tuberosum L., Sulphur application, antifungal activity*

Kükürt Uygulamalarının Patateste *Rhizoctonia solani* ve *Fusarium solani*'ye Karşı Antifungal Etkileri

Özet

Bu çalışma, patateste kükürt (% 98 S) uygulamalarının *Rhizoctonia solani*, *Fusarium solani* üzerine antifungal etkilerinin belirlenmesi amacıyla 2011-2012 yıllarında yürütülmüştür. Araştırmada elementel kükürt 0, 2, 4, 6, 8 ve 10 kg S/da dozlarında dikim sırasında tohum yatağına, dikimden önce toprak üzerine ve yaprağa olmak üzere 3 farklı yöntemle uygulanmıştır. Araştırmadan elde edilen sonuçlara göre, her iki enfeksiyon etmeni bakımından da kükürt uygulamaları ile uygulama x doz interaksiyonu istatistiki açıdan önemli bulunmuştur. Çalışmada her iki enfeksiyon için de tohum yatağına yapılan uygulamalar toprak ve yapraktan yapılan uygulamalara göre daha yüksek antifungal etki göstermiştir. Tohum yatağına yapılan uygulamalarda 8 kg/da, topraktan yapılan uygulamalarda 10 kg/da, yapraktan yapılan uygulamalarda ise 6 kg/da S dozu daha yüksek etki göstermiştir. *R. solani* enfeksiyonu bakımından enfekteli yumru oranı ve enfeksiyon şiddeti kontrolde sırası ile % 50.7 ve % 36.0 iken, bu oran toprağa yapılan 10 kg/da S uygulamaları ile sırası ile % 18.8 ve % 6.0'ya kadar düşmüştür. Kontrolde ortalama %11.4 ve %14.3 olarak belirlenen *F. solani* ile enfekteli yumru oranı ve enfeksiyon şiddeti oranları tohuma yapılan 8 kg/da S uygulamaları ile sırası ile % 6.8 ve % 6.0'ya düşmüştür. Kükürt uygulamaları ile patates bitkisinde ekonomik zararı yüksek *R. solani* ve *F. Solani* enfeksiyonlarına karşı önemli bir direnç oluşturulabileceği, kükürdün toprak ya da tohum yatağına uygulanmasının yapraktan uygulanmasına göre çok daha etkili olduğu ve fungal hastalıklarla mücadele için 6-8 kg/da S uygulamalarının yeterli olabileceği sonucuna varılmıştır.

Anahtar Kelimeler: *Patates, Solanum tuberosum L., Kükürt uygulaması, antifungal aktivite*

ID:559

Red rot resistant transgenic sugarcane developed by over-expression of SUGARWIN gene(s)

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Abstract

Sugarcane an agroindustrial crop, not only fulfils 70% of world's sugar need but is also main impending source of biofuel. Some biotic and abiotic stresses have devastating effects on sugarcane crop and sometimes may lead to complete crop failure. Red rot is a fungal disease caused by colletotrichun falcatum which severly affect yield and quality of sugarcane. To combat fungal diseases sugarcane plant is blessed with a wide variety of endogenous pathogenesis-related (PR) proteins i.e. glucanases, chitinases, chitosanases and proteases. These PR proteins hydrolyze fungal cell wall and may lead to fungal cell apoptosis. This study report the overexpression of two myco-protective genes i.e. SUGARWIN1 and SUGARWIN2 genes which have role in red rot resistance. Both genes were cloned under the CaMV35S i.e constitutive promoter. Bar gene was used as sselectable marker which confers resistance against gluphosinate (Phosphinothricin) for the selection of expression cassette. Biolistic transformation approach was used for transformation of expression cassette into embryogenic calli which were propagated from leaf whorls of sugarcane. Putative transformed plants were screened on phosphinothricin (selective agent) during regeneration. The regenerated shoots were shifted on rooting media and then plants were acclimatized. Transgenic event was confirmed by molecular analysis i.e. PCR (polymerase chain reaction). Overexpression of both genes was confirmed by expression analysis carried through qRT-PCR. Fungal bioassays of transgenic and untransformed plants were also carried out under in vitro conditions. The recent study established various parameters which may open new possibilities to gene transfer in monocots for the development of fungal resistant crops.

Key Words: *Sugarcane, Biolistic transformation, Young leaf whorls, SUGARWIN, Constitutive promoter, red rot disease, Colletotrichum falcatum.*

ID: 560

Tıbbı Aromatik Bitkilerin Yetiştiricilik Potansiyelinin Belirlenmesi(Amasya İli Suluova İlçesi Örneği)

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Özet

Bu çalışmada Amasya ili Suluova ilçesinde tıbbı aromatik bitki yetiştirme potansiyelini ortaya koyabilmek için anket çalışması düzenlenmiştir. İlçe Gıda Tarım ve Hayvancılık Müdürlüğü vasıtasıyla Çiftçi Kayıt Sisteminde yer alan çiftçi sayısı belirlenmiş (2006 adet) ve kolayda örnekleme yöntemi kulanılarak 343 adet katılımcı yardımıyla anket gerçekleştirilmiştir. Çalışma kapsamındaki köylerde ve ilçe merkezinde belirlenen çiftçi sayılarına göre yüzyüze görüşme yöntemiyle anketler yapılmıştır. Yüzyüze yapılan saha anketi çalışmaları sonucunda bölge üreticilerinin genel anlamda tıbbi aromatik bitkiler hakkında bilgileri olduğu ancak yetiştiricilik konusunda bazı çekinceleri olduğu ortaya çıkmıştır. Üreticiler çoğunlukla pazarlama konusunda şüphe yaşadıklarını ve pazarlama sorunun çözüldüğü takdirde üretime geçmeye istekli olduklarını belirtmişlerdir. İlçe merkezinde kurulacak bir ürün işleme merkezinin üreticileri tıbbi aromatik bitki yetiştiriciliğine sevk edeceği anlaşılmaktadır. Üreticilerin eğitim almaya istekli oldukları ve eğitim aldıklarında ise üretime geçeceklerini belirtmişlerdir. Tıbbi aromatik bitkileri yetiştirme isteği olan üreticilerin ürünlerin işlenmeleri noktasında en önemli talepleri distilasyon ve ekstraksiyon üniteleri olmuştur. Uygun iklim ve toprak şartlarına sahip Suluova ilçesinde kurulacak "Çiftçi Eğitim Merkezi" ve merkez bünyesinde hizmet verecek "Tıbbi Aromatik Bitkiler İşleme Merkezi" ilçe üreticilerine ve ilçe ekonomisine önemli katkılar sağlayacağı üreticilerle yapılan anket sonucunda anlaşılmaktadır. Ayrıca sonuçları Güçlendirmek amacı ile SWOT analizi çalışmaya dahil edilmiştir.

Anahtar Kelimeler: *Tıbbi Aromatik Bitkiler, Yetişitici potansiyeli, Amasya, Suluova*

ID: 561

Phytosiderophore Analog Efficiently Alleviates Iron Deficiency Symptoms in Soybean

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Abstract

Iron (Fe) bioavailability is dependent on soil pH. Its solubility, therefore bioavailability dramatically decrease in calcareous alkaline soils with high pH. Therefore, yields of soybean decrease when they are grown in alkaline soils, which cover 1/3th of the world's arable land. Inorganic micronutrient fertilizers with stabilizing chelates have been developed to rescue the micronutrient deficiency symptoms in crops grown in alkaline soils; yet, they bring a large economic burden to the farmers and their by-products, and accumulation causes environmental contamination. Therefore, alternative biodegradable chelated fertilizers are required to be developed to increase crop yields in sustainable agriculture. Grasses secrete phytosiderophores into the rhizosphere which increases Fe uptake by the plants, and these chemicals can help dicots, such as soybean, to uptake Fe more efficiently. Although it is difficult and expensive to produce them in a stable form, phytosiderophore 2′-deoxymugineic acid (DMA) derivative PDMA was cost-effectively produced as a stable analog. Here, we show that PDMA application from the soil eliminates the Fe deficiency symptoms in sensitive soybean plants when they are grown in calcareous alkaline soil with a pH of 8.5. Several physiological and biochemical parameters related to Fe deficiency response in soybean were increased in a dose-dependent PDMA application when they reached at V3-4 stage. Taken together, PDMA application from the soil increases the Fe uptake and accumulation in Fe deficiency-sensitive soybean cultivar, leading it to become Fe-efficient and tolerant in calcareous alkaline soil. In future studies, PDMA supplemented with different Fe sources may be formulated in a new type of micronutrient fertilizer to alleviate the Fe deficiency symptoms in dicots.

Keywords: *Alkaline soil, fertilizer, iron deficiency, phytosiderophore, soybean*

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ID: 568

Can calorie intake ensure food and nutritional security? The case of peri-urban residents of North Punjab, Pakistan

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Abstract

This study aims to investigate whether the calorie intake alone ensure food and nutritional security? For this purpose, panel data were collected from 105 residents of peri-urban areas of Rawalpindi, the largest city in North Punjab using stratified random technique. Dietary intake assessment method based on 7 days recall was used to measure calorie and three essential macro (protein, fats and carbohydrates) and four essential micro (iron, zinc, calcium and phosphorus) nutrients' sufficiency status. Food security indices were calculated using the sufficiency status of these nutrients. It was found that 22% of the household were measured as food insecure based on calorie sufficiency status. For essential nutrients' deficiency, it was found that 62%, 30%, 6%, 86%, 59%, 84% and 61% of the sample households were deficient in protein, fat, carbohydrate, iron, zinc, calcium and phosphorus consumption. The food and nutritional security indices confirm that calorie intake assessment does not provide enough information on food and nutritional security as 47% of the households were measured to be food insecure on weighted calculations. Furthermore, dietary patterns were also developed according to which, cereals were the main source of consumption of all the nutrients except fats. These ratios were not according to the desired dietary pattern identified in 2001. The multinomial logit model was used to identify the factors affecting household's food security. Four out of seven variables were significant. The model predictive efficiency was 55%. Monthly income was positively impacting food security while family size, perception regarding drinking water quality and incident of water borne diseases negatively affected the household food security.

Keywords: *calorie sufficiency; macro-nutrients; micro-nutrients, food and nutritional security; food security; food utilization*

Acknowledgement: The authors wish to acknowledge USAID for funding the project under IFPRI-PSSP program.

ID: 569

A study on determination of survival rate, some reproductive and growth traits of Akkaraman sheep reared rural farm conditions in Niğde province*

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Abstract

The research was carried out within the scope of the National Sheep and Goat Breeding Project of Turkey between 2017 and 2021 in the province of Niğde. In the study, the survival of lambs (120 days old (SR4)), reproductive and growth characteristics (birth, 60 days old (LW2) and 120 days old (WW) live weight) and daily live weight gains between birth and WW (DLWG) were evaluated and the effects of some environmental factors affecting these characteristics was determined. As research material, yield records of 30923 Akkaraman sheep breeds in 7 villages at 22 farms in Niğde province were examined. The average birth weight in lambs was determined as 4.36±0.01 kg. The live weight gain of 1.84 and 5.96 kg was achieved in Akkaraman lambs in terms of body weight on the LW2 and WW between 2017 and 2021, respectively (P<0.01). The highest WW was found in 2021 (36.43±0.08 kg), in four dam age (33.87±0.12 kg), single born (33.08±0.05 kg) and male lambs (33.88±0.06 kg) The effects of the year, dam age, gender and birth type were found to be statically significant on DLWG (P<0.05). Birth rate, fecundity and litter size were determined as 91%, 1.03 and 1.13, respectively. While no statistical difference was observed between birth types (P>0.05), the differences observed between male and female lambs were found significant (P<0.05) in terms of SR4. Although the highest SR4 was determined in the birth season of 2020 (96.21%), the lowest SR4 was determined in the birth season of 2019 (88.50%) (P<0.05). As a result, between 2017 and 2021 in Akkaraman lambs, a significant genetic progress was achieved, especially in terms of growth characteristics such as LW2, WW and DLWG, and the effects of all environmental factors on these characteristics were found to be significant.

Key Words: *Akkaraman, Lamb, Reproductive Characteristics, Growth Traits, Survival Rate*

Niğde İlinde Yetiştirici Koşullarında Akkaraman Koyunların Yaşama Gücü, Döl Verimi, Büyüme Özeliklerinin Belirlenmesi Üzerine Bir Araştırma

Özet

Araştırma, Halk Elinde Küçükbaş Hayvan Islahı kapsamında 2017-2021 yılları arasında Niğde ilinde Akkaraman ırkı koyunlarda üzerinde yürütülmüştür. Araştırmada, kuzuların yaşama gücü (120 günlük yaşta (SR4)), döl verimi ve büyüme özellikleri (doğum, 60 günlük yaş (LW2) ve 120 günlük yaş (WW) canlı ağırlıkları) ve doğum ile WW arası günlük canlı ağırlık artışları (DLWG) değerlendirilmiştir ve bu özellikler üzerine bazı çevresel faktörlerin etkileri belirlenmiştir. Materyal olarak, Niğde iline bağlı 7 farklı köydeki 22 işletmede 30923 baş Akkaraman ırkı koyunların verim kayıtları incelenmiştir. Kuzularda doğum ağırlığı ortalama 4,36±0,01 kg olarak tespit edilmiştir. Araştırmada, LW2 ve WW bakımından Akkaraman kuzularında 2017 ve 2021 yılları arasında sırasıyla 1,84 ve 5,96 kg bir canlı ağırlık artışı sağlanmıştır (P<0.01). En yüksek WW (36.43±0.08 kg) 2021 yılında, ana yaşı 4 olan (33,87±0,12 kg), tek doğan (33,08±0,05 kg) ve erkek kuzularda (33,88±0,06 kg) tespit edilmiştir. DLWG üzerine etkisi incelenen yıl, ana yaşı, cinsiyet ve doğum tipinin etkisi istatistiki olarak önemli bulunmuştur (P<0.05). Doğum oranı, koç altı koyun ve doğuran koyun başına doğan kuzu sayısı sırasıyla %91, 1,03 ve 1,13 olarak tespit edilmiştir. SR4 bakımından doğum tipleri arasında istatistiki bir farklılık gözlenmezken (P>0.05), erkek ve dişi kuzular arasında gözlenen farklılıklar önemli bulunmuştur (P<0.05). En yüksek yaşama gücü 2020 (96,21%) doğum sezonunda belirlenmesine karşın en düşük yaşama gücü 2019 (88,50%) doğum sezonunda tespit edilmiştir (P<0,05). Sonuç olarak, Akkaraman kuzularda 2017 ile 2021 yılları arasında özellikle büyüme özeliklerinden LW2, WW ve DLWG bakımından yıllar itibariyle kayda değer bir genetik ilerleme sağlanmış ve bu özellikler üzerine araştırmada etkisi incelenen tüm çevresel faktörlerin etkileri önemli bulunmuştur.

Anahtar kelimeler: *Akkaraman, kuzu, döl verimi özellikleri, büyüme özellikleri, yaşama gücü,*

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ID: 571

Evaluation of nutritional and antioxidant properties of *Chenopodium ambrosioides L.* and *Crassocephalum crepidioides* leaf meal as potential feed additives

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Abstract
This study analyzed the proximate, minerals, phytochemical profiles and antioxidant capacity of *Chenopodium ambrosioides* L. and *Crassocephalum crepidioides* leaf meals as potential feed additives. Fresh leaf of the plants were purchased from commercial markets, air-dried in an open shade, and blended into powder for the analysis. The result of the proximate analysis revealed that *C. crepidioides* contained higher moisture (6.66%), ash (21.04%), crude fibre (3.85%), crude fat (5.41%) and crude protein (17.11%) contents than *C. ambrosioide* leaf powder ($p < 0.05$) which had 6.31% moisture, 13.69% ash, 3.09% crude fibre, 4.48% crude fat, 15.99% crude protein and 56.12% carbohydrate. The result of the phytochemical analysis revealed that aqueous extract of *C. crepidoides* possessed higher total phenolic (13.34 mgGAE/g) and flavonoid (2.29 mgrutin/g)) contents than that of *C. ambrosioided* at (13.07 mgGAE/g) and (1.62 mgrutin/g) respectively, ($P < 0.05$). The aqueous extract of *C. ambrosioides* exhibited higher that antioxidant free radical scavenging activity (24.83%) than that of *C. crepidioides* (16.42%). In conclusion, this study has shown that these two vegetables contained nutrients and antioxidant and could be used as alternative feed additives in animal nutrition.
Keynote: *Antioxidant, proximate, mineral, plant leaf.*

ID: 572

Study of ecological and chemical indicators of the Girmizi Lake

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Abstract

There are more than 200 lakes with a total area of up to 3325 ha on the Absheron Peninsula. During the year, 41.5 million m³ of sewage of different composition are discharged into these lakes.The most polluted lakes are Boyuk Shor, Bulbula, Girmizi, Haji Hasan and Chukhurdere lakes. Since the concentration of oil products, heavy metals and toxic substances in the water is many times higher than the permissible norm, an increase in radionuclides is observed in the bottom sediments of the lakes. The discharge of household wastewater into lakes and surrounding areas further complicates the acute ecological situation on the Absheron Peninsula. A number of projects have been developed in order to solve environmental problems. Ecological, geological, morphological and other research works on all lakes on the peninsula have not yet been completed. In recent years, the increase in the construction of private houses and facilities in the surrounding area has caused the pollution of the Girmizi Lake. The Girmizi Lake is a lake with an average water level in this area and is in a tense ecological situation. The discharge of sewage caused a violation of the oxygen regime of the lake. For many years, this lake was used as a receiving reservoir for formation water from oil fields. Girmizi lake belongs to the group of brackish water lakes. But now the Girmizi Lake has turned into a sewage lake due to the discharge of oil and oil products and sewage. During the months of May-June 2022, samples were taken from the water of the Girmizi Lake, sewage water poured into the lake, bottom sediments, and soil in the area where the lake is located and analyzed for various physico-chemical parameters. During the months of May-June 2022, samples were taken from the water of the Girmizi Lake, sewage water poured into the lake, bottom sediments, and soil in the area where the lake is located and analyzed for various physico-chemical parameters. Water samples were taken from different depths in the lake area. Water salinity increases from west to north. Samples from the sampled soil areas were taken from different depths by drilling method. Pollution is mostly observed in the upper layers. The bottom sediments were taken from different depths (1m, 2m, 3m) by sinking with a special device. The most contamination was observed in the first 1 m depth. The amount of heavy metals in the taken samples was determined. Bottom sediment samples from Girmizi Lake contained 14.55% CaCO3, 37.68 mg/kg As, 0.44 mg/kg Cd, 0.21 mg/kg Cr, 7.22 mg/kg Cu, 1.44 mg/kg Co, 2.78 mg/kg Hg, 1.69 mg/kg Pb, 1.22 mg/kg Ni, 51.95 mg/kg Zn, 158.14 mg/kg Al, 113 mg/kg Fe, 568 mg/kg S, 124 mg/kg total nitrogen, 12.88 mg/kg total phosphorus, 105.27 mg /kg Ca. Background radiation in bottom sediment samples taken from Girmizi Lake is 15 mkr/H. In soil samples from the vicinity of Girmizi Lake 13.35% CaCO3, 54.33 mg/kg total phosphorus, 144 mg/kg total nitrogen, 128.97 mg/kg total Fe(III), 7.475 mg/kg total sulfate, 239.8 mg/kg total phosphate, 0.53 mg/kg As, 0.21 mg/kg Cd, 1.97 mg/kg Cr, 0.62 mg/kg Co, 2.26 mg/kg Cu, 0.2 mg /kg Hg, 0.1 mg/kg Pb, 2.63 mg/kg Ni, 8.66 mg/kg Zn were found.

Keywords: *Girmizi lake, pollution, heavy metals, water samples, bottom sediment samples*

ID: 573

Eco-chemical Study of Water and Bottom Sediments taken from Lake Zabrat Institute of Radiation Problems of ANAS, Azerbaijan Baku State University, Azerbaijan

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Abstract

The liquid extraction method was used for the preparation of water samples taken from Zabrat Lake. 0.5 liters of water samples were extracted 3 times with 30 ml of dichloromethane, dried with anhydrous sodium sulfate and concentrated in a rotary evaporator until the volume remained 1 ml. Deuterated naphthalene and phenanthrene were used as internal standards. The determination of organic compounds in the samples was carried out on a mass spectrometer gas chromatography device (GC-MS (Agilent, USA) HP6890 in one-dimensional and two-dimensional mode. Ionization energy is 70 eV. Capillary silicon column RTX-5MS (30 m), temperature mode: 40^0C (2 min.)-20^0C/min.-300^0C (10 min.). In the same way, samples of bottom sediments (1.4 and 1.6 g) were taken from the lake, extracted 3 times with 30 ml of dichloromethane, dried with anhydrous sodium sulfate, and condensed in a rotor evaporator until the volume remained 1 ml. Deuterated naphthalene and phenanthrene were used as the internal standard. The determination of organic compounds in the samples was carried out on a mass spectrometer gas-chromatography device (GC-MS (Agilent, USA) HP6890 in one-dimensional and two-dimensional mode. Ionization energy is 70 eV. Capillary silicon column RTX-5MS (30 m), temperature mode: 40^0C (2 min.)-20^0C/min.-300^0C (10 min.).

Table 1. The amount of organic matter in the bottom sediments of Zabrat Lake

Sampling stations / Organic substances	Unit of measurement	S1	S2
Benzene 1 µg/kg	µg/kg gm	8,53	23,33
Toluene 24 µg /l	µg/kg gm	16,43	43,09
Ethylbenzene 2 µg/kg	µg/kg gm	0,31	3,09
p-xylene50 µg/l	µg/kg gm	3,83	51,91

As can be seen from the table, the amount of organic matter in bottom sediments exceeds the permissible limit at stations S1 and S2.

Table 2. Determination of PAHs in water samples from Zabrat Lake

Sampling stations / PAHs	Unit	S25	S26
Naphthalene 0.02	µg /l	0,02	0,025
Acenaphthalene 0.006	µg /l	0,02	0,024
Anthracene 0.001	µg /l	0,02	0,02
Fluoranthene 0.02	µg /l	0,02	0,02
Fluorene0.006	µg /l	0,049	0,059
Phenanthrene0.006	µg /l	0,195	0,267
Benzaprene0.001	µg /l	0,02	0,02
Chrysene 0.003	µg /l	0,02	0,02
Pyrene 0.02	µg /l	0,02	0,02
Benzanthracene 0.006	µg /l	0,02	0,02

As can be seen from the table, the amount of PAHs other than naphthalene, pyrene, and fluoranthene exceeds the limit.

Keywords: *Zabrat Lake, water samples, bottom sediment samples, organic matter, PAHs*

ID: 574

Growth And Yield Responses Of Sesame And Sorghum In Sesame/Sorghum Intercropping.

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Abstract

A field trial was carried out at the Kwara State University Teaching and Research Farm in 2019/2020 cropping season. The aim of the project was to investigate the growth and yield of sesame as affected by population density of component sorghum. Seven population densities viz: 100SE:100SH, 100SE:75SH, 100SE:50SH, 100SE:25SH, 75SE:100SH, 50SE:100SH, and 25SE:100SH where SE and SH represented sesame and sorghum respectively were combined in a Randomized Complete Block Design (RCBD) and replicated three (3) times. Full population of each crop was also included in the treatment as a control. The height and grain yield of sorghum were significantly influenced by population density. The height decreased as the population density of component sesame decreased. Reduction in the population of sorghum from 75% to 25 % significantly reduced the height of sorghum between 8 and 10 weeks after planting (WAP). The seed yield of sesame was depressed by population density of component sorghum with the lowest yield (1.15 kg/ha) obtained at 100SH:25SE population ratio. The Land equivalent ratios (LER) were greater than unity where full population of sorghum was mixed with sesame and when 75% population was combined with full population of sesame. Reduction from 50-25% recorded LER value less than unity. The highest Land equivalent coefficient (LEC) value was obtained in 100SH:100SE population ratio. Aggressivity (A) values were positive for sorghum and negative for sesame in all the population ratio tested except, 50SH:100SE and 25SH:100SE population ratios. The competitive ratios (CR) values followed similar trend with the A values. The highest A value, 0.70 and -0.86 and CR, 18.2 and 4.20 respectively for sorghum and sesame were recorded at 100SH:25SE population ratios. Reasonable intercropping advantage was obtained at the treatment where full population ratio of both where intercropped.

Key words: *Sorghum, sesame, intercropping, population ratios, intercropping advantage.*

ID: 575

Fecal Microbiota Transplation

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Abstract

The human gut contains many types of bacteria. The gut microbiota in early life is highly dynamic and is shaped by many factors, including maternal gut microbiota, mode of delivery, and breastfeeding. With the transition to an adult diet, the bacterial species in the microbiota are diversifying. The gut microbiota plays a key role in human health and many diseases. Fecal microbiota transplantation (FMT) provides replacement of beneficial bacteria with a more suitable microbiome in patients with dysbiosis. FMT is the process of giving the microbiota part of the stool taken from a healthy donor to the intestines of the sick person by passing through various processes in order to restore the intestinal microbiota of the patient. In this review, research results on fecal microbiota transplantation, how and how it is used are presented.

Key Words: *Microbiota, Healty, Fecal transplation*

Fekal Mikrobiyota Transplasyonu

Özet

İnsan bağırsağı çok sayıda bakteri türü içermektedir. Erken yaşamdaki bağırsak mikrobiyotası oldukça dinamiktir ve maternal bağırsak mikrobiyotası, doğum şekli ve emzirme gibi birçok faktör tarafından şekillendirilmektedir. Yetişkin beslenme tarzına geçilmesiyle mikrobiyotadaki bakteri türleri çeşitlenmektedir. Bağırsak mikrobiyotası, insan sağlığı ve birçok hastalık açısından anahtar oynamaktadır. Fekal mikrobiyota transplantasyonu (FMT) disbiyozisli hastalarda faydalı bakterilerin daha uygun bir mikrobiyom ile değiştirilmesini sağlamaktadır. FMT, hastanın bağırsak mikrobiyotasını onarmak amacıyla sağlıklı donörden alınan gaitanın çeşitli işlemlerden geçirilerek mikrobiyota kısmının hasta kişinin bağırsaklarına verilmesi işlemidir. Bu derlemede fekal mikrobiyota transplantasyonu, nasıl ve ne şekilde kullanıldığı etkinliğine ilişkin araştırma sonuçları sunulmuştur.

Anahtar Kelimeler: *Mikrobiyota, Sağlık, Fekal transplantasyon*

ID: 576

Tea and Polifenols

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Abstract
Tea is the most widely consumed beverage in the world after water. Tea, *Camellia sinensis* (L.) Kuntze or Thea sinensis F. Theaceae, is a shrub or evergreen tree up to 16 m tall. Its leaves are alternate, exstipulate, lanceolate to obovate, up to 30 cm long, 2–5 cm broad, pubescent, sometimes becoming glabrous, serrate, acute or acuminate. Fresh leaves are often picked from late March and early April to July every year. Tea can be classified according to the processing procedures into black, green and oolong tea. The percentage of each type of tea produced and consumed in the world is: 75% black, 22% green, 2% oolong and 1% white tea. The chemical composition of tea is highly complex, owing to its possessing different classes of chemical compounds, including polyphenols, alkaloids, amino acids, proteins, minerals, vitamins, and carbohydrates. . The main tea polyphenols are catechins: (±)-catechin C, (-)-epicatechin EC, (+)-gallocatechin GC, (-)-epigallocatechin EGC, (-)-epicatechin gallate ECG, and (-)-epigallocatechin gallate EGCG. Epigallocatechin gallate is the most plenty catechin in green tea, which accounts for 50% of the total catechins With no fermentation, green tea leaves preserve their color and almost all of their catechin content, and therefore have greater antioxidant potential than oolong and black tea, which are semi-fermented or fully fermented, respectively. Green tea is rich in the flavonol group of polyphenol called catechin. Many epidemiological studies have been conducted to show that green tea can provide protection against several cancers such as breast, prostate, bladder, ovarian, colorectal, esophageal, lung, pancreatic, and skin cancer.It has proven the health-related anti-carcinogenic, antioxidant, anti-aging, anti-mutagenic, antimicrobial activities, anti-hypercholesterolemic and anti-inflammatory benefits of tea polyphenols. In this review, research results on tea polyphenols and their effects on health are presented.
Key Words: *Tea, Polyphenols, Catechins, Antioxidant*

Çay ve Polifenoller

Özet
Çay dünyada sudan sonra en çok tüketilen içecektir. Çay, Camellia sinensis (L.) Kuntze veya Thea sinensis F. Theaceae, 16 m yüksekliğe kadar çalı veya yaprak dökmeyen bir ağaçtır. Yaprakları alternatif, çıkıntılı, mızraksı ila obovat, 30 cm uzunluğa kadar, 2-5 cm genişliğinde, tüylü, bazen tüysüz, tırtıklı, sivri veya sivri uçludur. Taze yapraklar genellikle her yıl Mart ayının sonundan ve Nisan ayının başından Temmuz ayına kadar toplanır. Çay, işleme prosedürlerine göre siyah, yeşil, beyaz ve oolong çayı olarak sınıflandırılabilir. Dünyada üretilen ve tüketilen her çay türünün yüzdesi: %75 siyah, %22 yeşil, %2 oolong ve %1 beyaz çaydır. Çayın kimyasal bileşimi, polifenoller, alkaloidler, amino asitler, proteinler, mineraller, vitaminler ve karbonhidratlar dahil olmak üzere farklı kimyasal bileşik sınıflarına sahip olması nedeniyle oldukça karmaşıktır. Başlıca çay polifenolleri kateşinlerdir: (±)-kateşin C, (-)-epikateşin EC, (+)-gallocatechin GC, (-)-epigallocatechin EGC, (-)-epikateşin gallat ECG ve (-)-epigallokateşin gallat EGCG. Epigallokateşin gallat, toplam kateşinlerin %50'sini oluşturan yeşil çayda en bol bulunan kateşindi. Yeşil çay yaprakları fermantasyon olmadan renklerini ve kateşin içeriğinin neredeyse tamamını korur ve bu nedenle yarı fermente veya tamamen fermente olan oolong, beyaz ve siyah çaydan daha fazla antioksidan potansiyele sahiptir. Yeşil çay, kateşin adı verilen polifenolün flavonol grubu açısından zengindir. Yeşil çayın meme, prostat, mesane, yumurtalık, kolorektal, yemek borusu, akciğer, pankreas ve cilt kanseri gibi çeşitli kanserlere karşı koruma sağlayabileceğini gösteren birçok epidemiyolojik çalışma yapılmıştır. Çay polifenollerinin sağlık ile ilgili anti-kanserojen, antioksidan, anti-aging, anti-mutajenik, antimikrobiyal aktiviteler, anti-hiperkolesterolemik ve anti-inflamatuar yararlarını kanıtlamıştır. Bu derlemede çay polifenolleri ve sağlık üzerine olan etkilerine ilişkin araştırma sonuçları sunulmuştur.
Anahtar Kelimeler: *Çay, Polifenol, Kataşin, Antioksidant*

ID: 578

Investigation of the Single-Walled Carbon Nanotube Addition to SLA Resin: Printability and Electrical Properties

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Abstract

Stereolithography (SLA) method is one of the most promising approaches in additive manufacturing. SLA printing is based on photopolymerization reaction using laser light and liquid photosensitive resin. 3D complex structures could be perfectly fabricated by ready SLA resins however, they do not show sensing, optical and electrical properties alone. To develop functional 3D polymer-based structures, Single-Walled Carbon Nanotubes (SWCNTs) were incorporated into SLA resin at varying replacement ratios (10%, 20%, 30%, 50% of the resin). SWCNTs-SLA resin combination was then placed in the SLA device (Anycubic Photon Mono Se) and 3D polymer structures were fabricated at different infill densities. SWCNTs were selected due to their excellent electrical conductivity and optical properties for sensing applications. According to the printability performance, maximum replacement ratio in all geometries was found as 20% for acceptable printing process. The fabricated elements were then analyzed for their resistance measurements. Since the tablets were not a pure resistor, an AC circuit was used to measure the impedance of the element. The tablets displayed capacitive properties and did not show a significant change in electric conductivity properties with respect to SWCNTs concentration ($p \leq 0.05$). In the second part of the study, enzyme immobilization into the printed tablets (with/out SWCNTs) were investigated for adsorption capacity of the tablets. Since enzymes have protein structures, chicken albumin was used as a model protein. Tablets with/out CNT printed with different infill densities were waited in 1% protein solution for 24 h and then washed with distilled water. Then, absorbance values of protein and washing solution at 280 nm were measured by UV-vis spectrophotometer (Cary60 UV-Vis, Austria). Finally, adsorption capacity of the tablets was found with the help of calibration curve. As CNT incorporated tablets gave adsorption capacity as 534.4 ± 47.90 mg protein/g tablet, control tablets had 714.4 ± 13.55 mg protein/g tablet. In overall, the study demonstrated potential replacement of conventional SLA resin with SWCNTs up to a point (20%) to develop functional complex tablets for sensing property and deposition of proteins on the surface of tablets.

Key Words: *SLA printing, photocurable resin, carbon nanotube, protein immobilization, sensor*

ID: 579

Changes in Erosion Susceptibility of a Chromic Haplustert Pasture Soil by Some Polymers Under Simulated Rainfall

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Abstract
Due to the climate change that has become evident especially in the last ten years, the pastures in the Mediterranean climate zone have become even more vulnerable to degradation. High erosive precipitation increases the amount of erosion in these soils with increasing their erodibility. For this reason, it is inevitable to develop soil management practices by taking into account both soil/land characteristics and changes in climate components. The aim of this study was to determine to what extent some polymers such as polyacrylamide and polyvinylalcohol can prevent runoff and soil loss caused by simulated rainfall with 70 ± 5 mm intensity from erosion pans where a pasture soil was placed. For this purpose, aggregates of soil samples >8 mm from the A horizon of a Chromic Haplustert were used. Polyacrylamide and polyvinylalcohol solutions at different doses (0, 3.5, 7.0 and 14.0 kg ha^{-1}) were applied to the aggregates placed in the erosion pans by spraying. Erosion pans with slopes of 9% and 15% were exposed to simulated rainfall produced by a drop former rainfall simulator for one hour. The simulation trial was planned as 2 replications according to the randomized plots trial design (2 slopes x 2 polymers x 4 polymer doses x 2 replicates = 32 pans). During simulated rainfall, runoff water and sediment from pans were collected at 10-minute intervals. Transported soils were expressed as dry weight, and runoff waters were expressed as valumetric. According to the results obtained, the highest runoff occurred from a 15% inclined soil pan (11.06 mm) without polymer applied (control). After one hour of simulated rainfall, runoff did not occur from some pans with high-dose polymer applied. The amount of soil transported from the control pan by runoff and by splashing to the sides is 362 and 4241 kg ha^{-1}, respectively. The pan, in which the least soil is carried by splashing, was the one with a 9% slope and the highest dose of polyacrylamide (97 kg ha^{-1}). Statistical results show that polyacrylamide was more successful than polyvinylalcohol in reducing soil and water losses. These results indicate that the application of polymer to pasture soils can be a valid way to combat erosion, but the treatments should be carried out by choosing the right dose, taking into account factors such as the slope of the land, the erodibility of the soil and the erosivity of precipitation.
Key Words: *PAM, PVA, Rainfall erosivity, Soil erodibility, Soil management*

Chromic Haplustert Mera Toprağının Erozyona Duyarlılığında Bazı Polimerler Tarafından Yapay Yağış Altında Sağlanan Değişimler

Özet
Özellikle son on yılda kendini belli eden iklim değişikliği nedeniyle, Akdeniz iklim kuşağındaki meraları, degradasyona daha da açık hale gelmiştir. Yüksek eroziviteli yağışlar, erodibilitesi artan bu topraklarda erozyon miktarını giderek artırmaktadır. Bu nedenle, hem toprak/arazi özelliklerini hem de iklim elemanlarındaki değişimi dikkate alarak toprak yönetim uygulamaları geliştirmek kaçınılmazdır. Bu çalışmanın amacı, poliakrilamid ve polivinilalkol gibi bazı polimerlerin, mera toprağının yerleştirildiği erozyon tavalarından 70 ± 5 mm yoğunlukta yapay yağıştan kaynaklanan akış ve toprak kaybını ne ölçüde önleyebildiğini belirlemektir. Bu amaç için, bir Chromic Haplustert'in A horizonundan alınan toprak örneklerinin >8 mm olan agregatları kullanılmıştır. Erozyon tavalarına yerleştirilen agregatlara, farklı dozlarda (0, 3.5, 7.0 ve 14.0 kg ha^{-1}) poliakrilamid ve polivinilalkol solüsyonları püskürtülerek uygulanmıştır. Eğimi %9 ve %15 olarak ayarlanan erozyon tavaları, bir saat süre boyunca, bir drop former yağış simülatörünün ürettiği yapay yağışa maruz bırakılmıştır. Simülasyon denemesi tesadüf parselleri deneme desenine göre 2 tekerrürlü olarak planlanmıştır (2 slopes x 2 polymers x 4 polymer doses x 2 replicates = 32 pans). Yapay yağış boyunca tavalardan oluşan yüzey akış suları ve sediment 10 dakika aralıklarla toplanmıştır. Taşınan topraklar kuru ağırlık olarak, yüzey akış suları da valumetrik olarak ifade edilmiştir. Elde edilen sonuçlara göre, en fazla yüzey akış polimer uygulanmayan % 15 eğimli toprak tavasından (11.06 mm) meydana gelmiştir. Bir saatlik yapay yağışın sonunda yüksek doz polimer uygulanan bazı tavalardan yüzey akış oluşmamıştır. Kontrol tavasından yüzey akışla ve yanlara sıçrama yoluyla taşınan toprak miktarları sırasıyla 362 ve 4241 kg ha^{-1}'dir. Sıçrama yoluyla en az toprak % 9 eğim verilen ve en yüksek doz poliakrilamid uygulanan tavadan taşınmıştır (97 kg ha^{-1}). İstatistiksel sonuçlar göstermektedir ki toprak ve su kayıplarını azaltmada poliakrilamid polivinilalkolden daha başarılıdır. Elde edilen bu sonuçlar, erozyon ile mücadelede mera topraklarına polimer uygulamasının geçerli bir yol olabileceğine, ancak muamelelerin, arazinin eğimi, toprağın aşınabilirliği, yağışın erozivitesi gibi faktörler dikkate alınarak doğru doz seçimi yapılmak suretiyle gerçekleştirilmesi gerektiğine işaret etmektedir.
Anahtar Kelimeler: *Erozivite, Erodibilite, PAM, PVA, Toprak yönetimi*

ID: 580

Effect of Biofertilizers and Organic Amendments on Germination and Seedling Growth of Common Dry Zone Forest Species in Sri Lanka: Sustainable Reforestation Practices in Sri Lanka

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Abstract

Most of the dry zone forests in Sri Lanka are arisen after unsustainable farming practices. Therefore, the natural regeneration of plant species in these forests reported to be very poor due to the reduced soil fertility. This study was conducted to find possible measures for the successful seed germination and seedling establishment of common dry zone forest tree species by sustainable soil fertility management. A pot trial was carried out in a greenhouse at the Faculty of Applied Sciences, Rajarata University, Mihintale, Sri Lanka. The experiment comprised of 128 pots and four replicates. Pots were assigned with different soil fertility managements: T0: control (Top soil only), T1: Arbuscular mycorrhizal fungi (AMF), T2: a traditional mixed microbial culture (Jeewamurthum), T3: Compost, T4: Biochar, T5: T1+ T2, T6: T1+ T3, T7: T1+ T4; and different forest plant species: *Manilkara hexandra*, *Feronia limonia*, *Pterospermum conscens*, and *Bauhinia racemosa*. Seed germination percentage was measured two weeks after sowing, and shoot biomass, relative plant growth rate, and AMF colonization percentage were measured after four months of germination. The results revealed that inoculation of AMF enhance the seed germination percentage of all the selected plant species. Both sole and combined application of AMF and compost gives more benefits to all the tested plant species by enhancing all the measured growth parameters. The findings of present study would be useful in reforestation programs of dry zone forests in Sri Lanka by practicing sustainable procedures.

Key Words: *AMF, Biochar, Compost, Jeewamurthum*

ID: 581

Genetic Characterization Of *Escherichia Coli* O157: H7 Isolated From Meat In Tlemcen "Algeria"

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Abstract

In this study, we were interested in search of *E. coli* O157: H7, Shiga-toxin producing (STEC) in 230 samples of meat from different market located in Tlemcen city, Algeria. After enrichment and use of selective agents (Sorbitol Mac Conkey medium added with MUG supplement) that are intended to curb the growth of the annex flora, we have isolated 5 strains from meat. These strains presented the main characteristics of *E. coli* O157: H7, non sorbitol fermenting and negative β-Dglucuronidase, were biochemically tested for confirmation by the API 20E, and subjected to slide agglutination with the the *E. coli* Latex kit O157:H7. Genetic characterization revealed that all strains possess the genes *stx*2 and *ehxA* hemolysin, one strain does not possess the *eae* gene for intimin but instead it is the only strain that has the gene *stx1*. The study of the resistance of the strains to antibiotics disclosed they are sensitive to all antibiotics tested, ampicillin (10 µg), chloramphenicol (30 µg), gentamycin (10 µg), colistin 10 µg , flumequin (30 µg) , enrofloxacin (5 µg), nitrofurantoin (300 µg), cephalotin (30 µg), sulfamethoxazole-trimethoprim (1.25/23.75 µg), nalidixic acid (30 µg), norfloxacin (10 µg), ofloxacin (5 µg), kanamycin (30 µg), neomycin (30 µg), ceftiofur (30µg) and tetracycline (30 µg). Isolates were classed as sensitive or resistant to each antibiotic according to *the Clinical and Laboratories Standards Institute (formally NCCLS) guidelines (NCCLS, 2003). E*. coli strain ATCC 25922 was used for quality control.

Keywords: *E. coli* O157: H7, meat, *stx1*, *stx2*, antibiotics

ID: 582

The Ferritin in the Aquatic Products

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Abstract
The aquatic productions are ones of the important world food sources on the Earth. The balance of their nutrient composition should be struggled to protect for living things on the world, even humanity future as a healthy indivual in their life. Ferritin is a vital protein complex, which is a non-toxic form in order to dissolve and save the iron in a body. If it is necessary, ferritin is used to transfer or collect iron element in the fish body in order to increase growth rate, immune system activities, and reproduction. But, the iron could be produced some different forms in fish blood and they can regenerate negative effects to DNA and structure protein and it could be fatal to fish. Also, some factors cause increase or decrease the ferritin amount in fish blood. In this study, it is given more detail information about the definition, mechanism, functions of ferritin and indicating the last previous studies being conducted on the ferritin in the aquatic products.
Key Words: *Aquatic products, Ferritin, Aquaculture*

Akuatik Ürünlerde Ferritin

Özet
Yeryüzünde dünyanın önemli gıda kaynaklarından bazıları akuatik ürünlerdir. Besin komposizyon dengesi dünyada yaşayan organizmalarda korunma mücadelesindedir. Hatta, insanlığın geleceğinde sağlıklı bireyler olarak ferritin, toksk olmayan bir form olup demirin vücutta çözünüp saklanabildiği önemli bir protein compeksidir. Eğer, gerekli ise ferritin, demir elementini balık vücudunda transfer etmek veya biriktirmek için büyüme oranı, bağışıklık sistemi aktivitesi ve üremeyi artırmakta kullanılır. Fakat ferritin balık kanında bazı farklı formlarda bulunabilir ve bunlar DNA ve yapısal proteinlere balıklarda tekrar tekrar negatif etkiler oluşturabilir ve balıklarda belki ölümcül olabilirler. Bazı faktörler ise balıkların kanında ferritin seviyesinin yükselip düşmesine sebep olurlar. Bu çalışmada, ferritinin tanımı, mekanizması ve fonksiyonları ve akuatik organizmalar için ferritinin kullanımı üzerine önceden yapılmış çalışmalar hakkında detaylı bilgiler verilmiştir.
Anahtar Kelimeler: *Akuatik ürünler, Ferritin, Akuakültür*

ID: 583

Molecular analysis of the presence of Potato leafroll virus and Potato virus X

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Abstract

Potato is among the most important agricultural products in the world and is a plant species that is susceptible to more than 50 virus types in natural conditions. In this study, 298 leaf samples collected from areas where potato production is intense in Afyon, Nevşehir and Bolu provinces were used to determine the viruses affecting potato production in the region. In order to detect the presence of *Potato leafroll virus* (PLRV), *Potato virus X* (PVX) from leaves of potato plants showing virus symptoms, total RNA was isolated. After complementary DNA (cDNA) treatment with the obtained RNAs, they were subjected to RT-PCR using virus-specific primers. Of the 298 leaf samples tested, 43 were infected with PLRV (14.42%) and 3 with PVX (2.82%). 18 (16.21%) samples in Afyon, 11 (11.22%) in Nevşehir and 14 (15.73%) samples in Bolu province were found to be infected with PLRV. PVX was detected in 2 (1.80%) samples in Afyon and in 1 (1.02%) sample in Nevşehir. PVX infection was not detected in Bolu province. Some isolates with positive results were sent for direct sequence analysis and their phylogenetic relationships were determined by comparing the obtained sequence data with the isolates registered in GenBank. The partial sequence of 337 nucleotide CP regions of a total of 5 PLRV isolates, 2 from Niğde and 3 from Afyon, was obtained. Sequences obtained according to the sequencing result showed 99-100% nucleotide similarity with reference PLRV isolates. PLRV has been detected intensively in Afyon, Bolu and Nevşehir provinces, and the persistent transfer of the virus from field to field with more than 10 aphids and from year to year with infected tubers plays an important role in its spread.

Key Words: *Afyon, Bolu, Nevşehir, Potato leafroll virus, Potato virus X*

Potato leafroll virus ve Potato virus X' in Varlığının Moleküler Olarak Analizi

Özet

Patates, dünyada en önemli tarımsal ürünler arasında yer alır ve doğal koşullarda 50'den fazla virüs türüne hasssas bir bitki türüdür. Bu araştırmada, Afyon, Nevşehir ve Bolu illerinde patates üretiminin yoğun olarak yapıldığı alanlardan toplanan 298 yaprak örneği, bölgede patates üretimini etkileyen virüslerin belirlenmesi için kullanılmıştır. Virüs simptomu gösteren patates bitkilerinin yaprakları, *Potato leafroll virus* (PLRV), *Potato virus X* (PVX)'nin varlığını tespit etmek amacıyla, toplam RNA izolasyonu yapılmıştır. Elde edilen RNA lar ile tamamlayıcı DNA (cDNA) işleminden sonra virüs-spesifik primerler kullanılarak RT-PCR işlemine tabi tutulmuştur. Test edilen 298 tane yaprak örneğinin 43'si PLRV (%14.42) ve 3'ü PVX (%2.82) ile enfekteli bulunmuştur. Afyon'da 18 (16.21%), Nevşehir'de 11 (11.22%) ve Bolu ilinde 14 (15.73%) örnek PLRV ile enfekteli olarak bulunmuştur. PVX ise Afyon'da 2 (1.80%) ve Nevşehir'de 1 (1.02%) örnekte tespit edilmiştir. Bolu ilinde ise PVX enfeksiyonu tespit edilmemiştir. pozitif sonuc veren bazı izolatlar direkt sekans analizine gönderilmiş ve elde edilen sekans verilerinin GenBank'a kayıtlı izolatlarla karşılaştırılması yapılarak filogenetik ilişkileri belirlenmiştir. Niğde ilinden 2 ve Afyon ilinden 3 PLRV izolatı olmak üzere toplam 5 tane PLRV izolatının 337 nükleotidlik CP bölgelesinin kısmı sekansı elde edilmiştir. Sekans sonucuna göre elde edilen sekanslar, referans PLRV izolatları ile %99-100 oranında nüklotid benzerliği göstermiştir. PLRV Afyon. Bolu ve Nevşehir illerinde yoğun olarak tespit edilmiş ve etmenin 10'dan fazla afit ile persistent olarak tarladan tarlaya ve enfekteli yumrularla yıldan yıla taşınması yayılmasında önemli rol oynamaktadır.

Anahtar Kelimeler: *Afyon, Bolu, Nevşehir, Potato leafroll virus, Potato virus X,*

ID: 584

Justicia Carnea Leaf Meal Has The Potential To Improve The Performance And Immunoglobulins Of Broiler Chickens Fed Aflatoxin-Contaminated Diets

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Abstract

It was investigated whether *Justicia carnea* leaf meal (JLM) could improve the performance and immunoglobulins of broiler chickens fed diets contaminated with aflatoxin (AF). A total of 240 broiler chickens were randomly distributed (60 birds/treatment; 10 birds/replicate) into 4 treatments (Diet 1: No supplementation; Diet 2: 0.5mg/kg AF; Diet 3: 0.5mg/kg AF+ 250mg/kg JLM; Diet 4: 0.5mg/kg AF+ 500mg/kg JLM) in a 42 day feeding trial experiment. The final body weight and body weight gain recorded for birds fed diets 3 and 4 were higher ($P<0.05$) than in diets 1 and 2. The final body weight and body weight gain were significantly ($P<0.05$) lower in diet 2 compared to the rest diets. The feed intake of birds in diet 2 was significantly ($P<0.05$) lower than in diet 1 and the rest treatment groups. The immunoglobins A, E, G and M of the broiler chickens fed AF contaminated diet (diet 2) reduced ($P<0.05$) compared to the control (diet 1); however, there were improved ($P<0.05$) immunoglobins concentration in the birds fed the AF contaminated and JLM supplemented diets (diets 3 and 4), compared to diet 2. The 0.5 mg/kg AF dietary contamination impaired the body weight gain, feed intake and immunoglobin level of the broiler chickens. However, the 250mg/kg and 500mg/kg JLM dietary supplementation ameliorated the effect of the toxin on the performance characteristics and immunoglobin levels of the broiler chickens.

Keywords: *Mycotoxicosis; Broiler chickens; Growth; Immunoglobin; Phygens*

ID: 587

Determination Of Chemical And Microbiological Quality In Commercial Tahini Samples

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Abstract
Tahini samples from 10 different brands were gathered for this study from vendors and stores that sell it in Balikesir and Bursa. Samples were taken from two different lot numbers for each company. As a result of the analyzes made on the tahini samples, it was determined that the total oil amount of the samples changed between 49.76-58.7%, the salt amount changed between 0.001-0.0027%, the ash amount was between 1.02%-1.28% and the moisture value was between 1.1-1.5%; an average of 75 cfu/g viability was found after microbiological cultivations in which the presence of yeast and mold were examined, although none of the tahini samples had any samples that were contaminated with *Escherichia coli*, *Staphylococcus aureus*, or *Salmonella* spp. One of the tahini samples was not found in accordance with the Turkish Food Codex Tahini Communiqué in terms of the amount of oil. It is concluded that 90% of the samples were manufactured in line with the TGK when the results of the chemical and microbiological analyses were combined.
Key Words: *Tahini, Turkish Food Codex, Chemical Quality, Microbiological Quality*

Piyasada Satılan Tahin Örneklerinde Kimyasal Ve Mikrobiyolojik Kalitenin Belirlenmesi

Özet
Bu çalışma kapsamında Balıkesir ve Bursa illerindeki üreticilerden ve ticari olarak satış yapılan marketlerden 10 farklı markaya ait tahin numunesi toplanmıştır. Numuneler her bir firma için iki farklı parti numarasından olacak şekilde alınmıştır. Tahin numunelerine yapılan analizler neticesinde örneklerin toplam yağ miktarının %49.76-58.7, tuz miktarının %0.001-0.0027, kül miktarının %1.02-1.28, nem değerinin %1.1-1.5 aralığında değiştiği; maya ve küf varlığının analiz edildiği mikrobiyolojik ekimler sonucunda ortalama 75 kob/g canlılık belirlenirken tüm tahin numuneleri içerisinde *Escherichia coli, Staphylococcus aureus, Salmonella spp* kontamine olmuş örnek bulunmadığı tespit edilmiştir. Tahin numuneleri içerisinde bir firmaya ait tahin örneği yağ miktarı açısından Türk Gıda Kodeksi Tahin Tebliği'ne uygun bulunmamıştır. Kimyasal ve mikrobiyolojik analiz sonuçları bir arada değerlendirildiğinde numunelerin %90'ının TGK'ya uygun kalitede üretildiği yorumlanmaktadır.
Anahtar Kelimeler: *Tahin, Türk Gıda Kodeksi, Kimyasal Kalite, Mikrobiyolojik Kalite*

ID: 588

Determination Of Chemical And Microbiological Quality In Commercial Tahini Halva Samples

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Abstract

40 samples of tahini halva from 5 different firms, in 4 distinct varieties—plain, hazelnut, carob, and vanilla—were gathered for this study from producers in the provinces of Balikesir and Bursa as well as from commercial markets. Samples were taken from two different lot numbers for each company. As a result of the analyzes made on the tahini halva samples, it was determined that the total amount of sesame oil varied between 24.67-38.87%, the total amount of tahini ranged between 59.34-69.7%, the total moisture amount was between 0.1-0.9%, the total ash amount was 0.089-3.16%, and the total salt amount was between 0.001-0.024%; as a result of microbiological cultivations in which the presence of yeast and mold were analyzed, an average of 10 cfu/g in plain tahini halva samples, an average of 90 cfu/g in hazelnut tahini halva samples, an average of 45 cfu/g in carob tahini halva samples, and an average of 25 cfu/g in vanilla tahini halva samples were determined. All samples of tahini halva were found to be free of contamination with *Salmonella* spp., *Staphylococcus aureus* or *Escherichia coli*. When all of these findings were taken into consideration, it was found that one of the sampled firms did not produce in accordance with the Turkish Food Codex Communique on Tahini Halva (2015/28) in terms of total sesame oil (%) and ash content (%) of two companies. Combined, the findings of the chemical and microbiological analyses indicate that 85% of the samples were prepared in line with the TFC.

Key Words: *Tahini halva, Plain, Hazelnut, Carob, Vanilla, Turkish Food Codex, Chemical Quality, Microbiological Quality*

Piyasada Satılan Tahin Helvası Örneklerinde Kimyasal Ve Mikrobiyolojik Kalitenin Belirlenmesi

Özet

Bu çalışma kapsamında Balıkesir ve Bursa illerindeki üreticilerden ve ticari olarak satış yapılan marketlerden; sade, fındıklı, keçiboynuzlu ve vanilyalı olmak üzere 4 farklı çeşitte ve 5 farklı firmaya ait toplam 40 tahin helva numunesi toplanmıştır. Numuneler her bir firma için iki farklı parti numarasından olacak şekilde alınmıştır. Tahin helvası numunelerine yapılan analizler neticesinde toplam susam yağı miktarının %24.67-38.87, toplam tahin miktarının %59.34-69.7, toplam nem miktarının %0.1-0.9, toplam kül miktarının %0.089-3.16, toplam tuz miktarının %0.001-0.024 aralığında değiştiği; maya ve küf varlığının analiz edildiği mikrobiyolojik ekimler sonucunda sade tahin helvası numunelerinde ortalama 10 kob/g, fındıklı tahin helvası numunelerinde ortalama 90 kob/g, keçiboynuzlu tahin helvası numunelerinde ortalama 45 kob/g, vanilyalı tahin helvası numunelerinde ortalama 25 kob/g canlılık belirlenirken tüm tahin helvası numuneleri içerisinde *Escherichia coli, Staphylococcus aureus, Salmonella spp* kontamine olmuş örnek bulunmadığı tespit edilmiştir. Tüm bu sonuçlar değerlendirildiğinde numune alınan firmalardan bir tanesinin toplam susam yağı (%), iki firmanın ise kül miktarı (%) değeri açısından Türk Gıda Kodeksi Tahin Helvası Tebliği (2015/28)'ne uygun üretim yapmadığı belirlenmiştir. Kimyasal ve mikrobiyolojik analiz sonuçları bir arada değerlendirildiğinde toplanan numunelerin %85'inin TGK'ya uygun kalitede üretildiği yorumlanmaktadır.

Anahtar Kelimeler: *Tahin helva, Sade, Fındık, Keçiboynuzu, Vanilya, Türk Gıda Kodeksi, Kimyasal Kalite, Mikrobiyolojik Kalite*

ID: 592

Nutritional composition, sensory quality and consumer acceptability of beef sausage fortified with edible meat waste

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Abstract

This study assessed the proximate composition, sensory quality and consumer acceptability of beef sausage fortified with edible meat waste. Lean beef and edible meat waste (EMW) samples were obtained from commercial abattoir and combined in ratio 50:50 and 70:30 and designated as T1 and T2 respectively, while CT contained 90% lean meat and 10% fat. The fresh T1, T2 and CT sausages were thermal processed using microwave and oven-grilling cooking methods. The results showed significant difference in moisture, protein, lipid and ash content of raw and cooked sausages across treatments ($p < 0.05$). Raw sausage fortified with EMW had higher protein and lower lipid contents compared to control treatment (90/10, CT). Cooking of the sausage significantly decreased moisture and increase lipid, protein and lipid content, with microwaved sausage having higher values. The results of sensory quality showed that beef sausage fortified with EMW were all acceptable to consumers, irrespective of the cooking methods used. The distribution of consumers who liked the appearance, colour, texture and flavour of the sausage meat containing EMW were higher than those who dislike the products. Therefore, this study shows that EMW could be successfully used in meat industry to improve quality of sausage during production.

Keywords: *Edible meat waste, fat replacer, meat sausage, nutritional content, sensory quality*

Introduction

Throughout the continent, one or more processed meat products such as sausage, nuggets and meatball are extensively consumed on daily basis, although they may be costly at times (Elbakheet et al., 2017, Carballo, 2021). To ensure consistent availability of these products including sausage, researchers are working hard to reduce the cost of production by producing different varieties without compromising their nutritional and sensory quality (Hall, 2015; Carballo 2021). The processing of sausage involves the addition of different food components (ground lean meat, animal fat, salt, spices, and other flavouring ingredients) that could enhance digestibility and human well-being (Alao et al., 2021). The combination of these components also provide functional properties that improve the structure, nutritional and health qualities of the finished products (Fernández-Ginés et al., 2005).

Processing of animal carcass at the abattoir involves the production of substantial amount of edible animal by-products/wastes which could be blended with lean meat to make good sausages and reduce cost of production (Alao et al., 2017). In fact, some studies have revealed that some edible by products such as liver and blood could be used either partly or wholly during the making of sausage meat (Estévez et al., 2005; Yun-Sang and Cheon-Jei, 200; Amaral et al., 2013; Silva et al., 2013). The blending of lean meat with offals (liver, kidney, heart) and other meat products (edible meat waste) can also provide a rich animal protein with a better flavour. In Finland, liver sausage is considered appealing and approved by the general public whereas liver paˆte´s are customarily prepared in France and Spain (Estévez et al., 2005). In this regard, the act of using edible meat by products in meat processing has been very effective in producing sustainable meat production system (Jayathilakan et al., 2012; Lobato et al., 2014).

However, the amount of the edible meat by-products that has been utilized is to a greater degree smaller as compared to the amount produced at the abattoir. An example is the recovery of edible meat waste for sausage production (Alao et al., 2021). The edible meat waste refers to meat waste generated during the cutting and trimming of the meat at processing unit in the abattoir (Alao et al., 2021). This edible meat waste possess inherent capability to be used on a large scale in the meat processing industry for value-addition without any threat to nutritional content and consumer's acceptability (Alao et al., 2021).

After production, different culinary methods such as grilling, microwave cooking, oven grilling and frying are employed for cooking sausages (Singh et al., 2015; Adam and Abugroun, 2015). The type of cooking methods used usually contribute to the adhesion properties, tenderness and sensory properties of the sausage meat (Obuz et al., 2003; Koziol et al., 2016). Although the consumers' decision and overall judgement are influenced by the tenderness of meat and other factors such as flavour, juiciness, appearance, price, colour and food safety (Troy and Kerry, 2010). Therefore, the objective of this study was to determine the nutritional content, sensory quality and consumer acceptability of sausage meat fortified with edible meat wastes and thermal treated using microwave and oven-grilling cooking methods.

Materials and methods

Study Site and ethical statement

The study was carried out in Meat Science laboratory, Department of Livestock and Pasture Science, University of Fort Hare, South Africa. Before the commencement of the experiment, permission was obtained and approved by the University of Fort Hare's Research Ethics Committee (UREC) with certificate reference number MUC341SBAB01.

Sample Collection and Beef Sausage Production

The lean beef meat and edible meat waste (EMW) for production of the novel beef sausage were collected separately from slaughtered cattle at the commercial abattoir in East London in Eastern Cape Province of South Africa. The fresh meat samples were stored in a cooler box and transported immediately to Meat Science laboratory for sausage production. In production of sausage, the lean beef and edible meat waste samples were combined in ratio 50:50 and 30:70 and designated as T1 and T2 respectively, while the control contained 90% lean meat and 10% fat as CT. Each meat sample was spiced, mixed and minced through a 5mm plate using a mincer (TC22 EL ELEG.PLUS, Italy) and processed within 24 hours following their storage at 4°C. The meat samples were then pumped and stuffed lightly into 25mm diameter sheep sausage casing (Freddy Hirsch Company, Capetown. South Africa) with Tre-spade sausage filler tool.

The meat samples were thermal processed using microwave and oven-grilling cooking methods. In microwave method, fresh sausage samples (T1-MW, T2-MW and CT-MW) were cooked at 80°C for 4min. During oven-grilling (T1-OV, T2-OV and CT-OV), doneness was determined by inserting a probe thermometer (Thermo-pro TP- food thermometer) into geometrical centre of the sausage to measure its internal temperature. The samples were considered done when the digital thermometer gave an alarm and flashed green light. The samples were cooled at room temperature, vacuumed packed and stored at 80°C until the laboratory analysis was carried out.

Determination of proximate content and Warner-Bratzler shear force (WBSF)

The raw and cooked meat samples were analysed in triplicates for determination of moisture, ash, fat and crude protein content using method described by AOAC. Warner–Bratzler shear force (WBSF) values were determined on meat samples as indicators of tenderness using instron machine. Coring was obtained using hand-held coring device to make round core of about 10mm from the cooked samples. About 3 core was obtained at the center of each sample of the sausage. Shearing was done using Warner-Bratzler shear machine, with the speed of 400mm/min. The thickness of the vee-shaped cutting blade was about 1.02mm. The cored sausage was placed on the machine and cutting blade was used to cut through the sample. The maximum force (N) required to shear for each specimen was measured and the mean was recorded for tenderness.

Sensory Analysis of the meat sausage

A total of 60 untrained panellists (staff and students) were recruited and asked to rate their attributes on a 9-point hedonic scale, with 1 being "disliked extremely" and 9 being "liked extremely" in the middle "neither like nor dislike". The six most widely used sausage sensory characteristics were selected and panelists were asked to score each sample for overall likeness as well as the acceptability of appearance, flavour, taste, texture, and juiciness using a 9 hedonic scale. Before evaluation, the sausages were cut into slices of approximately 4 mm thickness and served at room temperature on white paper plates. The sausage samples were named according to their mixing ratio and cooking methods. Fresh clean water was provided for rinsing the palate before each sample was tested. For each sample, the panellists were expected score the overall acceptability as well as the acceptability of appearance, flavour, taste, hardness and juiciness.

Statistical analysis

The Statistical Analysis System (SAS version 9.1.3 of 2007) was used for all the analyses. PROC GLM procedure of SAS was used to consider the effects of the types of cooking used (microwave and oven-grill) and meat type (90/10, 30/70, and 50/50) on the nutritional content and tenderness of beef sausage. Significant differences between the least square means for cooking methods were performed using the Fishers' least significance difference (LSD) method of SAS, with a significance level of $p < 0.05$. Data generated on sensory quality were analysed and summarized as frequencies of respondent profiles on consumer's acceptability.

Results and Discussion

Sausage meat is one of the most widely utilized meat products among all processed meats because they can easily be produced from different meat types and varieties of meat products including edible meat waste and edible offal (Alao et al., 2021). The result of the proximate analysis of the uncooked and cooked meat sausage is presented in Table 1 and 2. The moisture content of the uncooked sausage ranges from 63.54 to 70.34% with CT (90/10 meat sausage) having the highest value (70.34%, Table 1, ($P<0.01$). The increase in moisture content of the T3 may the attributed to the presence of higher amount of lean meat (90%) compared to other treatments. Study has showed

quality sausage with high lean meat tend to have higher moisture content compared to less lean meat sausage (Cashman, 2017; Cunningham et al., 2015). This results is in contrast with finding of Youssef et al. (2012) who reported that high-fat patties had lower moisture content than low-fat patties. In Table 2, the cooked sausages treatments had the lowest moisture contents which ranged from 53.36 to 56.3% compared to the uncooked sausage ($P<0.01$). The results indicated that, uncooked sausage contained higher level of moisture than cooked sausage. The decline in moisture content can be as a result of evaporation during the cooking process as the temperature rises (del Pulgar et al., 2012). Earlier study has shown that majority of water loss during cooking is due to temperature-induced denaturation or structural changes in meat proteins (Pang et al., 2021). This result is in agreement with report of Youssef et al. (2012) who found that cooked meat sampled had lower moisture content compares to uncooked samples. Also, the results from this study also showed that cooking methods had a significant effect on moisture content of the sausages ($P<0.01$). The oven-grilled samples had the highest moisture contents (57.55%) as compared to microwaved samples (51.37%). It was also observed that the interaction of sausage treatment with cooking methods was significant at $P<0.01$ with the water content of the treatments. This result is similar to report of Janicki and Appledorf (2007) who found that beef patties cooked by microwave had lower moisture content than other cooking methods.

The amount of lipid content in raw sausages for T1 (30/70), T2 (50/50) and C3 (90/10) were 11.29%, 7.49% and 13.91%, respectively, with T3 having the highest value (Table 2). This is suggesting that edible meat wastes used in this study as fat replacer contain moderate amount of lipid content compared to animal fat used. Moreover, the value of lipid recorded in this study fall within the range of standard fat content for meat sausage (Lee et al. 2015). In comparison with raw sausage, cooking methods increased the lipid content of meat sausage with microwaved samples having higher content (13.05%) than oven-grilled samples (8.58%)(Table 2). The increase of lipid content in the microwaved sausage can be attributed to its ability to reduce moisture loss and increase amount of extractable lipids in the muscle samples compared to other cooking methods. This result is in line with findings of Alfaia et al. (2010) who reported a significant differences ($p < 0.01$) in total lipid content of microwaved sausage compared other treatments. In contrast, Janicki and Appledorf (2007) and Youssef et al. (2012) reported that meat samples cooked using microwave and grilling, respectively, had lower fat content compared to other cooking method. Generally, different studies have shown that cooking and cooking methods can increase the lipid and protein content of meat compared to uncooked meat (Cunningham et al., 2015; Falowo et al., 2017).

The ash content of the raw sausage significantly increased in T1 (4.41%) and T2 (4.38%) compared to CT (3.64%). Ash value is known as a pointer of total mineral content in a sample. This result is suggesting that sample T1 and T2 could possessed more mineral content than sample T3. However, the value of ash increased in the cooked sausage treatments with T1 (30/70), T2 (50/50) and CT (90/10) having 5.47%, 5.79% and 8.71%, respectively ($P< 0.01$). This is indicating that cooking could lead to significant changes in ash content of meat samples. For instance, cooking with a microwave (5.06%) and oven-grilling (8.25%) increased the ash content of the cooked sausage. These results are in agreement with Lopes et al. (2015) who reported that microwave and grilling are dry cooking methods and may be responsible for greater retention of ash compared to other cooking methods that involved cooking in water.

The protein content in the uncooked sausages was significantly higher in T1 (30/70) 13.9% and T2 (50/50) 19.34% compared to CT (90/10) 11.02%. This is unexpected as protein content in CT should be higher since it contained larger proportion of lean meat than other treatments. This is suggesting that edible meat wastes are rich in nutrient and could be used to enhance the nutritional quality of meat sausage. The results further showed that cooking significantly increased the protein content of the meat sausages with T1 (26.13%) and T2 (26.17%) having the higher values compared to CT (21.04%)($P <0.01$). This showed that cooking and cooking methods had a significant effect on the protein retention in the meat samples. These results are similar to the findings of Youssef et al. (2012), Cunningham et al. (2015) and Karimian-Khosroshahi et al. (2016) who reported that cooking reduces moisture content and subsequently increase the concentration of lipid and protein.

Figures 1abc and 2abc show the results obtained from the sensory analysis and indicates the differences between the appearance, colour, texture, flavour and overall acceptance attributes of the sausage meats containing edible meat waste and control treatment. The results revealed that sausages containing edible meat waste were all acceptable to the consumers, irrespective of the cooking methods used, when compared to control treatment. This result is in accordance with findings of Magoro et al. (2020) who reported no significant difference in sensory quality of sausage meat formulated with edible offal compared to control group. However the distribution of those who liked the appearance, colour, texture and flavour of the sausage meat were higher than those who dislike the products. This indicates that edible meat wastes can be successfully used in meat industry to replace fat in sausage production. Also, report has shown that edible meat waste consists of carbohydrates, proteins and fat based constituents that are needed for fat substitutes in sausage production (Weiss, 2010). Furthermore, the percentage of consumers who liked T1-MW (84.7%) were higher than those of T2-MW (65.5%) but comparable to those on T1-MW (83.1)(Table 1). The decrease in acceptability of T2-MW may be as a result of aroma of the edible meat waste which may affect the sensory attributes and thus, reduce the acceptability of the sausage (Alao et al. 2021). Similarly, the percentage of consumers that liked T1-OV (56.1%) were the same with that of T2-OV (56.9) (Table1) but lowered than those of CT-OV. This suggests the consumers preferred microwaved meat sausage more than the oven-grilled sausages. However, the tenderness of sausage treatments are significantly different from one another at $P<0.01$ and there was an interaction between the tenderness of the sausage samples and cooking methods at $P<0.01$ (Figure 3). The texture and overall acceptability of sausages formulated with edible meat waste were all tender and acceptable by panelists,

Table 1: Proximate composition of raw sausage made with edible meat waste as fat replacer

Parameters	*Sausage Type*				
(%)	CT (90/10)	T1 (30/70)	T2 (50/50)	SEM	P-Value
Lipid	13.91[a]	11.29[b]	7.49[c]	0.21	0.0001
Ash	3.64[c]	4.41[a]	4.38[b]	0.11	0.0001
Moisture	70.34[a]	65.37[b]	63.54[c]	0.11	0.0001
Crude Protein	11.02[c]	13.9[b]	19.34[a]	0.36	0.0001

CT 90/10 (Control, 90% lean beef +10%Fat), T1 50/50 (50% lean beef+50% edible meat waste), T2 30/70 (30% lean beef+70% edible meat waste)

Table 2**:** Proximate composition of raw sausage made with edible meat waste as fat replacer using different cooking methods

Parameters	*Sausage Type (S)*			*Cooking Type (C)*		*P- Value*			
(%)	CT (90/10)	T1 (30/70)	T2 (50/50)	Microwave	Oven-G	SEM	S	C	S x C
Lipid	10.29[b]	11.87[a]	10.29[b]	13.05	8.58	0.10	0.0001	0.0001	0.0001
Ash	8.71[a]	5.47[c]	5.79[b]	5.06	8.25	0.45	0.0001	0.0001	0.0001
Moisture	56.3[a]	53.73[b]	53.36[c]	51.37	57.55	0.18	0.0001	0.0001	0.0001
Crude Protein	21.04[c]	26.13[b]	26.17[a]	27.49	21.41	0.68	0.0001	0.0001	0.0001

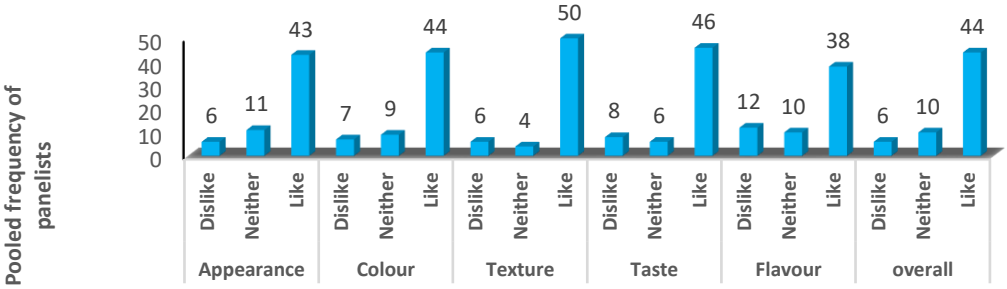


Fig. 1a: Distribution of panellists who liked 10% fat CT-MW sausage

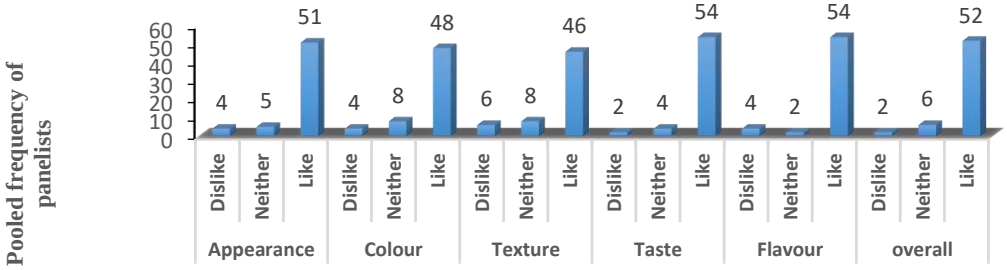


Fig. 1b: Distribution of panellists who liked 50% T1-MW sausage

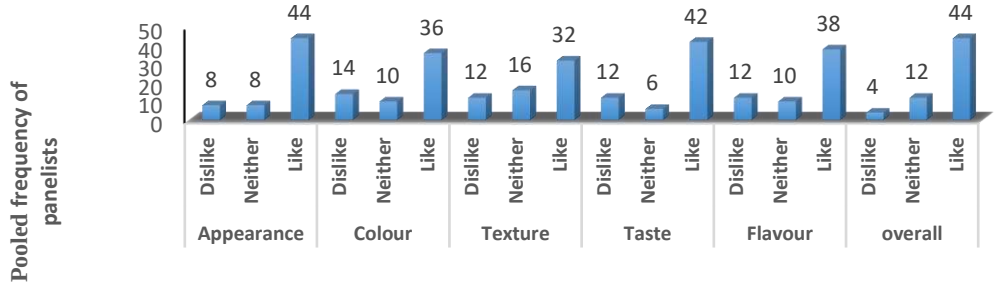


Fig. 1c: Distribution of panellist who liked 70% T2-MW sausage

10% fat CT = 90% lean beef +10%Fat, 50% T1= 50% lean beef+50% edible meat waste, 70% T2 = 30% lean beef+70% edible meat waste, MW: Microwave

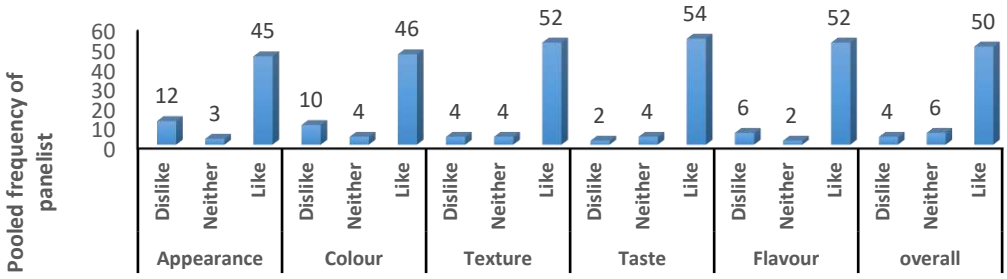


Fig 2a: Distribution of panellists who liked 10% fat CT-OV sausage

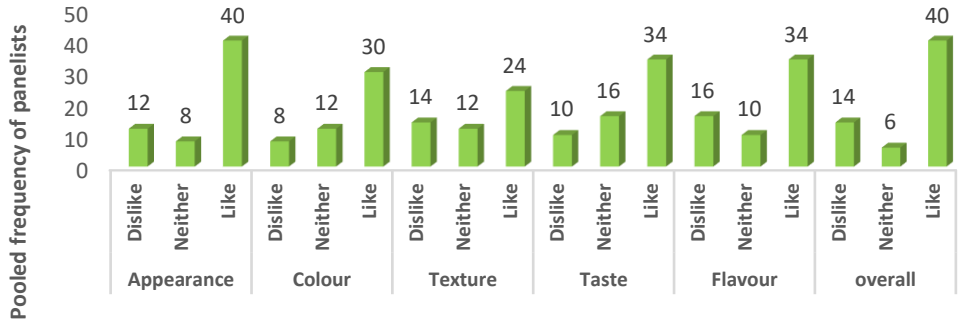
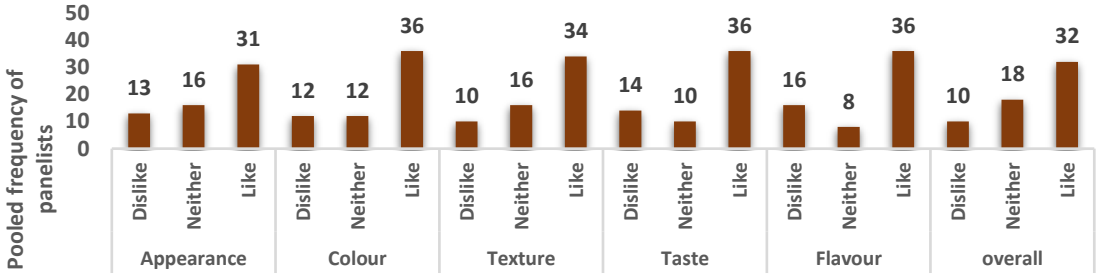


Fig. 2b: Distribution of panellists who liked 50% T1-OV sausage
Fig. 2c: Distribution of panellists who liked 70% T2-OV sausage



10% fat CT = 90% lean beef +10%Fat, 50% T1= 50% lean beef+50% edible meat waste, 70% T2 = 30% lean beef+70% edible meat waste, OV: Oven grilled

Table 3**:** Percentage of panellists that liked cooked beef sausage

Cooking method (C)	*Treatments (T)*	*%*
Microwave	CT-MW 90/10	83.1
	T1-MW 50/50	84.7
	T2-MW 30/70	65.5
Oven-grilling	CT-OV 90/10	73.6
	T1-OV 50/50	56.1
	T2-OV 30/70	56.9

CT 90/10 (Control, 90% lean beef +10%Fat), T1 50/50 (50% lean beef+50% edible meat waste), T2 30/70 (30% lean beef+70% edible meat waste)

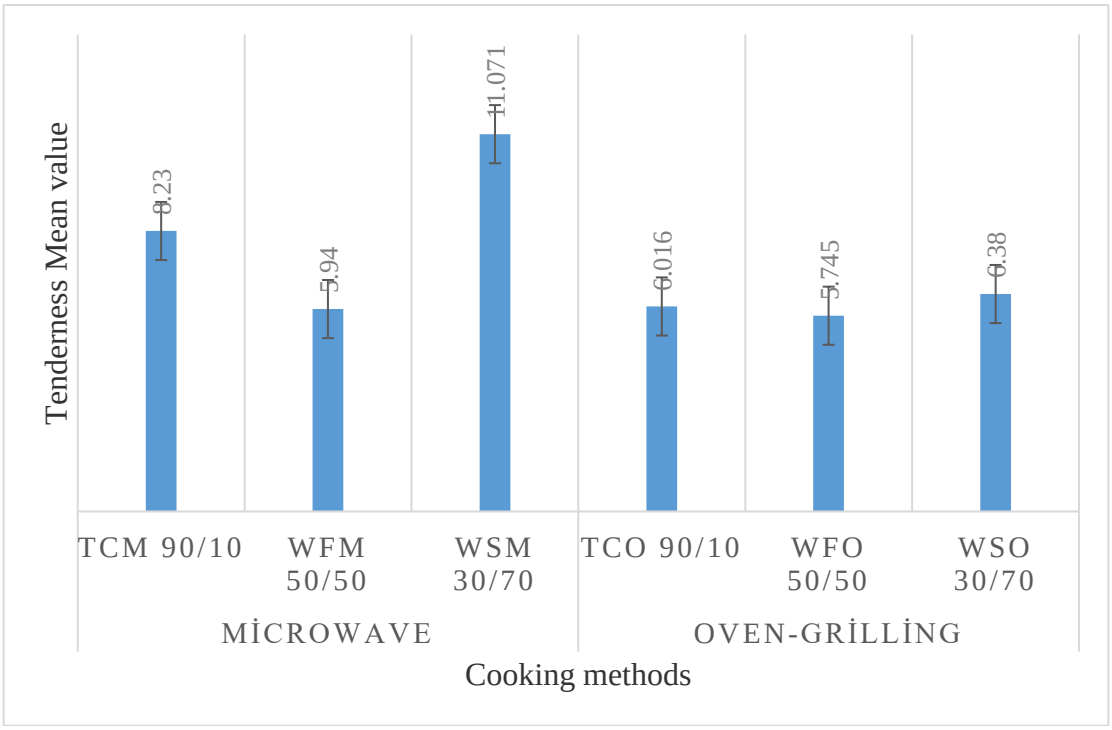


Figure 3: Effect of cooking methods on shear force values of meat sausages
CT 90/10 (Control, 90% lean beef +10%Fat), T1 50/50 (50% lean beef+50% edible meat waste), T2 30/70 (30% lean beef+70% edible meat waste)

Conclusion

Sausage is one of the important meat products that are in high demand throughout the world and this is likely to increase in the coming years. Unfortunately, the cost of the meat products such as sausage are sometimes on the high side. The results of the study also showed that, edible meat waste could be successively as fat replacer in beef sausage production without compromising it nutritional quality. The use of microwave during cooking will help to preserve the nutritional content of meat. Furthermore, this study has shown that the replacements of fat with edible meat waste in sausage production has overall acceptance in most of the attributes scored (colour, appearance, taste, texture and flavour) and these were above the desirable average. Thus, the utilization of the edible meat waste in production of sausages has the potential to increase profitability in meat industry and minimise meat waste in the industry.

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ID: 594

Wide Temperature Range Palm-Based Chocolate Spread

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Abstract

The study screened blended base oils (various ratio of palm superolein (POOo) and sunflower oil (SFO)) and waxes (0% - 3.5% sunflower wax (SFW), carnauba wax (CW) and bees wax (BW)) for the production of chocolate spread at wide range of temperature (5°C-45°C). Main parameters for the blended base oil screening were solid fat content (SFC) as well as hardness and spreadability of the chocolate spread from the blended base oils. Main parameters for the waxes screening were SFC of the selected blended base oil and waxes as well as hardness, spreadability and stability of chocolate spread containing selected blended base oil with different percentage of wax (OSW). Blended oil of POOo: SFO at 50:50 ratio was chosen as base oil as its SFC does not affected by temperature and its chocolate spread was still spreadable at 5°C and projected hardness of below commercial chocolate spread at 5°C. Chocolate spread produced from OSW of 3.5% SFW and 3.5% CW showed promising and positive results of spreadability at 5°C, hardness at 5°C as well as stability structure (no oiling out) at 5°C-40°C after 24 hr of storage. The SFC of OSW with 3.5% SFW showed constant trend at experimental temperatures of 5°C-45°C while the SFC of 3.5% CW showed constant trend at experimental temperatures of 15°C-40°C.

***Key Words**: Sunflower wax, Carnauba wax, Bees wax, spreadability, phase separation*

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Optimization of Nucleic Acid Isolation in High-Fat Dairy Products

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Abstract
Butter and cream are dairy products produced with milk fat and consumed heavily by consumers. Butter produced from sheep, goat and cow milk and their mixtures, and cream products produced from buffalo and cow milk and their mixtures are available in the market and find buyers at high prices. Extraction of nucleic acids to be analyzed is a very important step in Real Time PCR methods, which directly affects the result. It is necessary to obtain isolates of sufficient quality and concentration for PCR in products containing high fat and undergoing certain processes such as butter and cream. Commercial kit methods available on the market can sometimes be insufficient for products with high oil content. In the study, nucleic acid isolations were made in goat butter product with isolation kits belonging to Biotecon, Roche and Promega brands. During the isolations, it is aimed to increase the isolation efficiency by making changes in the parameters of extraction temperature, extraction time and sample amount. It is aimed to determine the optimum isolation conditions and to use these conditions in further analyzes to determine the Real Time PCR based origin determination and % milk mixture ratios in future studies.
Key Words: *Nucleic acid; Butter; Cream; Cow's milk; Goat's milk*

Yüksek Yağ İçeren Süt Ürünlerinde Nükleik Asit İzolasyonu Optimizasyonu

Özet
Tereyağı ve kaymak, süt yağı ile üretilen ve tüketiciler tarafından yoğun şekilde tüketilen süt ürünleridir. Koyun, keçi ve inek sütlerinden ve bunların karışımlarından üretilen tereyağları ile manda ve inek sütlerinden ve bunların karışımlarından üretilen kaymak ürünleri piyasada bulunmakta ve yüksek fiyatlarla alıcı bulmaktadır. Analizi yapılacak nükleik asitlerin özütlenmesi, Real Time PCR metotlarında, sonucu direkt etkileyen, oldukça önemli bir basamaktır. Tereyağı ve kaymak gibi yüksek yağ içeren ve belirli proseslerden geçmiş ürünlerde, PCR için yeterli kalitede ve konsantrasyonda izolatların elde edilmesi gerekmektedir. Piyasada bulunan ticari kit metotları yüksek yağ içeren ürünlerde kimi zaman yetersiz olabilmektedir. Yapılan çalışmada, Biotecon, Roche ve Promega markalarına ait izolasyon kitleri ile keçi tereyağı ürününde nükleik asit izolasyonları yapılmıştır. İzolasyonlar sırasında özütleme sıcaklığı, özütleme süresi ve numune miktarı parametrelerinde değişiklikler yapılarak, izolasyon verimlerinin arttırılması hedeflenmiştir. Optimum izolasyon şartlarının belirlenmesi ve bu şartların, daha sonraki çalışmalarda, Real Time PCR temelli orijin tayini ve % süt karışım oranlarının belirlenebilmesine yönelik ileri analizlerde kullanılabilmesi amaçlanmıştır.
Anahtar Kelimeler: *Nükleik asit; tereyağı; kaymak; inek sütü; keçi sütü*

Giriş

Süt lipitleri, sütün, kloroform, benzen, eter, petrol eteri vb. organik çözücülerde çözünen fakat suda çözünmeyen, hayvan hücrelerinde sentezlenen doğal bir besin öğesidir. Süt lipitleri genellikle süt yağı veya trigliseritler ve lipitler veya minör lipitler olmak üzere 2 grupta incelenir (Metin, 2001).

Süt yağı, yağ asitlerinin, 3 değerli bir alkol olan gliserin ile oluşturduğu trigliserit esterleridir. Süt yağı, süt lipitlerinin %98-99'unu oluşturur.

Süt yağından krema, tereyağı, kaymak, lüle kaymağı gibi bazı ürünler elde edilir. Sütün santrifüje edilmesiyle veya kendi halinde bırakılmasıyla elde edilen ve en az %18 süt yağı içeren süte krema, en az %82 süt yağı içeren ve içerisinde süt yağından başka yağ bulunmayan süt ürününe tereyağı, kaynatılmış sütün yüzey alanı geniş bir kapta bekletilmesi ile elde edilen süt yağınca zengin ve başka yağ içermeyen ürüne kaymak ve manda sütünden özel bir yöntemle elde edilen süt yağınca zengin ürüne lüle kaymağı denilmektedir (Metin, 2001).

Tereyağı ve kaymağın ekonomik değerini ve popülaritesini üretildikleri sütün orijini belirlemektedir. Örneğin keçi tereyağı, inek tereyağına göre oldukça değerlidir. Keçi sütü, özelikle çocuk ve yaşlı bireylerin beslenmesinde, fizyolojik rahatsızlıkların düzenlenmesinde ve vücut gelişiminde önemli pozitif etkilere sahiptir. Alerjenik özellikleri bakımından da keçi sütü, kendine has tadı ve lezzeti ile inek sütünün önünde yer almaktadır.

Koyun tereyağı da keçi tereyağı gibi, anti alerjenik özelliği ve inek tereyağına kıyasla daha yüksek mineral içeriği sebebiyle tercih edilmektedir.

Koyun, keçi ve manda sütleri ile üretilmiş tereyağı ve kaymakların popülaritesi ve ekonomik değerleri, bu ürünlerde taklit ve tağşiş yapılma ihtimalini de beraberinde getirmektedir. Piyasada yoğun şekilde bulunan koyun, keçi ve manda süt ürünlerine inek sütü de karıştırılabilmekte ve karışımın oranına bağlı olmakla birlikte, tağşişin saptanması tat ve kokudan mümkün olamamaktadır (Di Pinto ve diğerleri, 2017).

PCR temelli yöntemler, hayvan türlerinin tanımlanması için, süt ürünlerinde de çok sayıda testte başarılı bir şekilde uygulanmıştır. Bu yöntemler, yüksek oranda olgunlaştırılsa bile, hem sütte hem de peynirde somatik hücrelerden çıkarılan genomik DNA'nın kalıcılığına dayanır (Artuvan & Aksay, 2022). Türlerin tanımlanması için en yaygın deneyler, türe özgü mitokondriyal DNA (mtDNA) dizilerinin PCR analizine dayanır. Aslında, mtDNA doğal olarak büyütülmüş bir genetik değişkenlik kaynağı olarak düşünülebilir. Diğer teknikler, 28S ve 18S rRNA çoklu kopya genleri veya β-kazein genleri gibi nükleer DNA sekanslarına dayanarak süt ürünlerinin hayvansal teşhisi için iyi bilinen markerlerdir. PCR temelli hayvansal orijin analizlerinde mtDNA, kaynağa özgü daha fazla gen içermesi ve nükleer DNA'ya kıyasla çeşitliliği daha fazla gen dizilimi içermesi sebebiyle tercih edilmektedir. Tek türün tespitine dayanan PCR yöntemlerinin yanında, birden fazla türü aynı anda tespit edebilen çoklu (multiplex) PCR yöntemleri, daha hızlı ve daha ekonomik orijin tayini yapılabilmesini sağlamaktadır (Bottero ve diğerleri, 2003; Lopparelli ve diğerleri, 2007; Xue ve diğerleri, 2017; Kotowicz ve diğerleri, 2007).

PCR analizlerinde analiz edilecek dizileri mtDNA açısından zenginleştirmek önemli bir avantaj olmaktadır. Bu sebeple özellikle belirli işleme proseslerinden geçmiş ürünlerde yüksek kaliteli mtDNA izolasyonu önem taşımaktadır. PCR gibi moleküler yöntemlerin süt ürünlerinde kullanılması, ürünlerdeki nükleik asitlerin verimli bir şekilde özütlenmesini hedefleyen etkili ekstraksiyon stratejileri geliştirilmesine bağlıdır. Hayvansal ürünlerden DNA izolasyonuna yönelik ticari olarak üretilmiş farklı izolasyon kitleri bulunmaktadır. Bu kitler farklı performans değerleri göstermekte ve pahalı yöntemler olabilmektedir (Liao J. ve diğerleri, 2017; Volk ve diğerleri, 2014; Sanches ve diğerleri, 2013).

PCR analizlerinde analizin ilk basamağı olan nükleik asit izolasyonu, analizin sonucunu etkileyen en önemli aşamadır (Gryson, 2010). Yeterli konsantrasyon ve kalitede nükleik asit izole edilememesi halinde zincir reaksiyonları uygun verimle gerçekleştirilemeyeceği için analiz sonucu doğru olmayacaktır (Cankar ve diğerleri, 2006). Bu amaçla, nükleik asit izolasyonuna yönelik farklı çalışmalar yapılmıştır (Artuvan & Aksay, 2022).

Özellikle GDO analizlerinde nükleik asit ekstraksiyon metotlarının karşılaştırılmasına dayanan çalışmalar (Smith ve diğerleri, 2005; Elsanhoty ve diğerleri, 2011; Turkec ve diğerleri, 2015) göze çarpmaktadır. Bu çalışmaların dışında Liao, J. ve ark. 2017 yılında yaptıkları çalışmada, çiğ süt ve ısıl işlem görmüş süt ürünlerinde hızlı bir nükleik asit özütleme yöntemi geliştirilmesi üzerine çalışmışlardır. Çalışma sonucunda özellikle ısıl işlem görmüş süt ürünlerinde mtDNA izolasyonuna yönelik endüstride kullanılması amacıyla bir metot tanımlaması yapmışlardır (Liao J. ve diğerleri, 2017).

Liao, J. ve ark. 2016 yılında yaptıkları bir başka çalışmada süt tozundan DNA izolasyonuna yönelik bir ekstraksiyon metodu geliştirilmesini amaçlamışlardır. Çalışma sonunda geliştirdikleri metot ile süt tozunda tağşişin saptanması amacı ile PCR analizlerinde kullanılacak DNA'nın izole edilmesini sağlayacak bir metot optimize etmişlerdir (Liao J. ve diğerleri, 2016).

Pokorska, J. ve ark. 2016 yılında yaptıkları çalışmada, süt somatik hücrelerinden DNA izolasyonuna yönelik yeni bir metot geliştirmeye çalışmışlardır. Çalışma sonunda geliştirdikleri metot ile düşük miktarlardaki çiğ süt hücrelerinden DNA izole edilmesini sağlayacak bir metot geliştirmişlerdir (Pokorska ve diğerleri, 2016).

Volk, H. ve ark. 2014 yılında yaptıkları bir çalışmada, sütten DNA izole edilmesi amacıyla ticari izolasyon metotlarından 6 tanesi ile, ticari olmayan 3 izolasyon metodu ile ve kendi geliştirdikleri 2 izolasyon metodu ile karşılaştırma çalışması yapmışlardır. Çalışma sonucunda, kullandıkları metotlar ile izole ettikleri DNA'ların konsantrasyonlarını ve kalitelerini kıyaslamışlardır (Volk ve diğerleri, 2014).

Pirondini, A. ve ark. 2010 yılında yaptıkları bir çalışmada 7 farklı DNA ekstraksiyon prosedürünü kıyaslamışlardır. Çiğ süt, pastörize süt, UHT süt, yoğurt, krema, tereyağı ve Emmental Peynirinden DNA izolasyonu yapılmış ve DNA konsantrasyonları, kalite değerleri, agaroz jeldeki ve PCR'daki performansları karşılaştırılmıştır (Pirondini ve diğerleri, 2010).

Materyal ve Yöntem

İzolasyon çalışmalarında kullanılmak üzere, yüksek yağ içeren süt ürününü temsil etmesi amacıyla, Mersin Piyasası'ndan temin edilmiş keçi tereyağı kullanılmıştır.

Numunelerde Biotecon foodproof® Sample Preparation Kit III (BT) metoduna göre (Biotecon Diagnostics, 2016), MagNA Pure Compact Nucleic Acid Isolation Kit I (MP) metoduna göre (Roche Molecular Systems, Inc., 2012) ve Maxwell® RSC PureFood GMO and Authentication Kit (PM) metoduna göre (Promega Global, 2018) nükleik asit izolasyonları gerçekleştirilmiştir.

İzolasyon metotlarında verimi etkileyeceği düşünülen parametrelerde değişiklikler yapılmış, 3 farklı izolasyon sıcaklığı (65, 75 ve 85°C), 3 farklı numune miktarı (0.2, 0.5 ve 1 g) ve 3 farklı izolasyon süresi (30, 60 ve 120 d) seçilmiş ve bu faktörlerin verime etkileri incelenmiştir.

Shimadzu BioSpec-Nano Micro-Volume UV-Vis Spektrofotometre cihazı kullanılarak, izolatların 260 nm'deki absorbans değeri ile DNA konsantrasyonu (ng/µL), 260 nm/230 nm absorbans oranı ile DNA kalitesi ölçülmüştür (Manchester, 1996).

İzolasyon parametrelerinde yapılacak değişikliklerin verime etkisinin istatistiki olarak belirlenmesi amacıyla, IBM Istatistics SPSS 20.0 yazılımı ile konsantrasyon ve kalite değerlerinde tanımlayıcı istatistik testleri, varyans analizleri ve Post-Hoc testleri uygulanmıştır.

Bulgular ve Tartışma

Çalışma sırasında izolasyon sıcaklığının, izolasyon süresinin ve numune miktarının nükleik asit konsantrasyonuna olan etkisi araştırılmıştır. 3 farklı izolasyon kiti kullanılmıştır. Bu kitlerden MP (Roche Molecular Systems, Inc., 2012) ve PM (Promega Global, 2018) kitleri izolasyon robotu ile çalışan, BT (Biotecon Diagnostics, 2016) ise manuel çalışan kitlerdir. Parametreler seçilirken, kullanılan kitlerin standart metot basamaklarını da içerecek şekilde, bu basamakların altında ve üzerinde değerler tercih edilmiştir.

İzolasyon sıcaklığı olarak 65°C (kit verisinin altındaki değer), 75°C (kit verisi) ve 85°C (nükleik asitlerin denatürasyon sıcaklığının (90-95°C) (Kahya ve diğerleri, 2013) altındaki yüksek değer) değerleri seçilmiştir.

İzolasyon süresi olarak 30 d, 60 d ve 120 d değerleri seçilmiştir. 30 d değeri kitin önerdiği izolasyon süresidir. Çalışma öncesi yapılan ön denemelerde 120 d üzeri (yarım gün ve tam gün) izolasyon süreleri çalışılmış ancak izole edilen nükleik asit konsantrasyonunu arttırıcı yönde bir etki görülmemiştir. Bu nedenle 120 d izolasyon süresi üst sınır olarak seçilmiştir.

İzolasyon denemeleri sırasında, kuru ısı bloğu çalışma prensibi ile ve kitlerin sarf malzemeleri ile uyumlu olarak 2 ml hacimli tüpler kullanılmıştır. Bu tüplerin kapasitelerinin izin verdiği ölçüde numune miktarı seçilmiş ve bu nedenle en yüksek numune miktarı olarak 1 g seçilmiştir. 0,2 g numune miktarı, kitin önerdiği numune miktarı değeri olarak 0,5 g ise ara basamak olarak seçilmiştir.

Her bir izolasyon parametresi 3 paralel çalışılmıştır. İzole edilen nükleik asitlerin spektrofotometrik olarak kalite ve konsantrasyon (ng/µl) değerleri ölçülmüştür. Ölçüm sonuçlarının istatistiki analizi IBM Istatistics SPSS 20.0 yazılımı ile yapılmış, verilerin normal dağıldığı tespit edilmiş ve parametrik analizlerle sonuçlar değerlendirilmiştir. Sonuçların ortalama değerleri grafiğe geçirilmiştir (Şekil 1).

İzolasyon çalışmalarında, izolasyon robotu ile çalışan kitlerin, manuel kit metoduna göre daha anlamlı sonuçlar verdiği görülmüştür. Sıcaklık, süre ve numune miktarı parametrelerinin etkisi, izolasyon robotu ile çalışan metotlarda daha belirgin olarak ortaya çıkmıştır.

BT metodu ile yapılan çalışmalarda 1,14-7,57 ng/µl arası konsantrasyonda izolatlar elde edilmiştir. En yüksek konsantrasyon olan 7,57±0,87 ng/µl değeri, 85°C'de 0,5g numune ile 60 d süre izolasyon sonucunda elde edilmiştir (Şekil 1.a). Bu izolasyonun kalite değeri 2,87±0,44 olarak saptanırken, BT metodundaki tüm çalışmalarda, izolasyon kalitesinin 0,7 ile 4,3 arasında dalgalandığı görülmüştür. Kalite değerlerinde çok fazla değişkenlik saptanmıştır ($p<0,05$). Özütlenen nükleik asitlerin konsantrasyonlarının düşük olması ve kalite değerinde anlamlı sonuçlar çıkmaması sebebiyle BT metodunun, optimum koşulların belirlenmesine uygun olamayacağı düşünülmüş ve optimum metot olarak seçilmemesine karar verilmiştir.

MP metodu ile gerçekleştirilen izolasyonlarda izolatların kalite değerlerinin 1,47-2,29 arasında değiştiği gözlenmiştir. PM metodu ile yapılan çalışmalarda ise 1,57-2,56 aralığında kalite değişimleri belirlenmiştir. İzoalsyon robotlarında elde edilen nükleik asit izolatlarının kalite değerlerinin Real-Time PCR analizleri için optimum değerler olan 1,8-2,0 aralığına daha yakın olduğu saptanmıştır (Wang ve diğerleri, 2011).

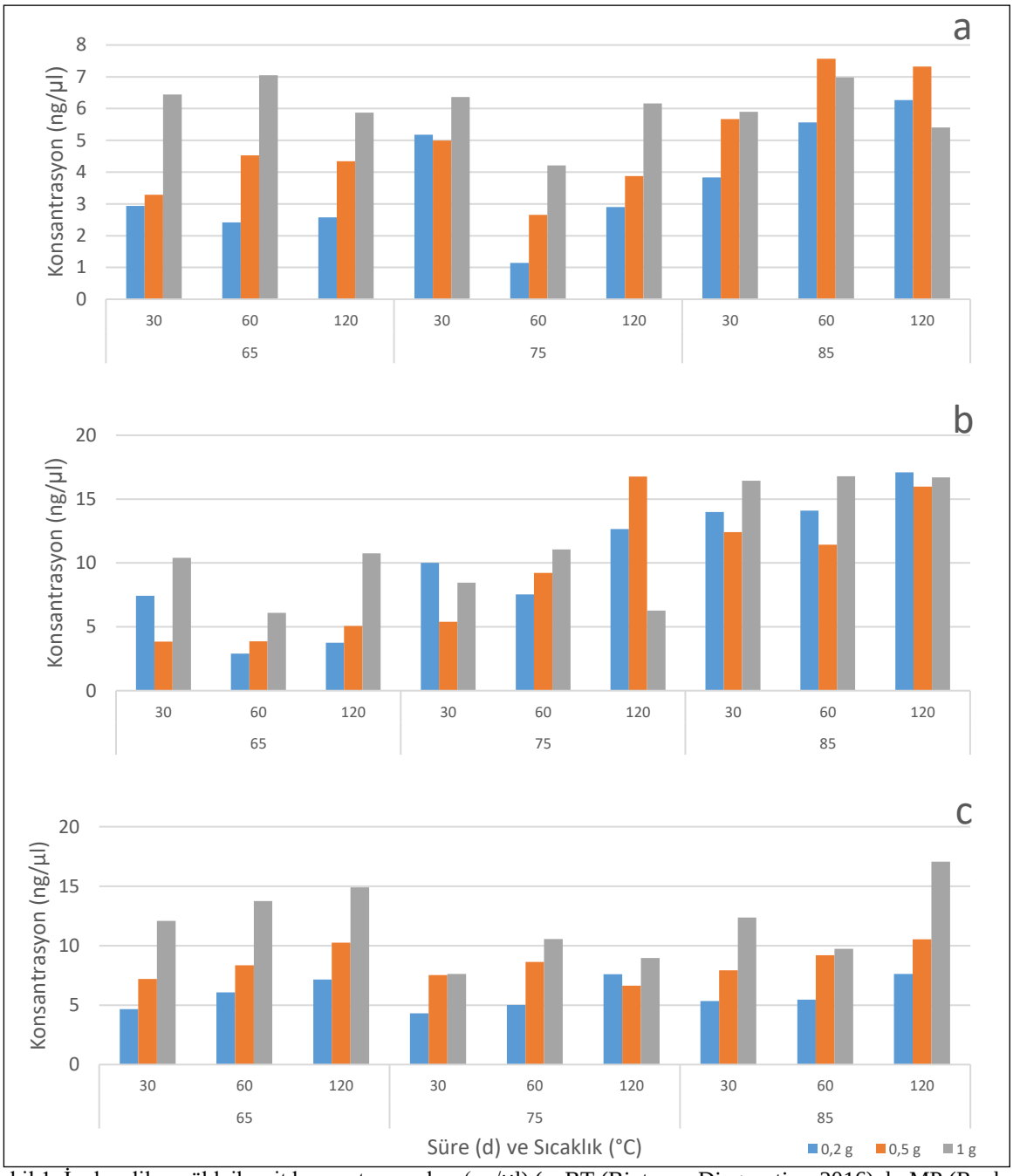
MP metodu çalışmalarında, sıcaklıktaki artışın özütlenen nükleik asit konsantrasyonunu arttırıcı yönde etki yaptığı belirgin olarak göze çarparken (Şekil 1.b), PM metodunda sıcaklık değişimindeki etkiden ziyade aynı sıcaklık uygulaması içerisinde numune miktarlarının etkisi daha belirgindir (Şekil 1.c) ($p<0,05$).

MP metodu ile 0,2 g numune alınarak, 65°C sıcaklıkta, 60 d süre ile yapılan izolasyonda 2,90±0,85 ng/µl konsantrasyon ve 1,74±0,46 kalite değeri ile en düşük verim elde edilmişken; PM metodundaki en düşük değer olan 4,30±1,20 ng/µl konsantrasyon ve 2,24±0,37 kalite değeri, 0,2 g numune, 75°C sıcaklık ve 30 dk izolasyon süresinde elde edilmiştir ($p<0,05$).

En yüksek verim elde edilen koşular ise, MP metodunda, 0,2 g numune, 85°C sıcaklık ve 120 d özütlemede elde edilirken, PM metodunda aynı sıcaklık ve sürede izolasyonla 1 g numune, çalışılarak elde edilmiştir. MP için en yüksek değer, 17,10±0,14 ng/µl konsantrasyon ve 1,95±0,07 kalite; PM için en yüksek değer ise, 17,06±0,57 ng/µl konsantrasyon ve 2,41±0,12 kalite değerleri olarak saptanmıştır ($p<0,05$).

Post-Hoc testlerinde, tüm çalışmalardaki konsantrasyon değerleri ile hesaplama neticesinde MP metodu ile 85°C'de 1 g numune alınarak 120 d izolasyon yapılması ile en optimum koşulun sağlanacağı belirlenmiştir ($p<0,05$).

Yüksek yağ içeren süt ürünlerinde, yüksek konsantrasyonda ve kaliteli nükleik asit ile devam edilecek olan Real-Time PCR metotlarının daha doğru sonuçlar vereceği düşünülmektedir. Piyasada yaygın olarak tüketime sunulan koyun, keçi, manda ürünlerinde inek sütü ile tağşiş olması muhtemeldir. Bu ürünlerde nükleik asit temelli nitel ve nicel analizlerle sonuç verilirken optimum şartları belirlenmiş izolasyon metotlarının kullanılması, analizin daha kesin sonuçlar vermesine katkı sağlayacaktır.



Şekil 1. İzole edilen nükleik asit konsantrasyonları (ng/µl) (a. BT (Biotecon Diagnostics, 2016), b. MP (Roche Molecular Systems, Inc., 2012), c. PM (Promega Global, 2018))

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Mathematical Modeling of Fresh Green Pepper (Capsicum L.) Dried at Different Powers in Microwave Oven

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Abstract

In this research, fresh green peppers were dried in a kitchen microwave oven at 600W, 700W and 800W. The drying curves of the study were compared with 5 different thin layer drying models in the literature. The changes in the moisture values of the samples against time were expressed graphically. R^2, χ^2 and RMSE values were used to determine the most suitable model for dried green peppers. Color values of fresh and dried peppers were determined. It was found that the L* and b* values of the dried peppers were lower and the a* value was higher than the fresh green peppers. In addition, the rehydration rate of dried peppers was calculated. It was determined that the rehydration ability of the peppers decreased as the applied microwave power increased. For this reason, it was found that the peppers with the highest rehydration rate were those dried with 600W. Also, it was found that the most suitable model for all microwave powers among the five drying models was the Logarithmic drying model. It was calculated that the R^2 values of the drying models ranged between 0.830-0.999, χ^2 values between 0.0001- 0.4684 and RMSE values between 0.0014-0.6121. It was determined that the highest R^2 (0.997-0.999), the lowest χ^2 (0.0001-0.0002) values and the lowest RMSE (0.0014-0.0035) values for all microwave powers belong to the Logarithmic drying model.

Key Words: *Drying, Mathematical Modeling, Microwave, Nonlinear analysis, Green pepper.*

Mikrodalga Fırında Farklı Güçlerde Kurutulan Taze Yeşilbiberin (*Capsicum L.*) Matematiksel Modellemesi

Özet

Bu araştırmada, taze yeşilbiberler mutfak tipi mikrodalga fırında 600W, 700W ve 800W güçlerde kurutuldu. Çalışmaya ait kuruma eğrileri, literatürde yer alan 5 farklı ince tabaka kurutma modeli ile karşılaştırıldı. Örneklerin zamana karşı nem değerlerindeki değişim grafiksel olarak ifade edildi. Kurutulan yeşilbiberlere en uygun modelin tespiti için R^2, χ^2 ve RMSE değerlerinden yararlanıldı. Taze ve kuru biberlerin renk değerleri belirlendi. Taze yeşilbiberlere göre kuru biberlerin L* ve b* değerlerinin daha düşük, a* değerinin ise daha yüksek olduğu saptandı. Bunun yanı sıra, kuru biberlerin rehidrasyon oranı hesaplandı. Uygulanan mikrodalga gücü arttıkça, biberlerin rehidrasyon kabiliyetlerinin azaldığı tespit edildi. Bu sebepten, en yüksek rehidrasyon oranına sahip biberlerin 600W ile kurutulanlar olduğu belirlendi. Beş kurutma modeli içerisinde bütün mikrodalga güçleri için en uygun modelin Logaritmik kurutma modeli olduğu bulundu. Kurutma modellerine ait R^2 değerlerinin 0.830-0.999, χ^2 değerlerinin 0.0001- 0.4684 ve RMSE değerlerinin 0.0014-0.6121 arasında değiştiği saptandı. Bütün mikrodalga güçleri için en yüksek R^2 (0.997-0.999), en düşük χ^2 (0.0001-0.0002) ve en düşük RMSE (0.0014-0.0035) değerlerinin Logaritmik kurutma modeline ait olduğu belirlendi.

Anahtar Kelimeler: *Kurutma, Matematiksel Modelleme, Mikrodalga, Nonlineer analiz, Yeşilbiber.*

ID: 597

Transplanted Aman Growth, Yield and Nutrient Uptake As Affected By Phosphorous

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Abstract
The pot experiment was carried out during the period from August to December, 2019 at the field laboratory of Soil, Water and Environment discipline, Khulna University, Khulna, Bangladesh to investigate growth, yield and nutrient uptake as affected by phosphorous of T-aman rice. Soil samples were collected from the Mailmara, Batiaghata at Khulna District in Bangladesh which are Bajoa soil series. The experiment was laid to fit a completely randomised design (CRD) with six treatments and three replications. The levels of phosphorus T1: 0kg P ha^{-1}, T2: 50kg P ha^{-1}, T3: 75kg P ha^{-1}, T4: 100kg P ha^{-1}, T5: 125kg P ha^{-1} and T6: 150kg P ha^{-1} were used in this experiment. Agronomic data (plant height and tiller number) revealed that at 45, 60, 75 and 120 days after transplanting (DAT) and at the time of harvest. Other agronomic parameter such as effective tiller, panicle length, 1000-grain weight, plant fresh weight and dry biomass also took after harvesting. P and K nutrient uptake of plants also observed. Highest panicle length was observed at T5: (P_2O_5 125 kg/ha) treatment and treatment T4: (P_2O_5 100 kg/ha) was the best for T. aman grain yield. Highest P uptake by T. aman rice grain was found at T6: (P_2O_5 150 kg/ha) treatment. P and K uptake for grain, straw and root were also affected by applying phosphorous fertilizer.
Key Words: *T-aman rice, yield, Nutrient uptake, Phosphorus, Agronomic parameter*

Introduction

Rice is the staple food of Bangladesh. Bangladesh is not only a rice-growing country but also a country of rice-eating people. Rice is cultivated in three seasons namely Aus (mid-March to mid-August), Aman (mid-June to November) and Boro (mid-December to mid-June). T. Aman rice covers about 50.92% of the rice areas of Bangladesh (BBS, 2005) of which modern T. Aman varieties cover 60% (BBS, 2005). In Ganges tidal floodplain Agroecological zone-13 T. aman is the main crop because the salt concentration in this region is high. The agro-ecological condition of this area favors the large-scale cultivation of T. aman rice. The larger portion of the saline area (0.65 million ha) exists in the districts of Khulna, Satkhira, Bagerhat, Barguna, Patuakhali, Pirojpur and Bhola on the western coast (west of Meghna) and the smaller portion (0.18 million hectares) in the districts of Chittagong, Cox's Bazar, Noakhali, Lakshimpur, Feni and Chandpur on the eastern coast (east of Meghna) (SRDI, 2009). Salinity causes an unfavorable environment and hydrological situation that limits normal crop production all year round. Low land rice like T. aman is the major component of cropping systems in these areas during the rainy season. In this period the salt is being leached out with percolating water from the root zone. In that case, the soil is suitable for growing submerged crops such as T. aman rice. Munns *et al.* (2006) reported that plant growth in saline soils is adversely affected because of reduced water uptake, salt toxicity, and nutrient imbalance.

Salinity is one of the major obstacles to increasing crop production in those regions of the world. Increasing concerns about rapid population growth and limited water resources in many countries exacerbate existing salinity problems in crop production and producers use poor quality water for irrigation. Rice (Oryza sativa L.) is considered one of the most important food crops in the world, but it is also considered to be very sensitive to salt (Maas and Hoffman, 1977).

Among the various essential elements, P is involved in all biochemical energy processes, storage, the nucleic acid formation, and plant reproduction. About 20-30% of the applied phosphate is available to plants, while about 80-90% of phosphorus is converted to other forms that are not readily available to plants and eventually lost to the environment causing water eutrophication (Schindler *et al.,* 2016). Stress caused by low availability of P is one of the major nutritional factors limiting rice grain yield worldwide (Rose *et al.,* 2013). According to the latest report, 46% of the world's arable land has low P-use Efficiency (PUE) (MacDonald et al., 2011).

Materials and Methods

A pot experiment was conducted at the field laboratory of Soil, Water and Environment Discipline in Khulna University. The soil sample was collected from a farmer's field of Batiaghata. The soil series was Bajoa and the location was Mailmara, Jolma, Batiaghata. In USDA Soil Taxonomy it is Typic Haplaquepts. The physiography was high Ganges River Floodplain. The experiment was carried out in the Robi season (August-December). The crop name was T. aman and the variety name was Vitti Aman was used as planting material.

Soil and pot preparation

Earthen pots were used in this experiment. The size of the pot was 23 × 29 cm. The collected soils were air-dried and then pulverized. All weeds, stubble and crop residues were removed from the soil. Each pot contains 5 kg sieved soil and was made ready for transplanting.

Fertilizer application and experimental design

According to FRG fertilizer recommendation guide (2012) basal doses of urea, muriate of potash (MoP), gypsum and zink sulfate as the sources of nitrogen, potassium, sulfur, and zink were estimated and that are given in table 1. And Triple Superphosphate (TSP) fertilizer level is variable for treatments.

Table. 1. Fertilizer Name and Fertilizer Level

Sl. No.	**Name of the fertilizer**	**Fertilizer level (kg ha^{-1})**
1.	MoP	70
2.	Gypsum	60
3.	Zinc Sulphate	8
4.	Urea	180

Different levels of Triple superphosphate were used as a phosphorous treatment Completely Randomized Design including 6 treatments with 3 replications. Thus, the total number of experimental pots is 18 and the treatments were randomly distributed to each pot. The treatments are shown in Table. 2.

Table. 2. Name of the treatments and fertilizer of Triple Superphosphate

Name of the treatment	***Dose of fertilizer(kg/ha)***
T1	0
T2	50
T3	75
T4	100
T5	125
T6	150

Transplanting

As it was T. aman, the seedlings should be uprooted from the seedbed when they are suitable for transplanting. The seedlings of 27 day-olds were transplanted in the pot on 8th August, 2019. Two hills were planted in each pot and then placed the pots according to CRD.

Harvesting and agronomic data collection

The crops were harvested on 12th December 2019 when they were in full maurity. Plant height recorded at 15 days interval starting from 45 to 120 days after transplantation (DAT). Tiller number hill^{-1} counted on 45, 60, 75 and 120 DAT up to harvest maintaining 15 days interval and effective tiller number hill^{-1} was counted only after harvest. Panicle length and 1000-grain weight(g) were measured after harvest. Weight was taken in an electric balance and the weight was adjusted to 14% moisture content (MC) by using the formula (Gomez and Gomez, 1984).

$$1000 \text{ grain weight at } 14\% \text{ MC} = \frac{(100 - sample\ MC) \times 1000 grain\ weight\ at\ sample\ MC}{(100-14)}$$

The yield of grain in g per pot was adjusted at 14% moisture content of grain:

$$\text{Grain yield at } 14\% \text{ MC} = \frac{10(100 - sample\ MC) \times potyield(g) at\ sample\ MC}{(100-14) \times p0tarea(m2) \times 1000}$$

Straw yield, Root yield were measured after harvesting by sun-dried to get constant weight. The biological yield was calculated by the following formula (Gomez and Gomez, 1984):

Biological yield (pot^{-1}) = grain yield+ straw yield + root yield

Chemical analysis of plants

Plants samples were collected from the field experiment analyzed for P and K content. The samples were digested with HNO_3- $HClO_4$ (2:1) as suggested by Jackson (1973) for the determination of P and K. The P was determined by vanadomolybdate yellow color method (Jackson, 1973). The K was measured by Flame analyzer (JENWAY).

Physical and chemical analysis of soil

The particle size analysis of the soils was done by the combination of the sieving and hydrometer method as described by Bouyoucos in 1936. Textural classes were determined using Marshall's Triangular Coordinate systems. Soil pH was determined electrochemically with the help of glass electrode pH meter using soil to water ratio of 1:2.5 as suggested by Jackson in 1967. The EC of the soil was measured at a soil: water ratio of 1:5 with the help of EC meter and then converted into a 1:1 ratio as USDA. The CEC of the soils was determined by extracting the soil with 1N KCl (pH 7.0) followed by replacing the potassium in the exchange complex by 1 N NH_4OAc. The displaced potassium was determined by a flame analyzer at 589 nm (Jackson, 1967). Soil organic carbon was determined by Walkley and Black's wet oxidation method as outlined by Jackson. Soil organic matter was calculated by multiplying the percent value of organic carbon by the conversion factor 1.724. Available Phosphorus was extracted from the soil with 0.5 M $NaHCO_3$ (Olsen, 1954) at pH 8.5 and the ascorbic acid blue color method was employed for determination (Murphy and Riley, 1962). Exchangeable K in soil with by extracting soils with 1 N NH_4OAC (pH 7.0) and then the K was measured by using a flame photometer (Kundsen et al., 1982).

Nutrient Uptake

After a chemical analysis of straw and grain samples, the nutrient uptake was calculated from the nutrient content and yield of rice crop by the following formula

Nutrient uptake = Nutrient content (%) × yield (kg ha^{-1}) /100

Statistical Analysis

Data were analyzed statistically by ANOVA to examine whether treatment effects were significant. Mean values were compared by Statistix 10.0 software.

Results and Discussion

The results present the effect of different rates of phosphorous fertilizer with applying procedure on P and K uptake as well as growth and yield of BR 23 T. aman Rice including soil physical and chemical properties. The soil physical and chemical properties are shown in Table. 3.

Table. 3. General properties of soil

Soil series	Bajoa
Drainage condition of soil	Moderately low
Soil pH	7.64
Soil EC (dS m^{-1})	0.8
Soil CEC (cmole kg^{-1})	20.46
Soil organic carbon (%)	0.96
Particle size analysis Sand Silt Clay	 8% 62% 30%
Soil texture	Silty Clay Loam
Available P (µg g^{-1})	15.38
Total P (µg g^{-1})	875
Total N (%)	0.64
Ca (cmole kg^{-1})	12.47
Mg (cmole kg^{-1})	6.56
Na (cmole kg^{-1})	1.83

Yield contributing characteristics of T. aman

The yield components include the plant height at different days after transplanting, panicle length, number of tillers at different days after planting, effective and non-effective tiller number and 1000-grain weight.

Plant height

The plant height was measured at 15 days interval from 45 to 120 days after transplanting. Plant height of T. aman rice was significantly influenced at DAT 45 due to the application of triple super phosphate fertiliser alone but non-significant in DAT 60, DAT 75, DAT 90 and DAT 120 (Fig. 1). Plant height varied from 84.33 cm (T1) at DAT 45 to 105.50 cm (T1) at harvest time (DAT 120) (Fig. 1.).

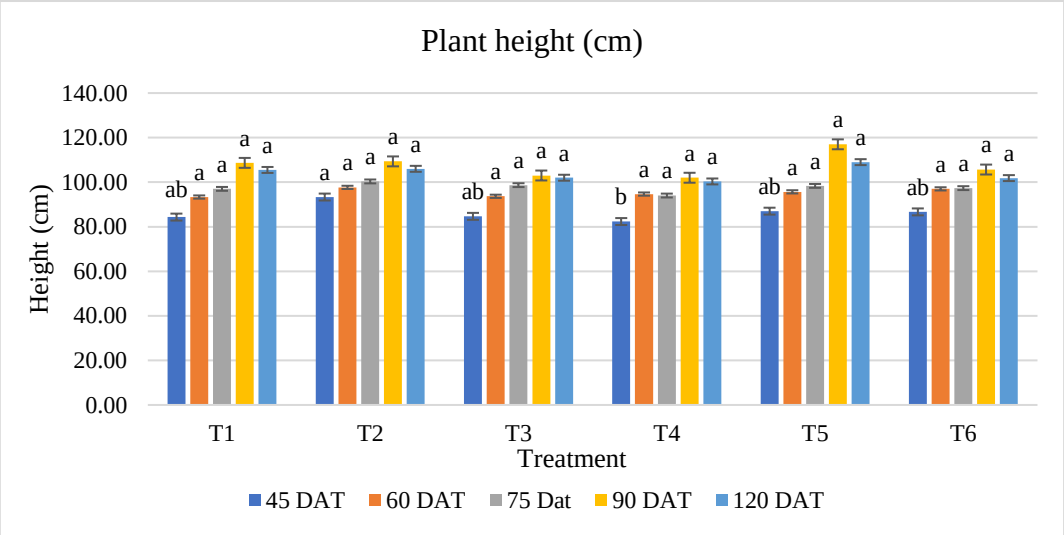

Fig. 1. Plant height at DAT

Number of tillers, panicle length, 1000 grain weight

The number of tillers has been counted on 45, 60, 75 DAT up to harvest. At DAT 45 and DAT 60 tiller number is significantly affected with the phosphorous treatment which is shown in Table. 4. but it is non-significant at DAT 75 (Table. 4.) and harvest time (DAT 120) (Table. 4.). Table. 4. also shows that tiller number varying from 9.33(T1) to 12 (T6).

Table. 4. Tiller number at DAT

Treatment	**45 DAT**	**60 DAT**	**75 DAT**	**120 DAT**
T1: ($P_2O_5$0 kg ha^{-1})	11.00 b	11.00 b	11.33 a	9.33 a
T2: ($P_2O_5$50 kg ha^{-1})	14.33 a	14.33 a	14.00 a	9.50 a
T3: ($P_2O_5$75 kg ha^{-1})	12.33 ab	12.33 ab	13.67 a	9.50 a
T4: ($P_2O_5$100 kg ha^{-1})	10.67 b	10.67 b	12.67 a	10.33 a
T5: ($P_2O_5$125 kg ha^{-1})	12.00 ab	13.00 ab	11.67 a	9.50 a
T6: ($P_2O_5$150 kg ha^{-1})	12.00 ab	12.00 ab	13.00 a	9.33 a
Mean	*12.06*	*12.22*	*12.72*	*9.58*
Stdv	*1.29*	*1.34*	*1.06*	*0.38*
cv	*13.52*	*13.52*	*17.02*	*22.32*

Columns annotated with the same letter are not significantly different at p<0.05 according to Tukey test

Rice grain yields are highly dependent upon the number of panicle-bearing tiller produced per plant. The effective and non-effective tiller is not significantly affected by the phosphorous treatment (Table. 5.). Observation showed that at harvest effective and non-effective tiller number varied from 17(T1) to 19(T6) with an average of 18.28 and from 0.33(T1) to 1.76(T2) (Table. 5.). Panicle length of T. aman rice was significantly influenced by the different treatments (Table. 5.). Panicle length due to different treatments varied from 23.11 cm in T1 to 23.56 cm in T2. The 1000-grain weight of T. aman rice was influenced non-significantly due to the application of triple super phosphate fertilizer alone and ranged from 26.43 (T1) to 24.90 (T6) g with the average 25.39 g (Table. 5.).

Table. 5. Effective Tiller, Non-effective tiller, panicle length, 1000 grain weight at harvesting time.

Treatment	**ET**	**NET**	**Panicle Length cm**	**1000 grain weight g**
T1: ($P_2O_5$0 kg ha^{-1})	17.00 a	1.67 a	23.11 ab	26.43 a
T2: ($P_2O_5$50 kg ha^{-1})	20.00 a	0.67 a	23.78 ab	26.23 a
T3: ($P_2O_5$75 kg ha^{-1})	20.67 a	0.33 a	22.06 b	24.80 a
T4: ($P_2O_5$100 kg ha^{-1})	17.00 a	0.33 a	23.89 ab	24.87 a
T5: ($P_2O_5$125 kg ha^{-1})	16.00 a	1.00 a	24.61 a	25.10 a
T6: ($P_2O_5$150 kg ha^{-1})	19.00 a	1.33 a	23.56 ab	24.90 a
Mean	*18.28*	*0.89*	*23.50*	*25.39*
Stdv	*1.88*	*0.54*	*0.86*	*0.74*
cv	*23.55*	*91.09*	*5.27*	*8.20*

Columns annotated with the same letter are not significantly different at p<0.05 according to Tukey test

Yields of grain, straw and root

Data on grain, straw and root of T. aman rice were significantly influenced by different P treatments have been presented in Table 6. The grain yield ranged from 4662.67 kg ha^{-1} (T1) to 5660 kg ha^{-1} (T6) which was affected by the treatment (Fig. 2).). The straw yield ranged from 12344 kg ha^{-1} (T1) to 16037.33 kg ha^{-1} (T6) which was affected by the treatment (Table. 6.) The root yield ranged from 832 kg ha^{-1} (T1) to 1692 kg ha^{-1} (T6) which was affected by the treatment (Table. 4.4.). And for this the biological yield was also significantly affected for applying P treatment which is shown in Fig. 2. The fig.2. also shows that biological yield varies from 17838.67 kg ha^{-1} (T1) to 23389.33 kg ha^{-1} (T6) with an average 20847.78 kg ha^{-1} for P treatment.

Table. 6. Effect of treatments on grain yield, straw yield, root yield and biological yield

Treatment	**Grain yield**	**Straw yield**	**Root yield**
	kg ha^{-1}		
T1: ($P_2O_5$0 kg ha^{-1})	4662.67 b	12344.00 c	832.00 e
T2: ($P_2O_5$50 kg ha^{-1})	4833.33 b	13632.00 b	1082.67 d
T3: ($P_2O_5$75 kg ha^{-1})	4944.00 b	14121.33 b	1281.33 c
T4: ($P_2O_5$100 kg ha^{-1})	5534.67 a	14450.67 b	1494.67 b
T5: ($P_2O_5$125 kg ha^{-1})	5549.33 a	15345.33 a	1589.33 ab
T6: ($P_2O_5$150 kg ha^{-1})	5660.00 a	16037.33 a	1692.00 a
Mean	*5197.33*	*14321.78*	*1328.67*
Stdv	*432.2731647*	*1298.844524*	*327.7036602*
cv	*3.32*	*3.21*	*8.12*

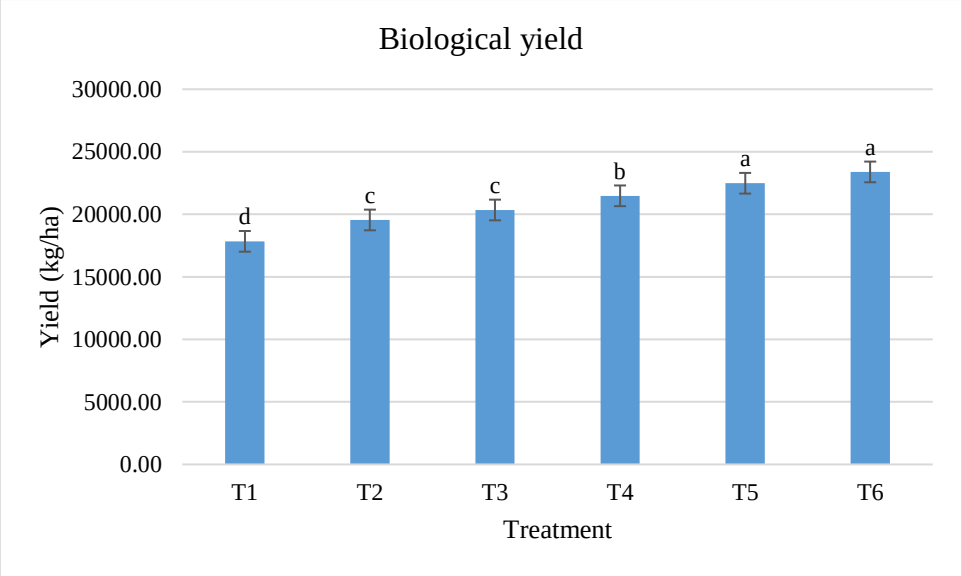

Fig. 2. Biological yield with treatment

Phosphorous and Potassium content

Results presented in Table. 7. indicated that phosphorous content in grain and root and for this total content by T. aman rice was significantly influenced by different P treatments under study. P content of grain was affected and varies 0.03% (T1) to 0.29% (T6). But P content of straw was not significantly affected (Table. 7.). P content of root was affected and varies 0.04% (T1) to 0.03% (T6). And total P content also affected by P treatment (Fig. 3.). The P content varies from 0.11%(T1) to 0.36% (T6).

Potassium (K) content was significantly affected only grain but non-significantly affected in root and straw content by different P treatment. The K content result was presented in table. 7. The K content was no significantly changed by P treatment which is shown in Fig. 4.

Table. 7. Phosphorous and potassium content by grain, straw and root of T. aman rice as affected by P fertilizer

Treatment	Grain		Straw		Root	
	K	P	K	P	K	P
T1: ($P_2O_5$0 kg ha^{-1})	0.002 a	0.03 f	0.17 a	0.04 a	0.04 a	0.04 bc
T2: ($P_2O_5$50 kg ha^{-1})	0.002 a	0.07 e	0.15 a	0.04 a	0.04 a	0.07 a
T3: ($P_2O_5$75 kg ha^{-1})	0.002 a	0.18 d	0.14 a	0.05 a	0.04 a	0.06 ab
T4: ($P_2O_5$100 kg ha^{-1})	0.001 b	0.20 c	0.14 a	0.04 a	0.04 a	0.03 d
T5: ($P_2O_5$125 kg ha^{-1})	0.001 b	0.23 b	0.14 a	0.04 a	0.04 a	0.07 a
T6: ($P_2O_5$150 kg ha^{-1})	0.002 b	0.29 a	0.17 a	0.04 a	0.04 a	0.03 cd
Mean	*0.002*	*0.16*	*0.15*	*0.04*	*0.04*	*0.05*
Stdv	*0.00*	*0.09*	*0.01*	*0.00*	*0.00*	*0.02*
cv	*4.79*	*6.07*	*10.15*	*18.07*	*8.56*	*18.63*

Columns annotated with the same letter are not significantly different at p<0.05 according to Tukey test

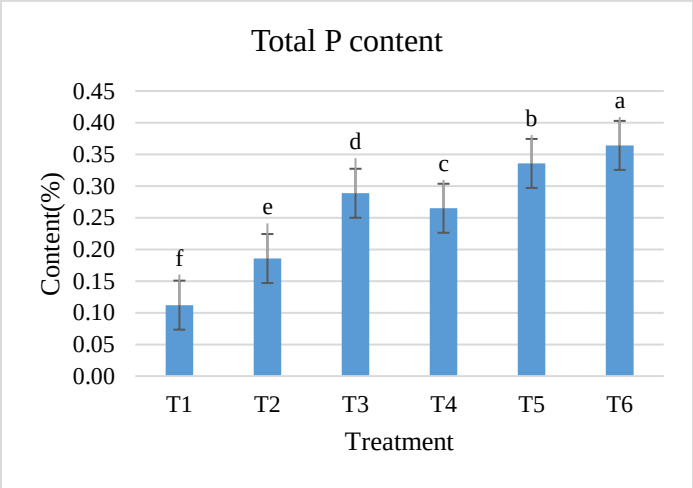

Fig. 3. Total P content of T. aman rice with treatment

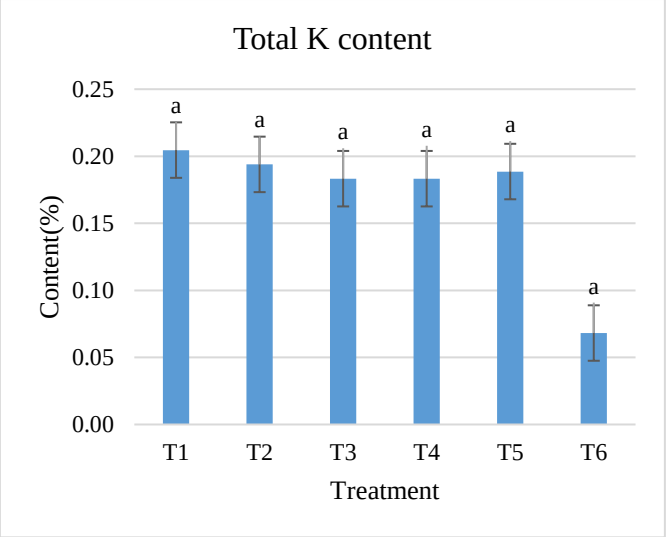

Fig. 4. Total K content of T. aman rice with treatment

Phosphorous and Potassium uptake

Phosphorous uptake by T. aman rice in grain, straw and root was significantly affected by various P treatments which were presented in Table. 8. Grain uptake of P ranges from 1.27 kg ha^{-1} (T1) to 16.17 kg ha^{-1} (T6), straw uptake of P ranges from 4.99 kg ha^{-1} (T1) to 7.14 kg ha^{-1} (T6) and root uptake of P ranges from 0.37 kg ha^{-1} (T1) to 0.57 kg ha^{-1} (T6) (Table. 8). In case of P uptake, T. aman rice was significantly influenced by different P treatment (Fig. 5.). The P uptake due to different treatments ranged from 6.63 kg ha^{-1} (T1) to 23.89 kg ha^{-1} (T6). Potassium uptake by T.aman rice in grain, straw and root was significantly affected by various P treatments (Table. 8.). The K uptake by grain varied from 11 kg ha^{-1} (T1) to 13 kg ha^{-1} (T6), in straw varied from 20.40 kg ha^{-1} (T1) to 26.51 kg ha^{-1} (T6) and root varied from 31.05 kg ha^{-1} (T1) to 63.15 kg ha^{-1} (T6) which are shown in Table 4.8. In case of this the K uptake also affected by applying triple superphosphate treatment which was shown in Fig. 6. and it varied from 51.56 kg ha^{-1} (T1) to 89.78 kg ha^{-1} (T6).

Table 8. Phosphorous and Potassium uptake by grain, straw and root of T. aman rice as affected by P fertilizer.

Treatment	**Grain**		**Straw**		**Root**	
	P	**K**	**P**	**K**	**P**	**K**
T1: ($P_2O_5$0 kg ha^{-1})	1.27 f	0.11 bc	4.99 b	20.40 b	0.37 c	31.05 d
T2: ($P_2O_5$50 kg ha^{-1})	3.45 e	0.11 bc	5.61 ab	21.08 b	0.79 b	40.41 c
T3: ($P_2O_5$75 kg ha^{-1})	8.71 d	0.11 b	7.52 a	19.57 b	0.76 b	54.65 b
T4: ($P_2O_5$100 kg ha^{-1})	10.99 c	0.10 c	5.87 ab	20.03 b	0.38 c	63.75 ab
T5: ($P_2O_5$125 kg ha^{-1})	12.72 b	0.10 c	6.27 ab	22.09 ab	1.04 a	67.79 a
T6: ($P_2O_5$150 kg ha^{-1})	16.17 a	0.13 a	7.14 ab	26.51 a	0.57 bc	63.15 ab
Mean	*8.88*	*0.11*	*6.23*	*21.61*	*0.65*	*53.47*
Stdv	*5.65*	*0.01*	*0.96*	*2.55*	*0.26*	*14.69*
cv	*8.23*	*5.61*	*19.89*	*12.03*	*20.13*	*10.15*

Columns annotated with the same letter are not significantly different at p<0.05 according to Tukey test

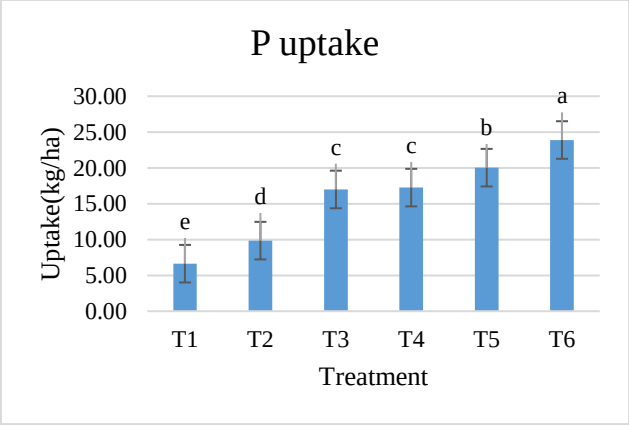

Fig. 5. P uptake of T. aman rice with treatment

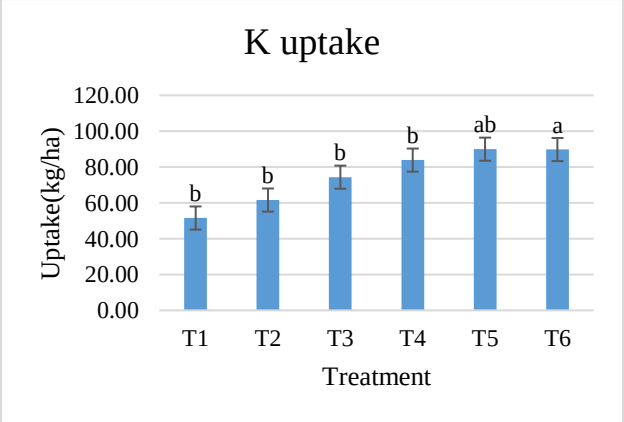

Fig. 6. K uptake of T. aman rice with treatment

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Transplanted Aman Growth, Yield and Nutrient Uptake As Affected By Phosphorous

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Abstract
The pot experiment was carried out during the period from August to December, 2019 at the field laboratory of Soil, Water and Environment discipline, Khulna University, Khulna, Bangladesh to investigate growth, yield and nutrient uptake as affected by phosphorous of T-aman rice**.** Soil samples were collected from the Mailmara, Batiaghata at Khulna District in Bangladesh which are Bajoa soil series. The experiment was laid to fit a completely randomised design (CRD) with six treatments and three replications. The levels of phosphorus T1: 0kg P ha^{-1}, T2: 50kg P ha^{-1}, T3: 75kg P ha^{-1}, T4: 100kg P ha^{-1}, T5: 125kg P ha^{-1} and T6: 150kg P ha^{-1} were used in this experiment. Agronomic data (plant height and tiller number) revealed that at 45, 60, 75 and 120 days after transplanting (DAT) and at the time of harvest. Other agronomic parameter such as effective tiller, panicle length, 1000-grain weight, plant fresh weight and dry biomass also took after harvesting. P and K nutrient uptake of plants also observed. Highest panicle length was observed at T5: (P_2O_5 125 kg/ha) treatment and treatment T4: (P_2O_5 100 kg/ha) was the best for T. aman grain yield. Highest P uptake by T. aman rice grain was found at T6: (P_2O_5 150 kg/ha) treatment. P and K uptake for grain, straw and root were also affected by applying phosphorous fertilizer.
Key Words: *T-aman rice, yield, Nutrient uptake, Phosphorus, Agronomic parameter*

Introduction

Rice is the staple food of Bangladesh. Bangladesh is not only a rice-growing country but also a country of rice-eating people. Rice is cultivated in three seasons namely Aus (mid-March to mid-August), Aman (mid-June to November) and Boro (mid-December to mid-June). T. Aman rice covers about 50.92% of the rice areas of Bangladesh (BBS, 2005) of which modern T. Aman varieties cover 60% (BBS, 2005). In Ganges tidal floodplain Agroecological zone-13 T. aman is the main crop because the salt concentration in this region is high. The agro-ecological condition of this area favors the large-scale cultivation of T. aman rice. The larger portion of the saline area (0.65 million ha) exists in the districts of Khulna, Satkhira, Bagerhat, Barguna, Patuakhali, Pirojpur and Bhola on the western coast (west of Meghna) and the smaller portion (0.18 million hectares) in the districts of Chittagong, Cox's Bazar, Noakhali, Lakshimpur, Feni and Chandpur on the eastern coast (east of Meghna) (SRDI, 2009). Salinity causes an unfavorable environment and hydrological situation that limits normal crop production all year round. Low land rice like T. aman is the major component of cropping systems in these areas during the rainy season. In this period the salt is being leached out with percolating water from the root zone. In that case, the soil is suitable for growing submerged crops such as T. aman rice. Munns *et al.* (2006) reported that plant growth in saline soils is adversely affected because of reduced water uptake, salt toxicity, and nutrient imbalance.

Salinity is one of the major obstacles to increasing crop production in those regions of the world. Increasing concerns about rapid population growth and limited water resources in many countries exacerbate existing salinity problems in crop production and producers use poor quality water for irrigation. Rice (Oryza sativa L.) is considered one of the most important food crops in the world, but it is also considered to be very sensitive to salt (Maas and Hoffman, 1977).

Among the various essential elements, P is involved in all biochemical energy processes, storage, the nucleic acid formation, and plant reproduction. About 20-30% of the applied phosphate is available to plants, while about 80-90% of phosphorus is converted to other forms that are not readily available to plants and eventually lost to the environment causing water eutrophication (Schindler *et al.,* 2016). Stress caused by low availability of P is one of the major nutritional factors limiting rice grain yield worldwide (Rose *et al.,* 2013). According to the latest report, 46% of the world's arable land has low P-use Efficiency (PUE) (MacDonald et al., 2011).

Materials and Methods

A pot experiment was conducted at the field laboratory of Soil, Water and Environment Discipline in Khulna University. The soil sample was collected from a farmer's field of Batiaghata. The soil series was Bajoa and the location was Mailmara, Jolma, Batiaghata. In USDA Soil Taxonomy it is Typic Haplaquepts. The physiography was high Ganges River Floodplain. The experiment was carried out in the Robi season (August-December). The crop name was T. aman and the variety name was Vitti Aman was used as planting material.

Soil and pot preparation

Earthen pots were used in this experiment. The size of the pot was 23 × 29 cm. The collected soils were air-dried and then pulverized. All weeds, stubble and crop residues were removed from the soil. Each pot contains 5 kg sieved soil and was made ready for transplanting.

Fertilizer application and experimental design

According to FRG fertilizer recommendation guide (2012) basal doses of urea, muriate of potash (MoP), gypsum and zink sulfate as the sources of nitrogen, potassium, sulfur, and zink were estimated and that are given in table 1. And Triple Superphosphate (TSP) fertilizer level is variable for treatments.

Table. 1. Fertilizer Name and Fertilizer Level

Sl. No.	**Name of the fertilizer**	**Fertilizer level (kg ha^{-1})**
5.	MoP	70
6.	Gypsum	60
7.	Zinc Sulphate	8
8.	Urea	180

Different levels of Triple superphosphate were used as a phosphorous treatment Completely Randomized Design including 6 treatments with 3 replications. Thus, the total number of experimental pots is 18 and the treatments were randomly distributed to each pot. The treatments are shown in Table. 2.

Table. 2. Name of the treatments and fertilizer of Triple Superphosphate

Name of the treatment	***Dose of fertilizer(kg/ha)***
T1	0
T2	50
T3	75
T4	100
T5	125
T6	150

Transplanting

As it was T. aman, the seedlings should be uprooted from the seedbed when they are suitable for transplanting. The seedlings of 27 day-olds were transplanted in the pot on 8th August, 2019. Two hills were planted in each pot and then placed the pots according to CRD.

Harvesting and agronomic data collection

The crops were harvested on 12th December 2019 when they were in full maurity. Plant height recorded at 15 days interval starting from 45 to 120 days after transplantation (DAT). Tiller number hill^{-1} counted on 45, 60, 75 and 120 DAT up to harvest maintaining 15 days interval and effective tiller number hill^{-1} was counted only after harvest. Panicle length and 1000-grain weight(g) were measured after harvest. Weight was taken in an electric balance and the weight was adjusted to 14% moisture content (MC) by using the formula (Gomez and Gomez, 1984).

$$1000 \text{ grain weight at } 14\% \text{ MC} = \frac{(100 - sample\ MC) \times 1000 grain\ weight\ at\ sample\ MC}{(100 - 14)}$$

The yield of grain in g per pot was adjusted at 14% moisture content of grain:

$$\text{Grain yield at } 14\% \text{ MC} = \frac{10(100 - sample\ MC) \times potyield(g) at\ sample\ MC}{(100 - 14) \times p0tarea(m2) \times 1000}$$

Straw yield, Root yield were measured after harvesting by sun-dried to get constant weight. The biological yield was calculated by the following formula (Gomez and Gomez, 1984):

Biological yield (pot^{-1}) = grain yield+ straw yield + root yield

Chemical analysis of plants

Plants samples were collected from the field experiment analyzed for P and K content. The samples were digested with HNO_3- $HClO_4$ (2:1) as suggested by Jackson (1973) for the determination of P and K. The P was determined by vanadomolybdate yellow color method (Jackson, 1973). The K was measured by Flame analyzer (JENWAY).

Physical and chemical analysis of soil

The particle size analysis of the soils was done by the combination of the sieving and hydrometer method as described by Bouyoucos in 1936. Textural classes were determined using Marshall's Triangular Coordinate systems. Soil pH was determined electrochemically with the help of glass electrode pH meter using soil to water ratio of 1:2.5 as suggested by Jackson in 1967. The EC of the soil was measured at a soil: water ratio of 1:5 with the help of EC meter and then converted into a 1:1 ratio as USDA. The CEC of the soils was determined by extracting the soil with 1N KCl (pH 7.0) followed by replacing the potassium in the exchange complex by 1 N NH_4OAc. The displaced potassium was determined by a flame analyzer at 589 nm (Jackson, 1967). Soil organic carbon was determined by Walkley and Black's wet oxidation method as outlined by Jackson. Soil organic matter was calculated by multiplying the percent value of organic carbon by the conversion factor 1.724. Available Phosphorus was extracted from the soil with 0.5 M $NaHCO_3$ (Olsen, 1954) at pH 8.5 and the ascorbic acid blue color method was employed for determination (Murphy and Riley, 1962). Exchangeable K in soil with by extracting soils with 1 N NH_4OAC (pH 7.0) and then the K was measured by using a flame photometer (Kundsen et al., 1982).

Nutrient Uptake

After a chemical analysis of straw and grain samples, the nutrient uptake was calculated from the nutrient content and yield of rice crop by the following formula

Nutrient uptake = Nutrient content (%) × yield (kg ha^{-1}) /100

Statistical Analysis

Data were analyzed statistically by ANOVA to examine whether treatment effects were significant. Mean values were compared by Statistix 10.0 software.

Results and Discussion

The results present the effect of different rates of phosphorous fertilizer with applying procedure on P and K uptake as well as growth and yield of BR 23 T. aman Rice including soil physical and chemical properties. The soil physical and chemical properties are shown in Table. 3.

Table. 3. General properties of soil

Soil series	Bajoa
Drainage condition of soil	Moderately low
Soil pH	7.64
Soil EC (dS m^{-1})	0.8
Soil CEC (cmole kg^{-1})	20.46
Soil organic carbon (%)	0.96
Particle size analysis Sand Silt Clay	 8% 62% 30%
Soil texture	Silty Clay Loam
Available P (µg g^{-1})	15.38
Total P (µg g^{-1})	875
Total N (%)	0.64
Ca (cmole kg^{-1})	12.47
Mg (cmole kg^{-1})	6.56
Na (cmole kg^{-1})	1.83

Yield contributing characteristics of T. aman

The yield components include the plant height at different days after transplanting, panicle length, number of tillers at different days after planting, effective and non-effective tiller number and 1000-grain weight.

Plant height

The plant height was measured at 15 days interval from 45 to 120 days after transplanting. Plant height of T. aman rice was significantly influenced at DAT 45 due to the application of triple super phosphate fertiliser alone but non-significant in DAT 60, DAT 75, DAT 90 and DAT 120 (Fig. 1). Plant height varied from 84.33 cm (T1) at DAT 45 to 105.50 cm (T1) at harvest time (DAT 120) (Fig. 1.).

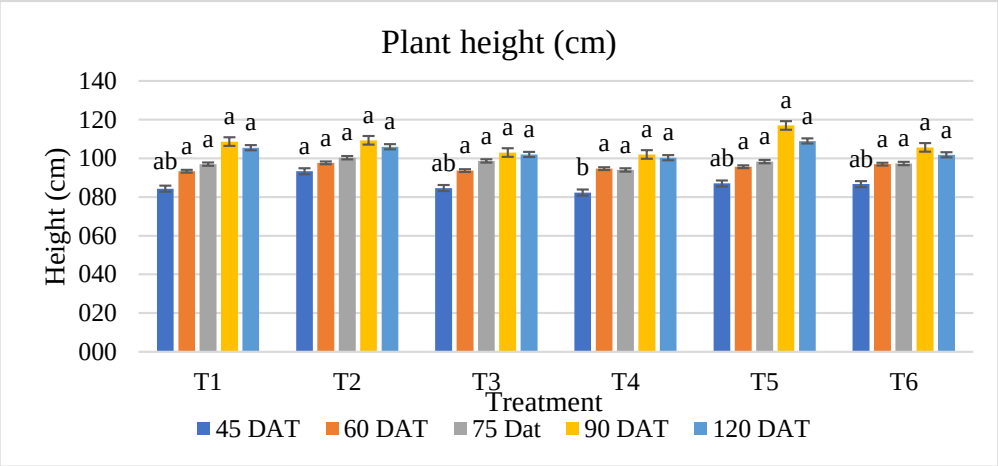

Fig. 1. Plant height at DAT

Number of tillers, panicle length, 1000 grain weight

The number of tillers has been counted on 45, 60, 75 DAT up to harvest. At DAT 45 and DAT 60 tiller number is significantly affected with the phosphorous treatment which is shown in Table. 4. but it is non-significant at DAT 75 (Table. 4.) and harvest time (DAT 120) (Table. 4.). Table. 4. also shows that tiller number varying from 9.33(T1) to 12 (T6).

Table. 4. Tiller number at DAT

Treatment	**45 DAT**	**60 DAT**	**75 DAT**	**120 DAT**
T1: ($P_2O_5$0 kg ha^{-1})	11.00 b	11.00 b	11.33 a	9.33 a
T2: ($P_2O_5$50 kg ha^{-1})	14.33 a	14.33 a	14.00 a	9.50 a
T3: ($P_2O_5$75 kg ha^{-1})	12.33 ab	12.33 ab	13.67 a	9.50 a
T4: ($P_2O_5$100 kg ha^{-1})	10.67 b	10.67 b	12.67 a	10.33 a
T5: ($P_2O_5$125 kg ha^{-1})	12.00 ab	13.00 ab	11.67 a	9.50 a
T6: ($P_2O_5$150 kg ha^{-1})	12.00 ab	12.00 ab	13.00 a	9.33 a
Mean	*12.06*	*12.22*	*12.72*	*9.58*
Stdv	*1.29*	*1.34*	*1.06*	*0.38*
cv	*13.52*	*13.52*	*17.02*	*22.32*

Columns annotated with the same letter are not significantly different at p<0.05 according to Tukey test

Rice grain yields are highly dependent upon the number of panicle-bearing tiller produced per plant. The effective and non-effective tiller is not significantly affected by the phosphorous treatment (Table. 5.). Observation showed that at harvest effective and non-effective tiller number varied from 17(T1) to 19(T6) with an average of 18.28 and from 0.33(T1) to 1.76(T2) (Table. 5.). Panicle length of T. aman rice was significantly influenced by the different treatments (Table. 5.). Panicle length due to different treatments varied from 23.11 cm in T1 to 23.56 cm in T2. The 1000-grain weight of T. aman rice was influenced non-significantly due to the application of triple super phosphate fertilizer alone and ranged from 26.43 (T1) to 24.90 (T6) g with the average 25.39 g (Table. 5.).

Table. 5. Effective Tiller, Non-effective tiller, panicle length, 1000 grain weight at harvesting time

Treatment	**ET**	**NET**	**Panicle Length cm**	**1000 grain weight g**
T1: ($P_2O_5$0 kg ha^{-1})	17.00 a	1.67 a	23.11 ab	26.43 a
T2: ($P_2O_5$50 kg ha^{-1})	20.00 a	0.67 a	23.78 ab	26.23 a
T3: ($P_2O_5$75 kg ha^{-1})	20.67 a	0.33 a	22.06 b	24.80 a
T4: ($P_2O_5$100 kg ha^{-1})	17.00 a	0.33 a	23.89 ab	24.87 a
T5: ($P_2O_5$125 kg ha^{-1})	16.00 a	1.00 a	24.61 a	25.10 a
T6: ($P_2O_5$150 kg ha^{-1})	19.00 a	1.33 a	23.56 ab	24.90 a
Mean	*18.28*	*0.89*	*23.50*	*25.39*
Stdv	*1.88*	*0.54*	*0.86*	*0.74*
cv	*23.55*	*91.09*	*5.27*	*8.20*

Columns annotated with the same letter are not significantly different at p<0.05 according to Tukey test

Yields of grain, straw and root

Data on grain, straw and root of T. aman rice were significantly influenced by different P treatments have been presented in Table 6. The grain yield ranged from 4662.67 kg ha^{-1} (T1) to 5660 kg ha^{-1} (T6) which was affected by the treatment (Fig. 2).). The straw yield ranged from 12344 kg ha^{-1} (T1) to 16037.33 kg ha^{-1} (T6) which was affected by the treatment (Table. 6.) The root yield ranged from 832 kg ha^{-1} (T1) to 1692 kg ha^{-1} (T6) which was affected by the treatment (Table. 4.4.). And for this the biological yield was also significantly affected for applying P treatment which is shown in Fig. 2. The fig.2. also shows that biological yield varies from 17838.67 kg ha^{-1} (T1) to 23389.33 kg ha^{-1} (T6) with an average 20847.78 kg ha^{-1} for P treatment.

Table. 6. Effect of treatments on grain yield, straw yield, root yield and biological yield

Treatment	**Grain yield**	**Straw yield**	**Root yield**
	kg ha^{-1}		
T1: ($P_2O_5$0 kg ha^{-1})	4662.67 b	12344.00 c	832.00 e
T2: ($P_2O_5$50 kg ha^{-1})	4833.33 b	13632.00 b	1082.67 d
T3: ($P_2O_5$75 kg ha^{-1})	4944.00 b	14121.33 b	1281.33 c
T4: ($P_2O_5$100 kg ha^{-1})	5534.67 a	14450.67 b	1494.67 b
T5: ($P_2O_5$125 kg ha^{-1})	5549.33 a	15345.33 a	1589.33 ab
T6: ($P_2O_5$150 kg ha^{-1})	5660.00 a	16037.33 a	1692.00 a
Mean	*5197.33*	*14321.78*	*1328.67*
Stdv	*432.2731647*	*1298.844524*	*327.7036602*
cv	*3.32*	*3.21*	*8.12*

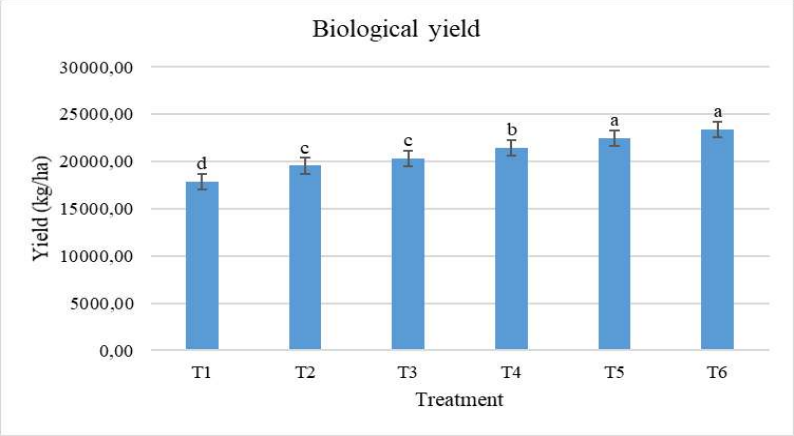

Fig. 2. Biological yield with treatment

Phosphorous and Potassium content

Results presented in Table. 7. indicated that phosphorous content in grain and root and for this total content by T. aman rice was significantly influenced by different P treatments under study. P content of grain was affected and varies 0.03% (T1) to 0.29% (T6). But P content of straw was not significantly affected (Table. 7.). P content of root was affected and varies 0.04% (T1) to 0.03% (T6). And total P content also affected by P treatment (Fig. 3.). The P content varies from 0.11%(T1) to 0.36% (T6). Potassium (K) content was significantly affected only grain but non-significantly affected in root and straw content by different P treatment. The K content result was presented in table. 7. The K content was no significantly changed by P treatment which is shown in Fig. 4.

Table. 7. Phosphorous and potassium content by grain, straw and root of T. aman rice as affected by P fertilizer

Treatment	**Grain**		**Straw**		**Root**	
	K	**P**	**K**	**P**	**K**	**P**
T1: ($P_2O_5$0 kg ha^{-1})	0.002 a	0.03 f	0.17 a	0.04 a	0.04 a	0.04 bc
T2: ($P_2O_5$50 kg ha^{-1})	0.002 a	0.07 e	0.15 a	0.04 a	0.04 a	0.07 a
T3: ($P_2O_5$75 kg ha^{-1})	0.002 a	0.18 d	0.14 a	0.05 a	0.04 a	0.06 ab
T4: ($P_2O_5$100 kg ha^{-1})	0.001 b	0.20 c	0.14 a	0.04 a	0.04 a	0.03 d
T5: ($P_2O_5$125 kg ha^{-1})	0.001 b	0.23 b	0.14 a	0.04 a	0.04 a	0.07 a
T6: ($P_2O_5$150 kg ha^{-1})	0.002 b	0.29 a	0.17 a	0.04 a	0.04 a	0.03 cd
Mean	*0.002*	*0.16*	*0.15*	*0.04*	*0.04*	*0.05*
Stdv	*0.00*	*0.09*	*0.01*	*0.00*	*0.00*	*0.02*
cv	*4.79*	*6.07*	*10.15*	*18.07*	*8.56*	*18.63*

Columns annotated with the same letter are not significantly different at p<0.05 according to Tukey test

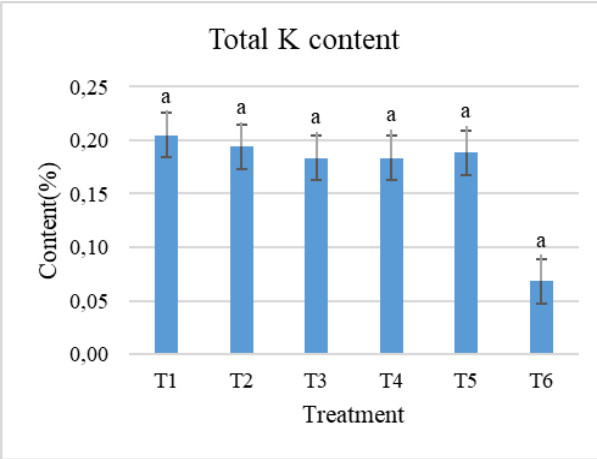

Fig. 3. Total P content of T. aman rice with treatment

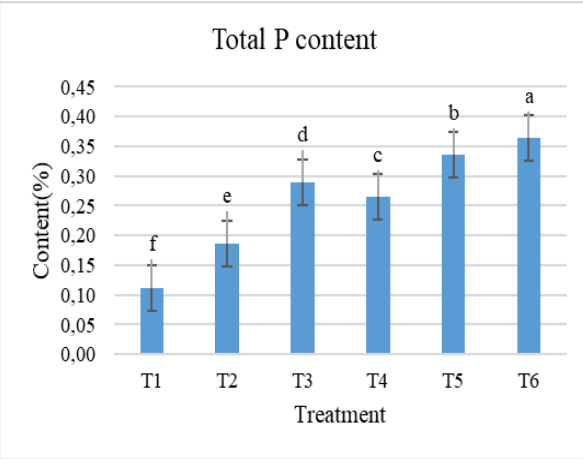

Fig. 4. Total K content of T. aman rice with treatment

Phosphorous and Potassium uptake

Phosphorous uptake by T. aman rice in grain, straw and root was significantly affected by various P treatments which were presented in Table. 8. Grain uptake of P ranges from 1.27 kg ha^{-1} (T1) to 16.17 kg ha^{-1} (T6), straw uptake of P ranges from 4.99 kg ha^{-1} (T1) to 7.14 kg ha^{-1} (T6) and root uptake of P ranges from 0.37 kg ha^{-1} (T1) to 0.57 kg ha^{-1} (T6) (Table. 8). In case of P uptake, T. aman rice was significantly influenced by different P treatment (Fig. 5.). The P uptake due to different treatments ranged from 6.63 kg ha^{-1} (T1) to 23.89 kg ha^{-1} (T6). Potassium uptake by T.aman rice in grain, straw and root was significantly affected by various P treatments (Table. 8.). The K uptake by grain varied from 11 kg ha^{-1} (T1) to 13 kg ha^{-1} (T6), in straw varied from 20.40 kg ha^{-1} (T1) to 26.51 kg ha^{-1} (T6) and root varied from 31.05 kg ha^{-1} (T1) to 63.15 kg ha^{-1} (T6) which are shown in Table 4.8. In case of this the K uptake also affected by applying triple superphosphate treatment which was shown in Fig. 6. and it varied from 51.56 kg ha^{-1} (T1) to 89.78 kg ha^{-1} (T6).

Table 8. Phosphorous and Potassium uptake by grain, straw and root of T. aman rice as affected by P fertilizer.

Treatment	**Grain**		**Straw**		**Root**	
	P	**K**	**P**	**K**	**P**	**K**
T1: ($P_2O_5$0 kg ha^{-1})	1.27 f	0.11 bc	4.99 b	20.40 b	0.37 c	31.05 d
T2: ($P_2O_5$50 kg ha^{-1})	3.45 e	0.11 bc	5.61 ab	21.08 b	0.79 b	40.41 c
T3: ($P_2O_5$75 kg ha^{-1})	8.71 d	0.11 b	7.52 a	19.57 b	0.76 b	54.65 b
T4: ($P_2O_5$100 kg ha^{-1})	10.99 c	0.10 c	5.87 ab	20.03 b	0.38 c	63.75 ab
T5: ($P_2O_5$125 kg ha^{-1})	12.72 b	0.10 c	6.27 ab	22.09 ab	1.04 a	67.79 a
T6: ($P_2O_5$150 kg ha^{-1})	16.17 a	0.13 a	7.14 ab	26.51 a	0.57 bc	63.15 ab
Mean	*8.88*	*0.11*	*6.23*	*21.61*	*0.65*	*53.47*
Stdv	*5.65*	*0.01*	*0.96*	*2.55*	*0.26*	*14.69*
cv	*8.23*	*5.61*	*19.89*	*12.03*	*20.13*	*10.15*

Columns annotated with the same letter are not significantly different at p<0.05 according to Tukey test

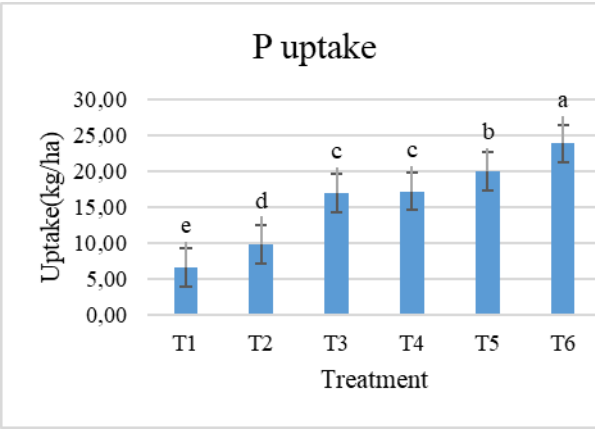

Fig. 5. P uptake of T. aman rice with treatment

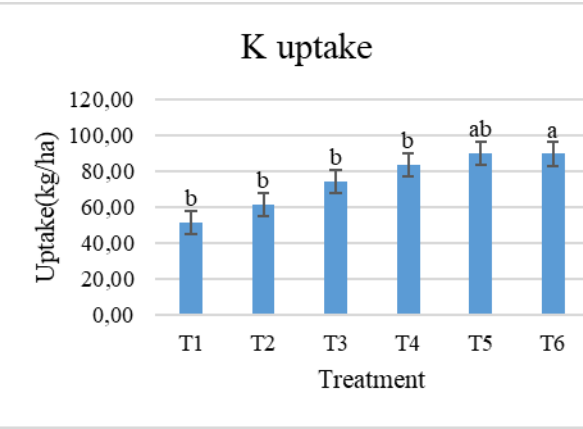

Fig. 6. K uptake of T. aman rice with treatment

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ID: 599

Determination of Biogas Energy Potential to be Obtained from Animal Manures in Van Province

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Abstract

Researchers have turned to alternative studies in order to benefit more from renewable energy sources due to fossil resources will be insufficient in the near future, environmental pollution as a result of fuel combustion and increasing energy demand. Biogas production, which is used in many areas such as heating, transportation, electricity, natural gas and chemical production, is one of the most attractive alternatives among these studies. Animal manure is also an important material used as a substrate in the production of biogas. For this purpose, the province of Van, which is one of the leading provinces of our country in terms of animal production and where cattle, sheep and poultry are grown intensively, was chosen as the research area. In the research, TUIK (Turkish Statistical Institute) 2021 data were used. It was made evaluations on the animal numbers data of the province of Van for 2021 and the amount of total manure and the biogas potential were determined. As a result of the research; The total amount of usable manure that can be obtained from animal waste in Van province is 1.449.597,063 tons/year and its conversion potential into biogas energy is calculated as 57.452.155,16 m^3/year. It has been determined that it is equivalent to 270.025.129,3 kWh of electricity or 67.793.543,09 m^3 of natural gas energy of the total biogas potential. This too; when evaluated with today's prices, it saves approximately 221 to 337 million TL/year, depending on the area of use.

Key Words: *Agricultural structures, Animal manure, Biogas potential, Biosystems, Van Province.*

Van İlindeki Hayvan Gübrelerinden Elde Edilebilecek Biyogaz Enerji Potansiyelinin Belirlenmesi

Özet

Fosil kaynaklarının yakın gelecekte yetersiz durumda kalacak olması, yakıtların çevre kirliliği oluşturması, enerji gereksiniminin gün geçtikçe artması, araştırmacıları, yenilenebilir enerji kaynaklarından daha fazla yararlanabilmek için alternatif çalışmalara yönlendirmiştir. Isınma ve ısıtma, ulaşım, elektrik, doğalgaz ve kimyasal madde üretimi gibi birçok alanda kullanılan biyogaz üretimi bu çalışmalar arasında en cazip alternatiflerden biridir. Hayvan gübreleri de biyogaz üretiminde substrat (enzimlerin tepkimelerinde işlenen madde) olarak kullanılan önemli bir materyaldir. Bu amaçla hayvasal üretim açısından ülkemizin önde gelen illeri arasında bulunan ve yoğun bir şekilde büyükbaş, küçükbaş ve kanatlı hayvan yetiştiriciliği yapılan Van ili, araştırma sahası olarak seçilmiştir. Araştırmada TÜİK (Türkiye İstatistik Kurumu) 2021 verileri kullanılmıştır. Van ili 2021 yılı hayvan sayıları verilerine ilişkin değerlendirmeler yapılarak gübre miktarları ile biyogaz potansiyeli belirlenmiştir. Araştırma sonucunda; Van ilinde hayvansal atıklardan elde edilebilecek toplam kullanılabilir gübre miktarı 1.449.597,063 ton/yıl ve bunun biyogaz enerjisine dönüşüm potansiyeli 57.452.155,16 m^3/yıl olarak hesaplanmıştır. Toplam biyogaz potansiyelinin; 270.025.129,3 kWh elektrik ya da 67.793.543,09 m^3 doğalgaz enerjisine eşdeğer olduğu saptanmıştır. Bu da; günümüz fiyatları ile değerlendirildiğinde kullanım alanına göre yaklaşık 221 ila 337 milyon TL/yıl arasında tasarruf sağlamaktadır.

Anahtar Kelimeler: *Tarımsal yapılar, Hayvan gübresi, Biyogaz potansiyeli, Biyosistem, Van ili.*

ID: 600

The effect of pomegranate (*Punica granatum* L.) flower extracts on the physicochemical properties of heat-treated chicken sausages

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Abstract
This study aimed to determine the effect of water and ethanol extracts of pomegranate flowers, which have the potential to be used as a natural antioxidant source in food products on the physicochemical properties of chicken sausage. In the study, pomegranate flower was extracted with water and ethanol and then lyophilized. Water and ethanol extracts were used in sausage at the dose of 350 and 200 ppm, respectively. In addition to extracts, sodium nitrite was used in sausages at the dose of 50, 100 and 150 ppm. The changes in color, TBARs, pH, moisture, ash, protein, fat and sensorial parameters were determined in chicken sausages prepared with pomegranate flower extracts during 30 days of storage. The results showed that using extracts in sausage production has no significant effects on moisture, ash, protein, and fat contents, and these were determined to average 53,24 %, 2,23%, 21,02%, and 23,95%, respectively. According to the TBARs analysis results, was no determined difference between the 1th and 7th days, while were observed significant differences between the 7th, 15th and 30th days. The TBARS values for all groups increased during the storage period. When the TBARs values on the, 15th and 30th days were examined, it was determined that the TBARs values decreased as the pomegranate flower concentration increased. When the pH value were examine, it was determined that the pH values decreased as the pomegranate flower concentration increased. On the 7th day, an increase occurred in the pH value of only the nitrite containing group, while the pH value of the other groups decreased. In addition, there were no significant changes in pH values on other days of storage. The results of the sensory analysis show that the sausages produced by adding pomegranate flower extract were less liked by the panelists compared to the control group samples, but at an acceptable level. The results of the present study showed that the aqueous and ethanolic extracts of pomegranate flowers can be used to improve the physicochemical properties of chicken sausage.
Key Words: *Pomegranate flower extract, water exraction, ethanol extraction, chicken sausage.*

Nar (*Punica granatum L.*) çiçeği ekstraktlarının ısıl işlem görmüş tavuk sucuklarının fizikokimyasal özellikleri üzerine etkisi

Özet
Bu çalışma, gıda ürünlerinde doğal bir antioksidan kaynağı olarak kullanılma potansiyeline sahip nar çiçeklerinin su ve etanol ekstraktlarının tavuk sucuğunun fizikokimyasal özelliklerine etkisinin belirlenmesi amaçlamıştır. Çalışmada nar çiçeği su ve etanol ile ekstrakte edildikten sonra liyofilize edilmiştir. Su ve etanol ekstraktları sucukta sırasıyla 350 ve 200 ppm dozlarında kullanılmıştır. Ekstraktlara ek olarak, sucuklarda 50, 100 ve 150 ppm dozlarında sodyum nitrit kullanılmıştır. Nar çiçeği ekstraktları ile hazırlanan tavuk sucuklarında 30 günlük depolama süresince renk, TBARS, pH, nem, kül, protein, yağ ve duyusal parametrelerdeki değişimler belirlenmiştir. Sonuçlar, sucuk üretiminde ekstrakt kullanımının nem, kül, protein ve yağ içerikleri üzerinde önemli bir etkisinin olmadığını ve bunların sırasıyla ortalama %53,24, %2,23, %21,02 ve %23,95 düzeyinde olduğu tespit edilmiştir. TBARS analiz sonuçlarına göre 1. ve 7. günler arasında fark belirlenmezken, 7. 15. ve 30. günler arasında anlamlı farklar gözlenmiştir. Tüm gruplar için TBARS değerleri depolama süresi boyunca artmıştır. 15. ve 30. günlerdeki TBARS değerleri incelendiğinde, nar çiçeği konsantrasyonu arttıkça TBARS değerlerinin düştüğü belirlenmiştir. pH değeri incelendiğinde nar çiçeği konsantrasyonu arttıkça pH değerlerinin azaldığı tespit edilmiştir. 7. günde sadece nitrit içeren grubun pH değerinde artış meydana gelirken diğer grupların pH değerinde düşüş meydana gelmiştir. Ayrıca depolamanın depolamanın diğer günlerinde pH değerlerinde önemli bir değişiklik olmamıştır. Duyusal analiz sonuçları nar çiçeği ekstraktı ilave edilerek üretilen sucukların panelistler tarafından kontrol grubu örneklere kıyasla daha az beğenildiğini ancak kabul edilebilir seviyede olduğunu göstermektedir. Bu çalışmanın sonuçları, nar çiçeklerinin sulu ve etanolik ekstraktlarının tavuk sucuğunun fizikokimyasal özelliklerini iyileştirmek için kullanılabileceğini göstermiştir.
Anahtar Kelimeler: *Nar çiçeği ekstresi, su ekstraksiyonu, etanol ekstraksiyonu, tavuk sucuğu*

ID: 601

Investigating Rural Households' Willingness To Pay For Improved Solid Waste Management And Its Driving Factors. Evidence From Nigeria

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Abstract

Improper disposal of solid waste has serious health and environmental implications. However, most solid waste management interventions in Nigeria focus on urban areas, with little attention to rural areas. Therefore, this study aims to investigate rural area solid waste management methods, their willingness to pay for improved solid waste management services, and the drivers of their willingness to pay. Data collected from 160 households was analysed with an open-ended elicitation method, descriptive statistics, and Probit regression. The findings revealed that rural households engaged in open-burning, indiscriminate bush throwing, nearby open dumpsites, land-filling, rivulets, roadside dumping, and dumping into drainage systems, all of which are poor solid waste management practices. The majority were aware (93.13%) of the health implications of these practices and were willing to pay (80.63%) a monthly premium of N452 (USD 1.06) for improved solid waste management. The factors influencing rural households' willingness to pay are awareness of the negative impact of improper solid waste disposal on health and the environment; education level; income; weekly solid waste volume; occupation; and marital status. These results call for more solid waste management awareness creation, sensitization, and provision of improved solid waste management with a monthly premium that will not exceed N452 (USD 1.06) in rural areas.

Keywords: Environmental risk, Health concern, Rural households, Solid waste management, Willingness-to-pay

ID: 602

Nephroprotective effect of Algerian date seed extract (*Phoenix dactylifera* L.) against mercuric chloride-Induced alterations of kidney tissue

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Abstract

Oxidative stress is a molecular mechanism that generates important renal damage in mercury toxicity. The present study was undertaken to evaluate the ability of Algerian date seed extract (ADSE) to prevent mercuric chloride ($HgCl_2$) nephrotoxicity. Female Wistar rats were given a single intraperitoneally injection of $HgCl_2$ (1.5 mg/kg B.W) after ten days of administration of date seed extracts by gastric gavage. Only the control group (C) received an injection of the vehicle (physiological water). The groups Hg-ADSE1, Hg-ADSE2 and Hg-STD were treated with aqueous date seed extracts at 150, 300mg/kg and ascorbic acid at 50mg/kg respectively, while the $HgCl_2$ group received distilled water. Renal function tests and a histological study of the kidneys were carried out 24 hours after HgCl2 exposure. Serum urea and creatinine results showed a highly significant decrease ($P \leq 0.001$) in the treated groups Hg-ADSE1, Hg-ADSE2 compared to the HgCl2 group. This decrease was almost normal in the Hg-ADSE1 group compared to the control (C). The biochemical results were confirmed by histological examination of the kidneys, which showed significant restoration of the renal glomeruli in the treated groups by ameliorating the alterations following $HgCl_2$ exposure. The results suggest a nephroprotective effect of Algerian date seeds (*Phoenix dactylifera* L.). The therapeutic action of this natural product would probably be due to the increase of the antioxidant defence mechanism in the toxicity induced by mercuric chloride.

Keywords*: Phoenix dactylifera* L., Nephroprotective effect, Oxidative stress, Mercuric chloride, histological study, *in vivo*.

ID: 603

Investigation of the Effect of Fertilizer Doses on Bean Pod Properties

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Abstract
The bean plant is a legume plant that binds free nitrogen of the air by the nodosity formed in the roots. For this reason, it was aimed to investigate the effect the pod of bean characteristics of bean by applying different doses of phosphorus and nitrogen on Göksun beans cultivar. In the study, 0, 3, 6, 9 kg da^{-1} phosphorus and 0, 4, 8, 12 kg da^{-1} nitrogen doses were applied to Göksun bean variety. The pod length (cm), pod width (mm), pod diameter (mm), number of pods per plant (edet), weight of a single pod (g), number of seeds per pod (pieces), weight of single seeds (g) of Göksun bean cultivar were investigated. In the research, it was noted that the effect of phosphorus doses only on the pod diameter, the effects of nitrogen doses on the pod length, pod diameter, pod width, single seed weight and seed number of pod were significant. The differences in number of pods in the plant, seed number of pods, pod length, pod weight, single seed weight in terms of phosphorus and nitrogen interaction were founded statistically significant. According to the results of the research, it was determined that 4 kg da^{-1} and above nitrogen dose applications made a positive contribution in terms of pod properties.
Keywords: *Bean, pod characteristics, phosphorus, nitrogen doses.*

Fasulyenin Bakla Özelliklerine Gübre Dozlarının Etkisinin Araştırılması

Özet
Fasulye bitkisi köklerinde oluşan nodozite ile havanın serbest azotunu bağlayan bir baklagil bitkisidir. Bu nedenle, Göksun fasulye çeşidine farklı fosfor ve azot dozu uygulanarak, bakla özelliği üzerindeki etkisini araştırılması amaçlanmıştır. Araştırmada 0, 3, 6, 9 kg da^{-1} fosfor ve 0, 4, 8, 12 kg da^{-1} azot dozları Göksun fasulye çeşidine uygulanmıştır. Göksun fasulye çeşidinin bakla uzunluğu (cm), bakla genişliği (mm), bakla çapı (mm), bitkide bakla sayısı (edet), tek bakla ağırlığı (g), baklada tane sayısı (adet), tek tane ağırlığı (g) incelenmiştir. Yapılan araştırmada, fosfor dozlarının sadece bakla çapına, azot dozlarının fasulye bitkisinin bakla uzunluna, bakla çapına, bakla genişliğine, tek tane ağırlığına, bakla tane sayısına, fosfor x azot interaksiyonu bitkide bakla sayısına, bakla tane sayısına, bakla uzunluna, bakla ağırlığına, tek tane ağırlığına istatistiksel olarak önemli etkide bulunduğu kaydedilmiştir. Araştırma sonuçlarına göre 4 kg da^{-1} ve yukarı azot doz uygulamalarında bakla özellikleri yönünden olumlu katkı sağladığı belirlenmiştir.
Anahtar Kelimeler: *Fasulye, bakla özellikleri, azot ve fosfor dozları.*

Giriş

Canlıların hayat kaynağı tarımla var olmaktadır. Tarımın gelişmesi toplumların hayat standartlarını da arttırmaktadır. Gelişmekte olan ülkeler besin kaynaklarını bitkisel ürünlerden sağlamaktadır. Baklagil bitkileri insan sağlına önemli katkıda bulunurken, sürdürülebilir tarımda toprak sağlığını da geliştirmektedir. Öncelikle yetiştirilecek bitkinin insana doğaya ve çevreye katkısının bilinmesi gereklidir. Baklagiller ucuz ve yüksek kaliteli bitkisel protein kaynağı olmalarının yanı sıra, tahıl tanelerinden yaklaşık iki kat fazla protein % 20-28, ayrıca %40.80-46.31 nişasta ve %1.02-1.77 yağ bulundurmaktadır (İdikut ve Karabacak 2020; Pekşen ve Artık 2005). Baklagil bitki grubunda bulunan, bilim dünyasında *Phaseolus vulgaris* L. olarak adlandırılan fasulye, iklim koşullarına göre bir dönem meyve veren, otsu bitkilerden olup, meyvesi taze ya da kuru olarak tüketilen sebzedir. Anavatanı Amerika olarak bilinen fasulyenin kalsiyum, protein ve vitamin bakımından zengin olması, en fazla B1 ve B2 vitaminleri bulundurması, tüm dünyada bolca tüketilen önemli bir kültür bitkisi olmasını sağlamıştır (Abacı ve Kaya, 2018; Suarez-Martineza, 2016). Fasulye bitkisinin toprağı koruyan iyi bir ekim nöbeti bitkisidir (Aserse ve ark 2020). Fasulye verimliliği, özellikle N ve P olmak üzere toprak besin maddesi mevcudiyeti ile sınırlıdır. Nitrojen eksikliği tane verimini azaltır çünkü N, depolanan karbonhidratların ve proteinlerin üretimi için gerekli olan klorofil, amino asitler, nükleik asitler ve lipidler dahil olmak üzere çeşitli temel moleküllerin yapısal bir bileşenidir. Verim kayıplarını önlemek için büyüme mevsimi boyunca toprağa azotlu gübre eklenebilir; ancak, sentetik değişiklikler pahalıdır, erişilmesi zordur. Bunun yerine fasulye yetiştiricileri, mahsulleri için bir besin kaynağı olarak simbiyotik nitrojen fiksasyonu yoluyla türetilenler de dahil olmak üzere organik N formlarına güvenilerek tarımın canlanmasını önermiştir (Wilker ve ark 2020). Toprağın kalitesi ve verimlilik tartışmaları 1980'den günümüze kadar gelişerek devam etmektedir. Günümüzdeki toprakların kalite ve verimlilikleri hakkında yapılan tartışmalar, seçilen toprak yönetim metotları tarafından toprakların dinamik özelliklerinin etkilenmesi dikkate alındığı için önceki tartışmalardan farklılık göstermektedir. Buradaki farklılık yalnızca azot, fosfor, potasyum ve toplam organik madde düzeyi gibi toprak karakteristiklerinde ortaya çıkmamakta, toprakların biyolojik aktiviteleri, organik madde fraksiyonları, suyun infiltrasyon özelliği ve strüktürel agregasyon gibi birçok

karakteristikleri de barındırmaktadır. (Lewandowski ve Zumwinkle, 1999) Fosforlu gübreler tohum veriminde yüksek etki ettiklerinin yanı sıra tohumun kalitesinin yükselmesinde de oldukça önemlidir. Ayrıca fosforlu gübreler nodülasyonu ve nitrogenaz aktivitesine etki ederek topraktaki azotun yararlanılabilirliğini arttırmaktır (Arıoğlu, 1994). Baklagillerde fosfor değerli bir makro element olup, ekimden önce toprağa muhakkak fosforlu gübre verilmelidir. Etiyopya gibi yarı kurak bölgelerde fasulye üretimi için 69 kg P_2O_5 ha^{-1} tavsiye edilebileceği belirtilmiştir (Girma, 2009). Baklagiller kendi azot ihtiyaçlarını karşılayabilir ama fosfor ihtiyaçlarını karşılayamazlar. Önder ve Akçin (1995) yaptıkları bir çalışma sonucunda tabana 0 azot ve 4 kg da fosfor dozu uygulayarak en yüksek dane verimini elde etmişlerdir. Bu sebepten dolayı toprakta yeterli miktarda fosfor yoksa, gübreleme işlemi ile katkı sağlanmalıdır (Parsak, 2006). Farklı fosfor dozlarının bitki boyu, bitki başına yan dal sayısı, baklada tohum sayısı ve bakla boyu üzerinde önemli bir farklılık oluşturmadığı, ilk bakla yüksekliği, bitki başına bakla sayısı ve bin tohum ağırlığı üzerine önemli etki bıraktığı tespit edilmiştir (Çetin ve Öztürk, 2012). Ülkemizde ticaret gübreleri kullanımı bazı bölgeler hariç, gübre kullanımı yoğun ve bilinçli bir uygulama şeklinde değildir. Yoğun kullanımının olduğu bölgelerde ise bu kullanım ne kadar fazla gübre o kadar fazla ürün mantığı ile yapılması nedeni ile sağlıklı bir gübreleme gerçekleştirilememektedir. Bu şartlar altında dahi ülkemiz gübre tüketimi birçok Avrupa ülkesi tüketiminin gerisinde bulunmaktadır. Rakam verilerine bakıldığında birim alanda kullanılması gereken azotlu gübre miktarı 83.7 kg N/ha iken, kullanılan azotlu gübre miktarı ise 38.5 kg N/ha olarak gerçekleşmiştir. Birim alanda kullanılması gereken fosforlu gübre miktarı 57.3 kg P2O5 /ha iken tüketilen fosforlu gübre (P2O5) miktarı 22.3 kg P2O5/ha olmuştur. (Eyüpoğlu, 2002). Alberto fasulye genomunda bazı tarımsal özelliklerine ve tane verimine etkilerini saptamak hedefiyle 2016 yılında Konya ili Altınekin ilçesi çiftçi tarlasında yürütülen çalışmada, bir yıl süreli olması sebebiyle kesin bir sonuç önerilmeyecek olmasına rağmen, fasulye yetiştiriciliğinde yüksek tane verimi elde edilebilmek için ekimde 5 kg/da N uygulamasının önerilmesinin daha uygun olacağı bildirilmiştir (Altunkaynak, 2018), Önder ve Akçin (1995) yaptıkları bir çalışmada tabana N0P4 dozunda en yüksek tane verimini elde etmişlerdir. Fasulye bitkisinin ürün olarak değerlendirilen kısmı baklalarıdır ve mutfaklarımızın vazgeçilmez besinidir. Bu nedenle toprağa uygulanan makro besin elementlerinden fosfor ve azot gübre dozlarının fasulyenin bakla özellikleri üzerindeki etkisinin araştırılması amaçlanmıştır.

Materyal ve Yöntem

Araştırma Kahramanmaraş koşullarında 2020 yılı Mart-Haziran ayları arasında yürütülmüştür. Denemede kullanılan Göksun fasulye çeşidi Tarımsal Araştırma Enstitüsünden (DAGTEM) temin edilmiştir. Fasulye tohumları sıra arası 50 cm ve sıra üzeri 10 cm ekim sıklığında ve tesadüf bloklarında bölünmüş parseller deneme desenine göre ekimi yapılmıştır. Gübre uygulamalarından 0, 0.3, 0.6, 0.9 kg ha^{-1} fosfor ana parsellere ekimle birlikte toprağa karıştırılmıştır. Alt parsellere uygulanan azotun 0, 0.4, 0.8, 1.2 kg ha^{-1} dozlarının yarısı ekimle diğer yarısı da bitkiler yaklaşık 10-15 cm yüksekliğinde uygulanmıştır. Fosfor gübresi olarak Triple süper fosfor, azot olarak ise % 46 üre gübresi kullanılmıştır. Kahramanmaraş, 37-38 kuzey enlemleri ve 36-37 doğu boylamları arasında yer almaktadır. Denemenin yürütüldüğü Mart, Nisan, Mayıs, Haziran aylara ait meteorolojik değerler sırasıyla ortalama sıcaklıklar 12.5, 15.9, 15.9, 25.4, yağışlar 173.4, 61.8, 18.5, 0.3, nispi nem % 67.3, 58.2, 47.2, 46.9 olarak kaydedilmiştir (Anonim, 2020a). Çalışmanın yapıldığı alanın 0-30 cm derinlik toprak özellikleri pH 7.71 (hafif alkalin) suya doymuşluk % 69.96 (killi tınlı), organik madde % 1.58 (düşük), $CaCO_3$ % 6.09 (orta) tuz % 0.05 (tuzsuz) P_2O_5 (kg de^{-1}) 2.84 (çok az), K_2O miktarı(kg da^{-1}) 55.51 (yüksek) (Anonim, 2020b). Bitkinin durumu ve toprak durumu gözlenerek damla sulama sistemi uygulanarak, bitkinin su ihtiyacı karşılanmıştır. Göksun fasulye çeşidinin bakla uzunluğu (cm), bakla genişliği (mm), bakla çapı (mm), bitkide bakla sayısı (adet), tek bakla ağırlığı (g), baklada tane sayısı (adet), tek tane ağırlığı (g) incelenmiştir (Karabacak, 2018). Elde edilen veriler JMP paket programı kullanılarak bölünmüş parseller deneme desenine göre analiz edilmiştir. Ortalamaların karşılaştırılmasında ise Duncan çoklu karşılaştırma testi uygulanmıştır.

Bulgular ve Tartışma

Kahramanmaraş koşullarında Göksun fasulye çeşidine uygulanan farklı fosfor ve azot dozlarının etkisinin incelendiği Göksun fasulye çeşidinin bakla uzunluğu (cm), bakla çapı (mm), bakla genişliği (mm), bitkide bakla sayısı (adet), tek bakla ağırlığı (g), baklada tane sayısı (adet), tek tane ağırlığına (g) ait ortalamalar ve uluşan gruplar sırasıyla Çizelge 1., 2., 3., 4., 5., 6 ve 7 verilmiştir.

Bakla Uzunluğu (cm)

Göksun fasulye çeşidine uygulanan farklı gübre doz uygulamasında azot dozları, fosfor x azot doz intereksiyonunun %1 önem seviyesinde bakla uzunluğunda farklılık oluşturduğu kaydedilmiştir. Uygulanan 0. 0.4, 0.8, 1.2 kg he^{-1} azot dozlarında Göksun fasulye çeşidinin bakla uzunluğu 6.635 ile 9.085 cm arasında değişmiştir. En yüksek bakla uzunluğu 0.4 kg ha^{-1} azot uygulamasından elde edildiği, azotun 0.8 kg ha^{-1} doz uygulamasında 8.973 cm bakla uzunluğu ile 0.4. kg ha^{-1} doz uygulamasından istatistiksek farklılık oluşturmamıştır. En düşük bakla uzunluğu 0 N doz uygulamasından elde edildiği ve onu 0.8 kg ha^{-1} uygulamasının izlediği kaydedilmiştir. Azot 0.8 ve 1.2 kg ha^{-1} doz uygulamaları bakla uzunluğunda azalışa neden olmuştur. Farklı fosfor (0, 0.3, 0.6, 0.9 kg ha^{-1}) doz uygulamalarında bakla uzunluğu 8.736 ile 9.06 cm arasında değişmiştir. Uygulanan farklı fosfor

dozları bakla uzunluğu üzerinde istatistiksel önemli farklılıklar oluşturmamıştır. Fosfor x azot dozları interaksiyonunda en yüksek bakla uzunluğu fosforun 0.9 kg ha $^{-1}$ ile azotun 4 kg ha^{-1} gübre dozlarından 9.943 cm olarak belirlenmiştir. En düşük bakla uzunluğu ise 8.100 cm olarak fosforun 9 kg ha $^{-1}$ ile azotun 1.2 kg ha $^{-1}$ gübre dozlarında kaydedilmiştir. Diğer fosfor x azot doz interaksiyonunda bakla uzunlukları 9.053-8.40 cm arasında değişen değerlere sahip olmuştur (Çizelge 1). Ülker ve Ceyhan (2008) Orta Anadolu ekolojisinde Sarayönü ve Çumra ilçesinde yetiştirilen 17 adet fasulye genotipinin bakla boyunun 8.22-10.84 cm arasında değiştiğini kaydetmişlerdir. Elde edilecek sonuçları, uygulanan besin elementleri olumlu veya olumsuz etkileyecektir. Bir besinin artmasıyla birlikte, diğer besin maddelerinin bulunabilirliği veya bitkilerin genetik potansiyeli sınırlayıcı faktörler haline gelmesiyle ilgili olabileceği vurgulanmıştır. (Marschner, 2012). Gübre dozlarının bakla boyu üzerinde interaksiyon etkisini daha önceki çalışmada elde edilen bulgular desteklemektedir.

Çizelge 1. Farklı fosfor ve azot dozları uygulanan Göksun fasulye çeşidinin bakla uzunluğuna ait ortalamalar ve oluşan gruplar.

	0 kg da^{-1} fosfor	0.3 kg ha^{-1} fosfor	0.6 kg ha^{-1} fosfor	0.9 kg ha^{-1} fosfor	Ortalamalar
0 kg ha^{-1} azot	8.546 c-f	8.400 ef	8.686 c-f	8.906 a-e	8.635 c
0.4 kg ha^{-1} azot	8.806 b-e	8.986 a-e	9.053 a-d	9.493 a	9.085 a
0.8 kg ha^{-1} azot	9.166 abc	8.866 a-e	9.412 ab	8.446 def	8.973 ab
1.2 kg ha^{-1} azot	8.933 a-e	8.913 a-e	8.993 a-e	8.100 f	8.735 bc
Ortalamalar	8.863	8.791	9.036	8736	8.857

Bakla Çapı (cm)

Kahramanmaraş koşullarında farklı gübre dozları uygulanarak yetiştirilen Göksun fasulyesinin bakla çapları, fosfor dozlarına göre istatistiksel olarak %5, azot dozlarına göre %1 önemlilik göstermiştir. Bakla çapında en düşük değer 0 kg he^{-1} fosfor doz uygulamasından elde edildiği ve diğer uygulamalardan istatistiksel olarak önemli farklılık gösterdiği belirlenmiştir. Diğer uygulamalarda bakla çapı sırasıyla 0.694, 0.697 ve 0.708 cm ile 0.9, 0.3, 0.6 kg he^{-1} fosfor doz uygulamasından elde edildiği ve kendi aralarında istatistiksel farklılık oluşturmadığı, aynı grupta yer aldıkları kaydedilmiştir. Fasulyenin bakla çapı en yüksek sırasıyla 0.729 ve 0.705 cm ile 0.4 ve 0.8 kg he^{-1} azot uygulamasından elde edildiği ve istatistiksel olarak aralarında farklılık oluşmadığı kaydedilmiştir. Azotun diğer 0 ve 0.8 kg he^{-1} dozunda bakla çapı sırasıyla 0.666 ve 0.662 cm olduğu kendi aralarında istatistiksel farklılık oluşturmadığı, aynı grupta yer aldığı tespit edilmiştir. Azotun 2. dozundan sonraki 3. ve 4. dozunda bakla çapında düşüşün olduğu görülmüştür. Fosfor x azot doz interaksiyonun yönünden bakla çaplarında istatistiksek önemli farklılıklar görülmemiştir. Bakla çapları fosfor x azot doz interaksiyonlarına göre 0.624-0.774 cm arasında değişim göstermiştir. Bakla çapı en iyi performansını azot dozunda 0.4 kg he^{-1}, fosfor dozunda ise 0.6 kg he^{-1} dozunda göstermiştir (Çizelge 2). Verma ve ark., (2014) Meghalaya'da 34 fransız fasulye genotipiyle yapılan çalışmada bakla çapının 0.72- 1.56 cm arasında olduğu ve genetik varyasyonun % 40 aşağısında olduğunu ifade etmişlerdir. Balint ve ark (2018) üç fasulye üzerindeki farklı gübre uygulamalarının etkisinin araştırıldığı çalışmada bakla çapının 0.610-0.785 cm arasında değiştiği kaydedilmiştir.

Çizelge 2. Farklı fosfor ve azot dozları uygulanan Göksun fasulye çeşidinin bakla çapına ait ortalamalar ve oluşan gruplar.

	0 kg da^{-1} fosfor	0.3 kg ha^{-1} fosfor	0.6 kg ha^{-1} fosfor	0.9 kg ha^{-1} fosfor	Ortalamalar
0 kg ha^{-1} azot	0.628	0.632	0.716	0.688	0.666 b
0.4 kg ha^{-1} azot	0.710	0.716	0.774	0.716	0.729 a
0.8 kg ha^{-1} azot	0.679	0.756	0.682	0.704	0.705 a
1.2 kg ha^{-1} azot	0.634	0.685	0.660	0.670	0.662 b
Ortalamalar	0.663 b	0.697 a	0.708 a	0.694 a	0.690

Bakla Genişliği (cm)

Farklı gübre dozları uygulanan Göksun fasulyesinin bakla genişliği üzerinde azot dozlarının %1 önem seviyesinde etkili olduğu, fakat fosfor dozlarının ve fosfor x azot doz interaksiyonunun istatistiksel olarak önemli olmadığı kaydedilmiştir. En fazla bakla genişliği 1.016 cm ile 0.8 kg he^{-1} azot uygulamasından elde edildiği, onu ikinci sırada 0.4 kg he^{-1} azot doz uygulaması 0.908 cm ile izlediği belirlenmiştir. Bakla genişliğinde en az 0 kg he^{-1} azot doz uygulamasından 0.728 cm ve onu ikinci sırada 0.777 cm ile 1.2 kg he^{-1} azot doz uygulamasının izlediği görülmüştür. Bakla genişliği fosfor dozlarına 0.786-0.903 cm arasında, fosfor x azot interaksiyonunda ise 0.753 – 1.313 cm arasına değişim gösterdiği kaydedilmemiştir (Çizelge 3). Farklı sulama yönteminin uygulandığı çalışmada bakla genişliğini Sezen ve ark. (2005) 13.2-15.2 mm, Önder ve ark. (2006) 10.5-11.2 mm, Büyükcangaz ve ark. (2008) 14-17 mm arasında değiştiğini kaydetmişlerdir. Ülker ve Ceyhan (2008) Orta Anadolu ekolojisinde

Sarayönü ve Çumra ilçesinde yetiştirilen 17 fasulye genotipin bakla genişliğini 0.900-1.172 cm arasında değiştiği kaydedilmiştir. Yapılan daha önceki çalışmadan da anlaşıldığı bakla genişliği çeşit özelliği yanı sıra çevresel faktörlerden etkilenmektedir.

Çizelge 3. Farklı fosfor ve azot doz uygulamalarının Göksun fasulye çeşidinin genişliğine ait ortalamalar ve gruplar

	0 kg da^{-1} fosfor	0.3 kg ha^{-1} fosfor	0.6 kg ha^{-1} fosfor	0.9 kg ha^{-1} fosfor	Ortalamalar
0 kg ha^{-1} azot	0.693	0.713	0.766	0.740	0.728 c
0.4 kg ha^{-1} azot	0.853	0.926	0.860	0.993	0.908 ab
0.8 kg ha^{-1} azot	1.313	0.932	0.900	0.920	1.016 a
1.2 kg ha^{-1} azot	0.753	0.743	0.826	0.786	0.777 bc
Ortalamalar	0.903	0.828	0.838	0.786	0.857

Bitkide bakla sayısı (adet)

Kahramanmaraş koşullarında 0. 0.4, 0.8, 1.2 kg he^{-1} azot doz uygulamasında Göksun fasulye çeşidinin bakla sayısı 12.100-14.450 adet arasında değiştiği ve azot gübre dozlarının istatistiksel olarak etkisinin önemsiz olduğu kaydedilmiştir. Farklı fosfor (0, 3, 6, 9 kg da^{-1}) doz uygulamaların da bakla sayısı 9.850 ile 15.083 adet arasında olduğu, istatistiksel olarak önemli farklılığın olmadığı belirlenmiştir. Bakla sayısı azot X fosfor interaksiyonu yönünden istatistiksel olarak %5 önem seviyesinde önemli olmuştur. Bakla sayısı en yüksek 18.733 adet olarak 0.6 kg fosfor ile 1.2 kg he^{-1} azot interaksiyonun da gerçekleşmiştir. En düşük bakla sayısı ise 6.866 adet ile 0.9 kg fosfor ve 1.2 kg azot he^{-1} interaksiyonunda görülmüştür. Diğer interaksiyonlarda bakla sayıları 9.400-16.866 adet arasında değişim göstermiştir (Çizelge 4). İyigün ve Kayan (2019) Eskişehir koşullarında 8 fasulye genotipi ile yapılan çalışmada bitkide bakla sayısı 14.00-26.01 adet arasında değiştiğini ve çeşitler arasında bitkide bakla sayısı yönünden istatistiki farklılığın önemli olduğu vurgulanmıştır. Kaçar ve ark (2004) Bursa koşullarında üç fasulye çeşidine uyguladıkları azot dozlarının bitkide bakla sayısında önemli farklılık oluşturduğu, en az bakla sayısının kontrolde olduğu, 3 ve 6 kg da^{-1} azot uygulaması ile arasında farklılığın olmadığı, en yüksek bakla sayısının 12 kg da^{-1} azot uygulamasından elde edildiği ve 9 kg da^{-1} azot uygulaması ile arasında önemli farklılığın olmadığı kaydedilmiştir. Özsoy Altınkaynak (2018) Alberto fasulye çeşidine uygulanan farklı azotlu gübrelemede en düşük bitkide bakla sayısının kontrolde elde edildiği, en yüksek bitkide bakla sayısının 5 kg da^{-1} azotun ekimde uygulamasından elde edildiğini bildirmiştir. Öztürk (2019) Fasulye bitkisine azotlu gübre bölerek ve sulama durumunda dikkate alınarak yapılan çalışmada bitkide bakla sayısının, azot gübre uygulamasından etkilenmediği ve bakla sayısının 13.93-16.13 adet arasında değiştiği kaydedilmiştir. Zewdie ve Hassen (2021) Fasulye bitkisine uygulanan 0, 1, 2, 3, 4 kg da^{-1} fosfor dozlarının, kontrole göre bitkideki bakla sayısını önemli derecede artırdığını kaydetmişlerdir. En yüksek bakla sayısı 2 kg da^{-1} fosfor uygulamasından alındığı, 3 ve 4 kg uygulamasında daha düşük bakla sayısı elde edildiği belirlenmiştir. Farklı bölgelerde de araştırılması gerekeceğini, fosfor alımını, toprağın mineral içeriğinin engelleyeceğini belirmiştir. Deneme alını için 6 kg da^{-1} azot önerildiğini vurgulamıştır. Pang ve ark. (2018) Fosforun yeterince alınmasının bitki büyümesi ve gelişmesi için çok önemli olduğu, azalan kullanılabilirlik ürün veriminde bir düşüşe neden olacağı vurgulanmıştır. Tesfaye ve Balcha (2015) fasulye bitkisi için fosfor dozunun artması bitkide bakla oranını artığı, fakat 13.2 kg ha^{-1} üzerindeki P oranının üzerindeki uygulamalardaki düşüş P kaynağının optimal seviyeye ulaşması veya fasulye verim potansiyelinin sınırlandırılması, bir besinin artmasıyla birlikte diğer besin maddelerinin bulunabilirliği veya bitkilerin genetik potansiyeli sınırlayıcı faktörler haline gelmesiyle ilgili olabileceği vurgulanmıştır. (Marschner, 2012). Besin maddelerinin artan P düzeyine sahip olması (Mengel ve Kirkby, 2001) veya tane verimindeki artış hızının P arzındaki artış oranından kaynaklanacağı belirtilmiştir.

Çizelge 4. Farklı fosfor ve azot dozları uygulanan Göksun fasulye çeşidinin bakla sayısına ait ortalamalar ve oluşan gruplar.

	0 kg da^{-1} fosfor	0.3 kg ha^{-1} fosfor	0.6 kg ha^{-1} fosfor	0.9 kg ha^{-1} fosfor	Ortalamalar
0 kg ha^{-1} azot	11.533 cd	11.933 cd	14.33 bcd	12.400 bcd	12.100
0.4 kg ha^{-1} azot	12.000 cd	17.733 abc	13.600 bcd	10.733 de	13.016
0.8 kg ha^{-1} azot	12.800 bcd	16.733 ab	13.200 bcd	9.400 de	13.033
1.2 kg ha^{-1} azot	16. 866 ab	15.33 abc	18.733 a	6.866 e	14.450
Ortalamalar	13.300	15.083	14.366	9.850	13.15

Tek Bakla Ağırlığı (g)

Göksun fasulyesinin tek bakla ağırlığı uygulan farklı fosfor ve azot gübre dozları yönünden istatistiksel olarak önemli farklılık oluşturmamıştır. Farklı azot doz uygulamasında tek bakla ağırlığı 1.428-1.549 g arasında değişim

göstermiştir. Tek bakla ağırlığı farklı fosfor dozları yönünden 1.407-1.640 g arasında değişen değerlere sahip olmuştur. Fosfor X azot gübre dozları interaksiyonu istatistiksel olarak tek bakla ağırlığına %1 önem düzeyinde etkili bulunmuştur. Tek bakla ağırlığında en yüksek 1.723 g olarak 0.3 kg fosfor ile 0.4 kg he^{-1} interaksiyonun da kaydedilmiştir. En düşük bakla ağırlığı ise 1.186 g ile 0.9 kg fosfor ve 0 kg azot he^{-1} interaksiyonunda belirlenmiştir. Diğer interaksiyonlarda tek bakla ağırlıkları 1.673-1.230 g arasında değişin değerlere sahip olduğu kaydedilmiştir (Çizelge 5). Sakız fasulyesine farklı dozlarda molibden uygulamasında (Müftüoğlu ve ark., 2021) tek bakla ağırlığının 410-502 mg arasında değiştiği ve molibden uygulamasının istatistiksel olarak önemli farklılık oluşturmadığını kaydedilmiştir.

Çizelge 5. Farklı fosfor ve azot dozları uygulanan Göksun fasulye çeşidinin tek bakla ağırlığı ait ortalamaları ve oluşan grupları

	0 kg da^{-1} fosfor	0.3 kg ha^{-1} fosfor	0.6 kg ha^{-1} fosfor	0.9 kg ha^{-1} fosfor	Ortalamalar
0 kg ha^{-1} azot	1.480 b-f	1.643 abc	1.403 efg	1.186 h	1.428
0.4 kg ha^{-1} azot	1.536 a-f	1.723 a	1.520 b-f	1.353 fgh	1.533
0.8 kg ha^{-1} azot	1.440 c-f	1.610 a-d	1.673 ab	1.473 c-f	1.549
1.2 kg ha^{-1} azot	1.230 gh	1.586 a-e	1.540 a-f	1.616 a-d	1.493
Ortalamalar	1.420	1.640	1.534	1.407	1.501

azot X fosfor interaksiyonu %1 önemli

Baklada Tane sayısı (adet)

Farklı gübre dozlarının uygulandığı Göksun fasulye çeşidinin baklada tane sayıları azot dozları, fosfor x azot doz interaksiyonu yönünden %5 önem düzeyinde istatistiksel olarak farklılık oluşturduğu kaydedilmiştir. Baklada tane sayısı en yüksek 5.016 adet ile 0.4 kg he^{-1} azot uygulamasından elde edildiği, onu ikinci sırada 5.000 ile azotun 0.8 kg he^{-1} doz uygulamasının, üçüncü sırada 1.2 kg he^{-1} doz uygulaması 4.766 adetle izlediği ve en az 4.641 adet ile 0 dozundan elde edildiği kaydedilmiştir. Fosfor x azot dozları interaksiyonunda en yüksek baklada tane sayısı 5.466 adet ile fosforun 3 ve azotun 1.2 kg he^{-1} gübre uygulama interaksiyonunda görülmüştür. En düşük bakla tane sayısı ise sırasıyla 4.366 ve 4.466 adet ile azotun 1.2 kg x fosforun 0 kg he^{-1} ve yine azotun 1.2 kg x fosforun 9 kg he^{-1} doz interaksiyonundan elde edildiği ve aynı grupta yer aldığı kaydedilmiştir. Baklada tane sayısı ile ilgili diğer interaksiyonlarda ise değerler 4.600-5.330 adet arasında değişim göstermiştir. Farklı fosfor dozları yönünden bakla tane sayısında istatistiksel farklılık görülmemiştir. Baklada tane sayısı uygulanan fosfor dozlarına göre 4.716-5.083 adet arasında değişim gösterdiği tespit edilmiştir (Çizelge 6). Topal (2019), farklı ekim zamanı ve farklı bakla çeşidi ile yapılan çalışmada baklada tane sayısının 2.38-4.00 adet arasında değiştiğini belirlemiştir. Yeken ve ark (2018) Türkiye'deki yerel kuru fasulye çeşitlerinde baklada tane sayısının 4-6.4 adet arasında olduğunu kaydetmişlerdir.

Çizelge 6. Farklı fosfor ve azot dozları uygulanan Göksun fasulye çeşidinin tane sayısı ait ortalamalar ve oluşan grupları

	0 kg da^{-1} fosfor	0.3 kg ha^{-1} fosfor	0.6 kg ha^{-1} fosfor	0.9 kg ha^{-1} fosfor	Ortalamalar
0 kg ha^{-1} azot	4.700 cde	4.733 cde	4.533 de	4.600 de	4.641 b
0.4 kg ha^{-1} azot	4.733 cde	4.900 a-e	5.330 ab	5.100 a-d	5.016 a
0.8 kg ha^{-1} azot	5.266 abc	5.233 abc	4.800 b-e	4.700 cde	5.00 a
1.2 kg ha^{-1} azot	4.366 e	5.466 a	4.766 b-e	4.466 e	4.766 ab
Ortalamalar	4.766	5.083	4.858	4.716	4.856

Tek tane Ağırlığı (g)

Göksun fasulye çeşidine uygulanan farklı gübre doz uygulamasında azot dozları (%1), fosfor x azot doz intereksiyonunun (%5) istatiksel olarak tek tane ağırlığında önemli farklılık oluşturduğu belirlenmiştir. Tek tane ağırlığı en az 0.205 g ile 0 kg ha^{-1} azot doz uygulamasından elde edilmiştir. Diğer 0.4, 0.8, 1.2 kg ha^{-1} azot dozlarında, sırasıyla bakla tane ağırlığı 0.251, 0.250, 0.240 g olduğu ve istatistiksel olarak aralarında önemli farklılık oluşturmadığı, aynı grupta yer aldığı kaydedilmiştir. Fosfor x azot dozları interaksiyonunda en yüksek tek tane ağırlığı 0.293 g ile fosforun 0.6 ve azotun 0.8 kg he^{-1} gübre doz interaksiyonunda tespit edilmiştir. En düşük tek tane ağırlığı ise 1.166 g olarak fosforun 9 ile azotun 0 kg he^{-1} gübre doz interaksiyonunda kaydedilmiştir. Diğer fosfor x azot doz interaksiyonunda tek tane 0.200-0.280 g arasında değişim göstermiştir. Farklı fosfor (0, 0.3, 0.6, 0.9 kg he^{-1}) doz uygulamaların da tek tane ağırlığı 0.209-0255 g arasında değişmiştir. Uygulanan farklı fosfor dozları tek tane ağırlığı üzerinde istatistiksel önemli farklılıklar oluşturmamıştır. (Çizelge 7). Topal (2019), farklı ekim zamanı ve farklı bakla çeşidi ile yapılan çalışmada yüz tane ağırlığı 22.53-48.16 g arasında değiştiği, diğer bir ifadeyle tek tane ağırlığı 0.225-0.481 g arasında olduğu anlaşılmaktadır.

Çizelge 7. Farklı fosfor ve azot dozları uygulanan Göksun fasulye çeşidinin tek tane ağırlığı ait ortalamalar ve oluşan gruplar

	0 kg da^{-1} fosfor	0.3 kg ha^{-1} fosfor	0.6 kg ha^{-1} fosfor	0.9 kg ha^{-1} fosfor	Ortalamalar
0 kg ha^{-1} azot	0.200 efg	0.223 c-f	0.233 b-e	0.166 g	0.205 b
0.4 kg ha^{-1} azot	0.253 a-d	0.266 abc	0.256 abc	0.230 b-f	0.251 a
0.8 kg ha^{-1} azot	0.203 d-g	0.246 a-e	0.293 a	0.256 abc	0.250 a
1.2 kg ha^{-1} azot	0.180 fg	0.263 abc	0.236 b-e	0.280 ab	0.240 a
Ortalamalar	0.209	0.250	0.255	0.233	0.236

Sonuç

Kahramanmaraş koşullarında Göksun fasulye çeşidine fosfor ve azot dozlarının dört farklı dozları uygulanarak bakla özelliği üzerindeki etkisi araştırılmıştır. Araştırmada fasulye baklasının bakla uzunluğu, bakla genişliği, bakla çapı, bitkide bakla sayısı, tek bakla ağırlığı, baklada tane sayısı, tek tane ağırlığı incelenmiştir. Fosfor dozlarının etkisi incelenen özelliklerden sadece fasulyenin bakla çapı üzerinde, azot dozlarının etkisi bakla uzunluğu, bakla çapı, bakla genişliği, tek tane ağırlığı, bakla tane sayısı üzerinde görülmüştür. Bitkide bakla sayısı, bakla tane sayısı, bakla uzunluğu, bakla ağırlığı, tek tane ağırlığı fosfor x azot dozu interaksiyonundan etkilenmiştir. Araştırma sonunda 4 kg da^{-1} ve yukarı azot doz uygulamaları bakla özellikleri üzerinde olumlu katkıda bulunurken, fosfor etkisinin net görülemediği belirlenmiştir. Fosforun etkisini gözlemek için azotun sabitlenmesi gerektiği sonucuna varılmıştır.

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Revisiting The Food Security And Nutrition Status Of Farming Households After Covid-19 Lockdown In Nigeria

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Abstracts

Despite the global challenges of high food insecurity, covid-19 set-in which is said to have contributed to the phenomenon. However, most recent studies were conducted during the COVID-19 lockdown, indicating a need to assess households' food security after the lockdown. Therefore, this study investigated rural households' (who are mostly farmers) food security status and dietary diversity as a proxy for nutrition status in Nigeria. Two hundred and forty farming households were randomly selected for the study. The data collected was analysed using descriptive statistics, the USDA 18 food security questionnaire core module, the household dietary diversity score, and logit regression. The results revealed that the majority of the farming households were food insecure (66.3%) and malnutrition was also prevalent among rural farming households as 62.9 per cent had a low dietary diversity score. The positive determinants of household food security were access to credit, cooperative membership, income, and marital status. While household size negatively influenced rural household food security. This study calls for development agents' and governments' intervention to reduce the high level of food insecurity and malnutrition among rural farming households through the provision of financial support and awareness creation on family planning.

Keywords*: Covid-19 pandemic, dietary diversity, farmers, food insecurity, rural households*

ID: 605

A Review on Soil water Conservation by mulching Practices

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Abstract
Due to global warming and erratic rainfall in dry and semi-arid regions, agricultural water resources have been depleted over time. Mulching has a critical influence as a water-saving practice in rain-fed crop production to minimize water stress in agriculture. It is primarily crucial for retaining soil moisture, regulating soil temperature, and minimizing soil evaporation, all of which have an impact on crop productivity. Mulching has several strategic implications for the soil ecology, crop development, and climate. Mulch insulates the soil, assisting in the creation of beautiful and protected landscapes by providing a barrier from cold and hot temperatures. Water use inside the soil root zone is a critical event for increasing water efficiency and conserving water resources through mulching. Mulching is also responsible for the attractiveness of farmlands in addition to being a water-saving practice. Mulch material selection is mostly determined by availability, climate, durability, and cost-effectiveness. It must also be environmentally feasible to be used indefinitely. As a result, it is determined that the various mulching materials used in agriculture may save water resources, resulting in increased crop production in rain-fed agriculture.
Keywords*: Mulching; Soil resources; water efficiency; Soil temperature*

ID: 606

Added-Protein Kefir: Biochemical Changes in In Vitro Digestion Stages

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Abstract
Fermented milk products, which have a history equal to human history, constitute an important part of the dairy industry today. While yogurt is at the beginning of fermented milk products in our country, it is seen that buttermilk and then kefir have an important place in the beverage scale. Milk proteins, on the other hand, show specific functions that positively affect healthy nutrition due to the bioactive components in their composition, as recently determined, that they provide the necessary amino acids for growth and development. In our study, the changes in ACE activity and antioxidant capacity of the samples were examined in the in vitro digestion process by enriching the kefir samples with whey proteins, casein, and skimmed milk powder, which are the natural components of milk. While ACE inhibition values were in the range of 78.63-90.30% pre-digestion, they changed in the range of 86.97-96.38% after gastrointestinal digestion. It was determined that the %ACE inhibition values of the control (K) sample remained at the lowest level at all stages of digestion and that the difference between the K sample and the protein-rich samples was significant ($p<0.05$). Antioxidant activity value ranging from 0.3615-0.5512 meq Ascorbic acid/µg before digestion was determined as 1.3796-1.9313 meq Ascorbic acid/µg after gastrointestinal digestion ($p<0.05$). In the study, the sample with the highest % ACE inhibition activity among kefir samples was determined as casein-rich kefir sample at all stages of digestion. In terms of antioxidant activity capacity, kefir samples containing whey protein at all stages of digestion were identified as the samples with the highest potential. Considering the increasing trend of healthy nutrition and the therapeutic effects in fermented products, kefir with increased protein content can be considered as an alternative product for fermented beverages, which is the most preferred in our country. In the light of these results, it can be said that protein-rich fermented beverages will contribute to a healthy eating model due to their health-supporting effects.
Keywords: *Kefir, Milk proteins, In vitro digestion, ACE activity, Antioxidant capacity*

ID: 607

Performance of *Anadolu-T* broiler parent stock and their hybrids

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Abstract

The aim of this study was to reveal the trends in age-related growth, feed intake and some reproduction traits in a Anadolu-T (A2×A1) and Ross-308 female *PS* breeders, as well as growth, feed intake, feed conversion ratio, and livability characteristics in four-way Anadolu-T [(B2×B1)×(A2×A1)] and Ross-308 hybrids. In the study, 120 d-old male and female *PS*s were randomly allocated to floor pens (2.2×1.8 m) in 4 replications of 30 chicks each (7.5 birds/m^2) and reared up to 18 weeks of age. At 20 weeks of age, two groups were randomly formed from female *PS* breeders (40 hens in each group) for the laying period. In order to obtain four-way hybrid, female *PS*s (*A2×A1*) was assigned 5 males from (*B2×B1*) (male:female ratio: 1/8). Regarding the four-way hybrids, 90 male-female mixed chicks from both genotypes for each parental age were placed in each pen with 1.8x2.2 sizes with 3 replicates of each genotype with 30 chicks.

Regarding the *PS* breeders, the body weight (BW), average daily feed intake (ADFI), age at first egg (AFE, in d), number of eggs, egg weight and egg mass were determined during 64 weeks. Catalog values of Ross-308 *PS*s were used to compare the same parental traits. For four-way hybrid and commercial genotype, weekly BW, weekly cumulative FI, feed conversion ratio (FCR) and liveability characteristics were compared by averaging the values observed at 32 and 52 weeks of age. Total feed intake for Anadolu-T and Ross-308 *PS* males were 52012 g (116.1 g/d) and 50904 g (114 g/d), and for females 55014 g (122.8 g/d) and 55062 g (123 g/d) d), respectively. Anadolu-T *PS*s reached age at 5% production age 5 days later than Ross-308 and laid 16 fewer eggs. Anadolu-T *PS* hens laid heavier eggs, with an average egg weight of 65.1 g in Anadolu-T vs 62.1 g in Ross-308. Egg mass of Anadolu-T and Ross-308 *PS*s was calculated as 37.1 g and 42.6 g, respectively. The 6-weeks BW ($P < 0.001$), FI ($P < 0.05$) and FCR ($P < 0.001$) of Anadolu-T and Ross-308 hybrids was 2787.6 g and 3048.8 g; 4673.0 g and 4453.8 g; and 1.674 and 1.473, respectively.

In conclusion, the fewer egg production in Anadolu-T *PS*s with the contribution of delayed sexual maturity limits chick production. Therefore, selection for earlier sexual maturity and higher egg production in Anadolu-T dam lines is considered very important in increasing reproductive performance. The fact that hybrid performances were also higher in Ross-308 indicates that multi-trait intensive selection is required in Anadolu-T sire lines, which takes into account FCR, breast yield and abdominal fatness, as well as fast growth.

Key Words: *Broiler, Hybrid, Egg number, Feed efficiency, Body weight*

Introduction

The rapid increase in the world population has increased the demand for protein-rich animal products and puts pressure on the livestock sector (Steinfeld et al., 2006). World chicken meat production has more than doubled in the last 20 years and reached 120 million tons (FAOSTAT, 2022), and it is estimated that chicken meat will be the most consumed form of animal protein in the world in the near future (OECD/FAO, 2021).

Turkey is completely foreign-dependent in terms of genetic material used in hybrid production, and an increasing number of parent stock (*PS*) and partially grandparent stock chicks are imported every year. Although Turkey is in a good position in world broiler production, no significant progress has been made in the breeding and production of pure lines from which hybrids are produced (Sarıca et al., 2018). Today, there are only three companies on the world market engaged in breeding and selection of fast-growing broiler pure lines: Aviagen Broiler Breeders, Cobb-Vantress and Hubbard (de Jong et al., 2017). This monopolized structure makes sustainable production difficult for the Turkish broiler industry. In addition, the avian-flu epidemic in Europe and UK in 2021 has restricted the production of commercial breeding companies that keep stock flocks mostly in these countries (DAERA, 2022; IZSVe, 2022). This highlights the importance of local breeding and the availability of genetic resources against stockbreeding problems. For these reasons, in order to meet at least a certain part of the broiler production in Turkey with local resources, the breeding and selection of 5 pure line breeders (3 dam and 2 sire lines) at the national level was started in 2015 (Sarıca et al., 2016) and these broiler lines were registered as "*Anadolu-T*" in 2020 (Sarıca et al., 2021). However, there is no study revealing the performance of four-way cross hybrids produced for commercial use and their two-way cross parent stock.

The aim of this study was to reveal the trends in age-related growth, feed intake and some reproduction traits in a Anadolu-T (A2×A1) and Ross-308 female *PS* breeders, as well as growth, feed intake, feed conversion ratio, and livability characteristics in their four-way hybrids.

Materials and Methods

The Anadolu-T parent stock (*PS*) material of the study was provided from "*Eskişehir Geçit Kuşağı Agricultural Research Institute*", and four-way cross hybrids were produced in Ondokuz Mayıs University, Agricultural Faculty, Research and Application Farm. All procedures were approved by the Ondokuz Mayis University Animal Care and Use Ethics Committee (Decision no: 2017/31; date: 30.06.2017).

The Anadolu-T male *PS*s (*B2×B1*) used in the study were obtained by crossing the males of the B2 line and the females of the B1 line, while Anadolu-T female *PS* breeders (*A2×A1*) were obtained by crossing the females of the A1 line and the males of the A2 line. Catalog values of Ross-308 were used as commercial *PS* flock (Aviagen, 2021). In the production of four-way cross hybrid [(*B2×B1*)×(*A2×A1*)], males of (*B2×B1*) *PS*s and females of (*A2×A1*) *PS* breeders were mated. In comparison of Anadolu-T hybrids, Ross-308 hybrids at the same breeder age from a commercial enterprise were used.

In the study, 120 d-old male and female *PS*s were randomly allocated to floor pens (2.2×1.8 m) in 4 replications of 30 chicks each (7.5 birds/m^2) and reared up to 18 weeks of age. Wood shavings were used as litter material. Water was given freely through nipple drinkers. All *PS* birds were fed ad-libitum for the first 14 days with chick starter crumbs (2,800 kcal/kg ME; 20.0% CP; 1.30% dig. Lys; 0.60% dig. Met; 1.00% Ca; 0.50% aP). However, after this age, restricted feeding has been implemented up to 64 weeks; grower (15-42 days; 2,750 kcal/kg ME; 18.0% CP; 0.75% dig. Lys; 0.35% dig. Met; 1.20% Ca; 0.45% aP) and developer (between 43-126 days; 2,750 kcal/kg ME; 14.5% CP; 0.65% dig. Lys; 0.33% dig. Met; 1.50% Ca; 0.40% aP) feeds were used. All *PS* birds were vaccinated against Marek's, New castle disease, Gumboro, Fowl Typhoid, Fowl Pox, and all sanitary and biosecurity practices were strictly implemented during the study. House temperature and humidity values were kept at optimum (32-33 ºC in the first 3 d-old, gradually decrease to 21 ºC up to 28 d-old, then continue as 21-22 ºC). The photoperiod was 24L:0D for the first 3 days, 10L:14D for the 14-140 days, and the first light stimulation was implemented at 141 days, the lighting program was 14L:10D at 24 weeks onwards.

At 20 weeks of age, two groups were randomly formed from female *PS* breeders (40 hens in each group) for the laying period. In order to obtain four-way hybrid, female *PS*s (*A2×A1*) was assigned 5 males from (*B2×B1*) (male:female ratio: 1/8). To encourage the nest using *PS* breeder hens, a nest box per 4.5 birds was placed in each pen at 20 weeks of age. Groups of 40 females and 5 males were reared in a floor system with 3.5×3.5 m (3.8 birds per m2) pen sizes in the climate controlled house between 24 to 64 weeks. Feeding of males and females was done separately. The feeder area per hen was 15 cm, and 26 cm for the male. Water was freely supplied by 8 nipple drinkers per pen (5.6 birds per nipple). All birds were fed with pre-laying ration from 127 to154 days of age and with laying ration at 155 days afterwards.

In order to produce four-way broiler hybrids at 32 and 52 weeks of age, 120 hatching eggs were collected and incubated with Ross-308 eggs taken from the commercial enterprise at the same week of parental age. After 21 days of incubation, 90 male-female mixed chicks from both genotypes were placed in each pen with 1.8x2.2 sizes with 3 replicates of each genotype with 30 chicks. Both broiler test studies were carried out in the same broiler house for 6 weeks. Standart temperature (first 3 days 32-33 ºC, gradually decrease to 21 ºC until 28 d-old onwards), relative humidity (50-70%), ventilation, lighting (first 3 days 24L:0D, 4-14 days 20L:4D, 4-6 days 18L:6D) procedures were applied. All birds were fed ad-libitum with chick starter (1-15 days; 23% CP, 3000 kcal/kg ME), chick (16-28 days; 22% CP, 3100 kcal/kg ME), broiler (29-35 days; 21%, 3100 kcal/kg ME) and finisher (39-42 days; 18% CP, 3100 kcal/kg ME) feeds.

Regarding the *PS* breeders, the growth (individual weekly body weight [BW, in g]), and average daily feed intake [ADFI, in g/day per bird], total feed intake [g/bird] in both male and female *PS* bredeers, reproduction (age at first egg [AFE, in d], number of eggs [n/hen], egg weight [in g]) and egg mass (g egg weight/hen per week) determined in only *PS* hens during 64 weeks. Catalog values of Ross-308 *PS*s were used to compare the same parental traits (Aviagen, 2021). For four-way hybrid and commercial genotype, weekly body weight (BW, in g), weekly cumulative feed intake (FI, in g), feed conversion ratio (FCR, g.feed intake/g.body weight gain) and liveability (%) characteristics were compared by averaging the values observed at 32 and 52 weeks of age. For *PS* breeder characteristics, evaluations were made on the means of each trait. In comparison of hybrids with commercial one, one-way analysis of variance was used for each trait and Tukey HSD post-hoc test was implemented for multiple comparisons when $P < 0.05$.

Results and Discussion

Parent stocks (PSs)

The BW and ADFI trends of Anadolu-T and Ross-308 *PS*s between 0-64 weeks are shown in Figure 1A and Figure 1B, respectively. Growth period (0-23 weeks) BW values were very close in both *PS* groups. However, after 40 weeks of age, both male and female Anadolu-T *PS*s had lower BW than Ross-308. The ADFI of Anadolu-T female *PS*s were very close to Ross-308. However, Anadolu-T male *PS*s showed more stable ADFI from 24 to 64 weeks, while there was a linear increase in Ross-308s. Total feed intake for Anadolu-T and Ross-308 *PS* males were 52012 g (116.1 g/d) and 50904 g (114 g/d), and for females 55014 g (122.8 g/d) and 55062 g (123 g/d) d), respectively (Aviagen, 2021).

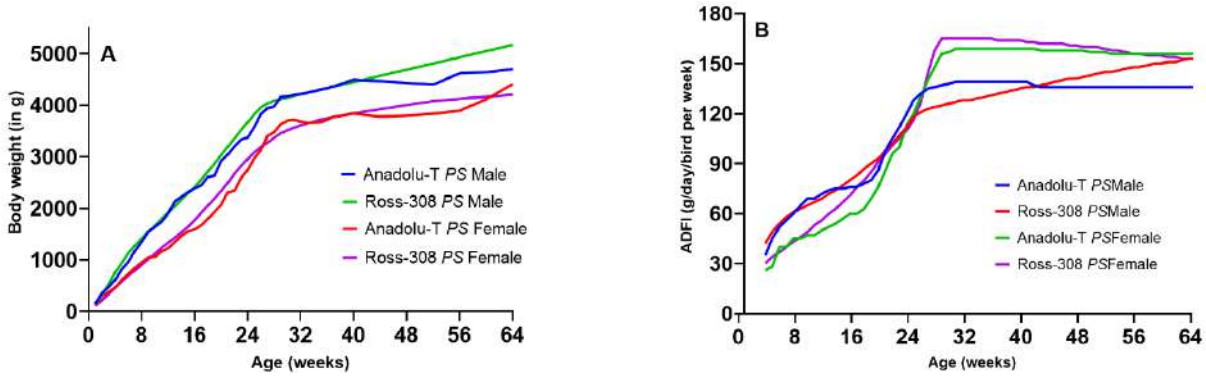

Figure 1. Trends of weekly body weight **(A)**, average daily feed intake (ADFI, in g/day/hen per week) **(B)** in Anadolu-T and Ross-308 *PS*s from 0 to 64 weeks.

Cumulative egg number (n of eggs/hen), laying percentage (%, henweek), egg weight (g) and egg mass (g/hen) of AnadoluT and Ross308 *PS*s are shown in Figure 2A, 2B, 2C and 2D, respectively. From the first egg, Anadolu-T *PS*s had fewer cumulative egg number than Ross-308, with approx. 16 fewer eggs at 64 weeks (Figure 2A). Similarly, the laying percentage was lower in Anadolu-T *PS* up to 55 weeks, but close to Ross-308 after that age (Figure 2B). Also, age at first egg was 179 d and age at 5% production 180 d (26 weeks) in Anadolu-T and 175 d (25 weeks) in Ross-308 *PS* hens (unpublished data). The impaired reproductive performance in Anadolu-T *PS* seems possibly to be due to a delayed age at first egg or 5% production (Wolc et al., 2020). Because Anadolu-T *PS*s reached age at 5% production age 5 days later than Ross-308 and laid 16 fewer eggs (Aviagen, 2021).
Although the mean egg weight was similar at the beginning and end of the laying period between two genotypes, Anadolu-T *PS* hens generally laid heavier eggs, with an average egg weight of 65.1 g in Anadolu-T vs 62.1 g in Ross-308 (Figure 2C). Egg mass values also had a similar trend to the laying percentage, while in the peak and last period, egg mass of Anadolu-T and Ross-308 *PS*s was calculated as 37.1 g and 42.6 g, respectively. The heavier egg weight in Anadolu-T *PS*s seems to be most likely related to the delayed first laying or sexul maturity (Arango et al., 2007; Wolc et al., 2020). The lighter egg mass in Anadolu-T *PS* is due to the lower weekly lay percentage.

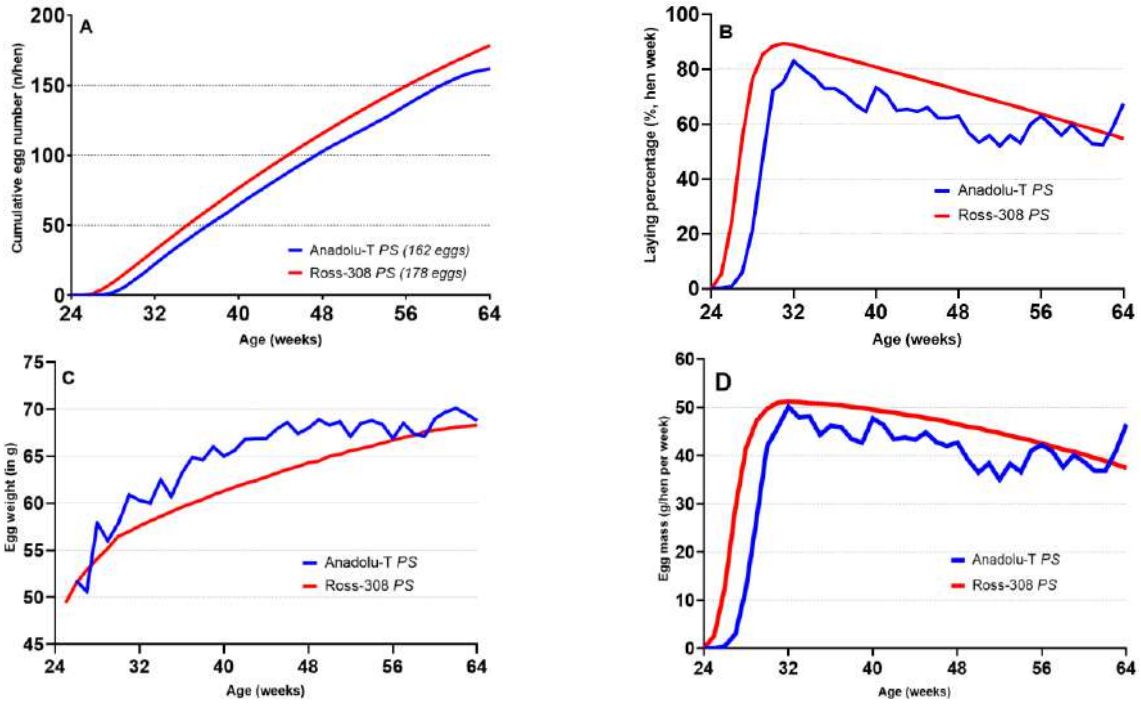

Figure 2. Trends of cumulative egg number (n of eggs/hen) (**A**), laying percentage (%, hen-week) (**B**), egg weight (in g) (**C**), and egg mass (g egg weight/hen per week) (**D**) in Anadolu-T and Ross-308 *PS* hens between 24 and 64 weeks.

Hybrids

Body weight (BW), feed intake (FI), feed conversion ratio (FCR) and liveability values of Anadolu-T and Ross-308 hybrids between 0-6 weeks of age are given in Figure 3A, 3B, 3C and 3D, respectively. The difference between Anadolu-T and Ross-308 hybrids, which were similar in terms of chick weights, emerged from 1 week of age and was 2787.6 g and 3048.8 g at 6 weeks of age, respectively ($P < 0.001$, Figure 3A). The FI at first week was higher in Ross-308 ($P < 0.001$), while it was lower at week 6 weeks ($P < 0.05$), with similar feed intake amounts between 2 and 5 weeks of age (Figure 3B). While FCR values at 1 and 2 weeks of age were similar between genotypes, Ross-308 benefited significantly more effectively from 3 to 6 weeks ($P < 0.05$) and was determined as 1.674 and 1.473 for Anadolu-T and Ross-308 hybrids at 6 weeks of age, respectively ($P < 0.05$, Figure 3C). The fact that the Ross-308's FCR is 0.2 units better is due to its higher BW value by intaking less feed during 6 weeks. As is known, FCR (or its components BW and FI) is a heritable trait and has a moderate (0.30-0.40) heritability. Genetic selection for FCR in broilers for long generations has produced chickens that can benefit from feed more effectively (Prakash et al., 2020; Marchesi et al., 2021; Berger et al., 2022). In addition, selection for increasing breast yield and reducing abdominal fatness in multi-trait models contributed to the improvement of FCR due to genetic correlations between these traits (Le Bihan-Duval et al., 1998; Chen et al., 2021). We know from our previous observations that Anadolu-T hybrids have approximately 3% less breast yield and 1.3% more abdominal fat compared to Ross-308 (unpublished data). There was also no significant difference in liveability between hybrid genotypes (Figure 3D).

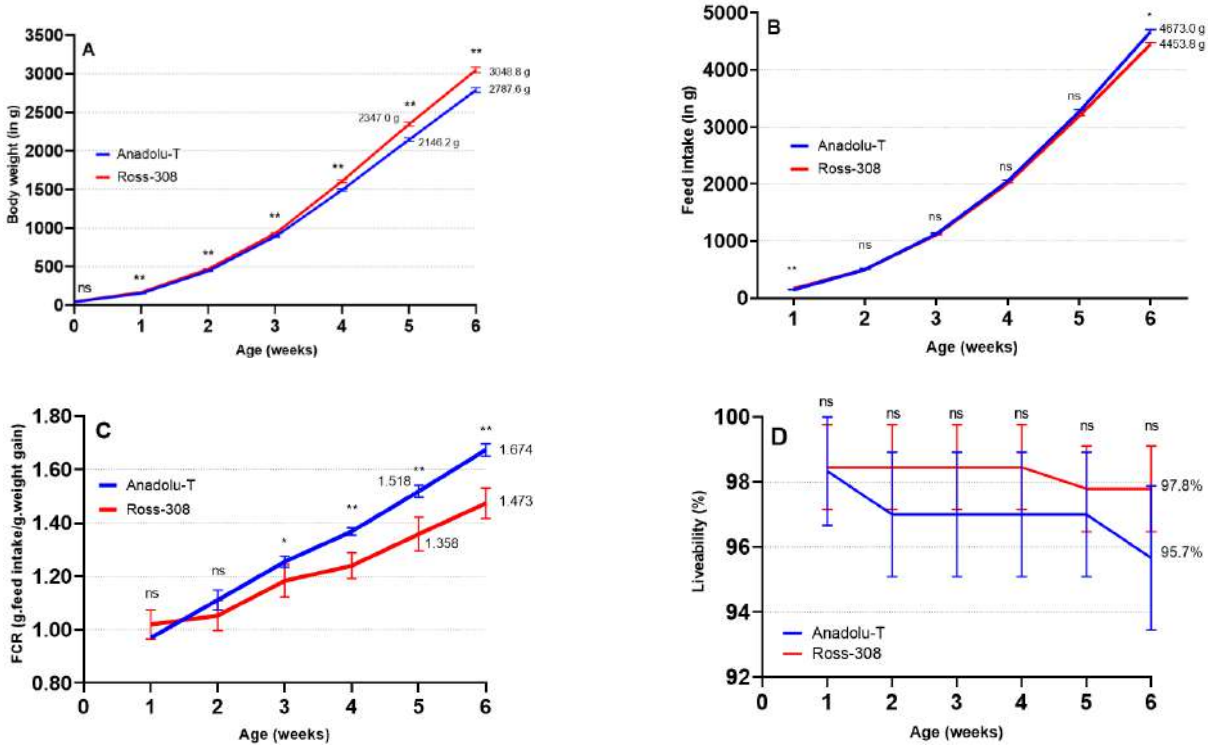

Figure 3. Trends of body weight (in g) (**A**), cumulative feed intake (in g) (**B**), feed conversion ratio (g.feed intake/g.weight gain) (**C**), and liveabilty (%) (**D**) in Anadolu-T and Ross-308 hybrids from 0 to 6 weeks.
ns: no significant difference between two hybrid genotypes; *: $P < 0.05$; **: $P < 0.001$.

In conclusion, regarding the parental traits, excessive BW increase was successfully prevented in Anadolu-T *PS*s with daily restricted feeding. The fewer egg production in Anadolu-T *PS*s with the contribution of delayed sexual maturity limits chick production. Therefore, selection for earlier sexual maturity and higher egg production in Anadolu-T dam lines is considered very important in increasing reproductive performance. The fact that hybrid performances were also higher in Ross-308 indicates that multi-trait intensive selection is required in Anadolu-T sire lines, which takes into account FCR, breast yield and abdominal fatness, as well as fast growth.

Acknowledgements

We would like to thank the technical staff and workers at "*Eskişehir Geçit Kuşağı Research Institute*" which provided this study material and carried out the breeding and selection of Anadolu-T pure lines, and Ondokuz Mayıs University Project Office (Ref Nr, PYO.ZRT.1901.18.014) and General Directorate of Agricultural Research and Policies (Ref Nr, TAGEM/16/ARGE17) for financially supporting this study. We also acknowledge

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Research on the Bio-ecology, Morphology and Seasonal Variation of *Dendrobaena veneta* (Rosa, 1886)

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Abstract

Dendrobaena veneta (Rosa, 1886) (Annelida: Clitellata: Lumbricidae) is one of the most widely used compost worms which has; 50–70 mm body length, with striated red pigmentation and clitellum on segments 27–33. This taxon is now widely distributed all over Europe. The origin of this species is suggested to be in the East Mediterranean. *D. veneta* has been the subject of several cell-biological, immunological, soil and environmental studies.In this context, the main purpose and content of the study is to analyze the bio- ecology, morphology and seasonal variation of *D. veneta* with the data which was obtained from the observations and examinations carried out during 2020-2022 in two different habitat locality in Nevşehir province

Key Words: *D.veneta, biology, Ecology, Morphology, Seasonal variation, Nevşehir*

Dendrobaena veneta (Rosa, 1886)'nın Biyo-ekolojisi, Morfolojisi ve Mevsimsel Varyasyonu Üzerine Araştırma

Özet

Dendrobaena veneta (Rosa, 1886) (Annelida: Clitellata: Lumbricidae) en yaygın kullanılan kompost solucanlarındandır ve morfolojik olarak; 50-70 mm gövde uzunluğu, çizgili kırmızı pigmentasyon ve 27-33 segmentlerinde yer alan klitellum özelliklerine sahiptir. Bu takson Avrupa genelinde yaygın olarak dağılım göstermektedir. *D.veneta* türünün kökeninin Doğu Akdeniz olduğu ileri sürülmektedir. *D. veneta* çoğunlukla; hücre biyolojisi, immünoloji, toprak ve çevresel konulardaki çeşitli çalışmalara konu olmaktadır. Bu bağlamda; bu çalışman temel amaç ve içeriğini, Nevşehir ili kapsamıda iki farklı localitede yer alan habitatlarda 2020- 2022 yıllarar arasında sürdürülen araştırma ve gözlem verilerinden elde edilen sonuçların biyo-ekolojik, morfolojik ve mevsimsel varyasyon bakımından incelenmesi oluşturmaktadır.

Anahtar Kelimeler: *D. veneta, Biyoloji, Ekoloji, Morfoloji, Mevsimsel değişim, Nevşehir*

ID: 609

Determination of the Recreational Status of the Marmaris National Park

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Abstract
In this study, it was aimed to determine the recreational status of Günnücek Sweetgum Forest, Pamucak Local Icmeler Beach, Adaağzı Locality Cennet Island and Adaköy-Aktaş Areas and recreational pressures on these areas in Marmaris National Park. Marmaris National Park provides different recreational activities due to its historical, biological and ecological structure, geomorphological, geological, natural and cultural resource values. The size of the National Park and its location intertwined with Marmaris town center resulted in the excess of uncontrolled usage areas. This situation was evaluated as a factor that increases the recreational pressure.
Key Words: *Recreation, Recreational Pressure, Marmaris National Park*

Marmaris Milli Parkı Rekreasyonel Durumunun Belirlenmesi

Özet
Bu çalışmada Marmaris Milli Parkı içerisinde yer alan Günnücek Sığla Ormanı, Pamucak Mevki İçmeler Sahili, Adaağzı Mevki Cennet Adası ve Adaköy-Aktaş Mevki alanlarının rekreasyonel durumları ve bu alanlar üzerine olan rekreasyonel baskıların belirlenmesi amaçlanmıştır. Marmaris Milli Parkı, konumu itibariyle sahip olduğu tarihi, biyolojik ve ekolojik yapısı, jeomorfolojik, jeolojik doğal ve kültürel kaynak değerler nedeniyle farklı rekreasyonel aktiviteler sunmaktadır. Milli Parkın büyüklüğü ve Marmaris ilçe merkezi ile iç içe geçmiş bir konumda bulunması kontrolsüz kullanım alanlarının artmasına neden olmaktadır. Bu durum ise rekreasyonel baskıyı artıran faktör olarak değerlendirilmiştir.

Anahtar Kelimeler: *Rekreasyon, Rekreasyonel Baskı, Marmaris Milli Parkı*

Giriş

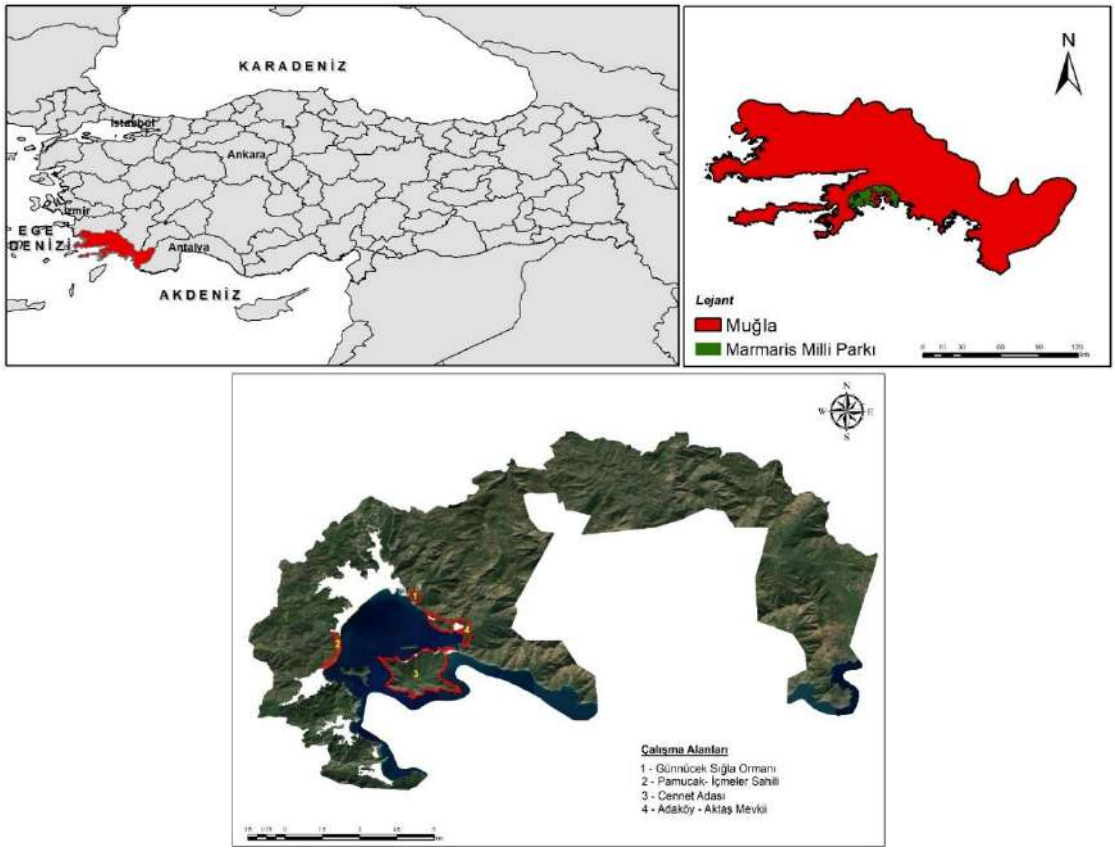
İnsan doğada varoluşundan bu yana, doğaya egemen olmaya çalışmıştır. Hızla artan nüfus ve beraberinde getirmiş olduğu talep çeşitliliği, sanayi ve teknolojik gelişmeler doğal kaynaklar üzerindeki baskıyı ortaya çıkarmıştır. Plansız ve kontrolsüz doğal kaynak tüketiminin yanında getirdiği birtakım çevre sorunlarının artışıyla birlikte insanoğlu, doğal kaynakların korunması ve yönetimine ilişkin gelecek nesillere aktarılması gerektiği kanaatiyle bir takım koruma yönetim arayışına girmiştir. Türkiye'de ise, 1937 yılında doğanın korunması konusunda yürürlüğe giren 3116 ve 3117 Sayılı Kanun'lar ile koruma ve yönetim anlayışı oluşmaya başlamıştır. 1956 yılında kabul edilen 6831 Sayılı Orman Kanunu ile milli parkların ve orman alanlarının oluşturulmasına yönelik ilk çalışmalar başlamıştır. Yine bu kanunun 25. maddesi ile ender ekosistemleri içinde barındıran yerlerin milli park statüsü içerisine alınması sağlanmıştır. 2022 yılı itibariyle Türkiye'de milli park sayısı 48, bu alanların yüzölçümü 884 566 ha (DKMP, 2022) olup, bu alanların ülke yüz ölçümüne oranı ise %1,13'dir.

1996 yılında milli park ilan edilen Marmaris Milli Parkı, 29206 ha büyüklüğünde (%85'i karasal alan, %15'i ise denizel alan) olup, birçok ekosistemi içerisinde barındırmaktadır. Milli Park içerisinde yer aldığı "Datça-Bozburun Yarımadaları", Avrupa'da korunması gereken 100 orman sıcak noktasından, ülkemizde ise 9 orman sıcak noktasından biridir. Ayrıca, milli park Dünya Doğayı Koruma Vakfı'nın (WWF) doğa koruma açısından küresel düzeyde öncelikli 200 ekolojik bölgeden biri olan "Akdeniz Ormanları" ve denizel olarak "Akdeniz Bölgesi" içinde yer almaktadır. Biyolojik çeşitlilik ve tehdit açısından Akdeniz Bölgesi dünyanın 25 sıcak ve önemli noktasından biridir. Milli Park; önemli doğa alanı, önemli bitki alanı, endemik bitki alanı, önemli kuş alanı ve önemli memeli alanı içinde yer almaktadır (Anonim, 2015).

Günümüzde artan yoğun kentleşme ve endüstriyel gelişmelerin artışıyla ortaya çıkan doğa yoksunu kentlerin yaşam koşulları, insanlar üzerinde bazı baskılar oluşturmaktadır. Bu baskılardan kaçış ve kentsel yeşil alanların nitelik ve niceliklerinin yetersizliği, insanların kent merkezlerine yakın, doğal ve açık alanlardaki rekreasyonel faaliyetlere yönelimini artırmaktadır. Çağdaş toplumun gittikçe artan temposu ve stresi göz önüne alındığında, rekreasyonun öneminin artmaya devam edeceği ve rekreasyonel etkinliklere olanak sağlayan parkların da ön plana çıktığı görülmektedir (Manning ve More, 2002). Günümüzde rekrasyonel etkinliklerin büyük bir kısmı doğada bulunmakta ve kaynak olarak çoğunlukla doğal kaynaklar kullanılmaktadır (Karaküçük 1999). Bu sebeple bireylerin kent yaşamının olumsuz etkilerinden kurtularak fiziksel ve ruhsal yenilenme gereğiyle yönelecekleri çevre, kuşkusuz doğal çevredir (Akesen, 1984).

Milli parklar, içinde yaşayan canlılar da dâhil olmak üzere olağanüstü güzellikteki manzaraları korumak ve insanlara bu yerleri gezip görme fırsatı vermek için kurulmuş ve bu nedenle korunmuştur (Straaten, 1997). Batı ülkelerinin sanayi devrimini daha önce yaşamaları, doğal kaynak talebinin artması, koruma fikrinin zamanla oluşması, ekonomik gelirin artması ve insanların farklı bir mekâna gitmek istemeleri milli parklar gibi önemli korunan alanları ziyaret etme düşüncesini doğurmuştur (Kervankıran ve Eryılmaz, 2014). Bu bağlamda doğal ve kültürel bakımdan içerisinde barındırdığı zengin peyzaj özellikleri ile rekreasyonel kaynak değeri olan milli parklar çeşitli etkinliklere imkan sağlaması açısından her geçen gün daha fazla ilgi görmektedir.
Yukarıda verilen bilgiler ışığında, bu çalışmada Marmaris Milli Parkı içerisinde yer alan Günnücek Mevki Sığla Ormanı, Pamucak Mevki İçmeler Sahili, Adaağzı Mevki Cennet Adası ve Adaköy-Aktaş Mevki alanlarının rekreasyonel durumları ve bu alanlar üzerine olan rekreasyonel baskıların belirlenmesi amaçlanmıştır.

Materyal ve Yöntem
Bu çalışmanın materyalini Marmaris Milli Parkı oluşturmuştur. Marmaris Milli Parkı'nın rekreasyonel durumu, Günnücek Sığla Ormanı, Pamucak-İçmeler Sahili, Cennet Adası ve Adaköy-Aktaş Mevki alanları esas alınarak belirlenmiş ve değerlendirilmiştir (Şekil 1).



Şekil 1. Çalışma alanlarının konumu

Çalışmanın ilk aşamasını alanının seçimi oluşturmaktadır. Sonra, belirlenen çalışma alanının, doğal ve kültürel kaynak değerleri ile ilgili literatür taraması yapılmıştır. Bu çerçevede, çalışma alanlarının mevcut rekreasyonel alan kullanımları belirlenmesi ve rekreasyonel kaynak değerlerinin saptanmasına yönelik arazide gözlem ve tespitler yapılmıştır. Yapılan arazi gözlem ve tespitler neticesinde, araştırma alanının rekreasyonel durumu ile rekreasyonel baskılar belirlenmiştir. Gözlem ve tespitler araziden alınan fotoğraflarla da desteklenmiştir.

Bulgular ve Tartışma
Rekreasyonel Kullanım Durumları
Marmaris Milli Parkı'nın konumu ve jeomorfolojik yapısı nedeniyle ziyaretçilerin rekreasyonel eğilimi genellikle orman içi, su kıyıları veya açık alanlar olmaktadır. Milli park içerisinde karstik yapıda 2. derece doğal sit statüsüne sahip Nimara (Cennet) Adasındaki Nimara Mağarası ile Turunç yerleşmesinde yer alan Kumlubük Mağarası bulunmaktadır. Yine, milli parkta bulunan Physkos (Marmaris) ve Amos (Kumlubük) şehirleri 1. Derece Arkeolojik Sit Alanı statüsünde olup, bu antik kentlerin ziyaret edilmesi amacıyla belirlenen tur güzergahları bulunmaktadır. Milli parkta kaynak değerlerinin daha iyi algılanması, kanyon, mağara ve diğer jeolojik - jeomorfolojik oluşumların, orman alanlarının ve bunların çevresindeki görsel peyzaj değerlerinin izlenebilmesini

sağlayan dört yürüyüş yolu ve beş tur güzergahı bulunmaktadır. Marmaris Milli Parkı'nın deniz yoluyla da gezilebilmesi ve görülebilmesi amacıyla, Marmaris, Kumlubük ve Ekincik'in başlangıç veya bitiş noktaları olduğu, mevcutta da yoğun olarak kullanılan tekne tur güzergahları bulunmaktadır. Milli Park alanının izlenmesine yönelik olarak yürüyüş yolları ile ulaşım yolları üzerinde, önemli vista alanlarında yedi manzara seyir noktası düzenlenmesi önerilmiş olup, mevcutta üç seyir terası rekreasyonel kullanım alanı olarak hizmet sunmaktadır. Milli Park içinde yaban keçilerinin ve kuşların doğal ortamlarında gözlemlenebilmesi amacıyla, alanın kuzey bölümlerinde iki yaban hayatı gözlem noktası önerilmiş, ancak henüz alanda mevcut bir kullanım bulunmamaktadır (Şekil 2).

Ziyaretçiler milli parka, hem Muğla ili D400 devlet karayolu hem de hava ve deniz yolu ile ulaşım imkanına sahip olabilmektedir. Marmaris şehir merkezinde yer alan uluslararası liman milli parkın önemli bir ziyaretçi ağını oluşturmaktadır. Marmaris ilçesinin turizm şehri olması sebebiyle, mayıs ile eylül ayları arasında ziyaretçi yoğunluğu oluşmaktadır. Marmaris Milli Parkı'nın 2018-2022 arasındaki ortalama yıllık ziyaretçi sayısı 11 330 062'dir.

Milli park içerisinde düzenlenen rekreasyonel alanların büyük çoğunluğu turizme yönelik kullanılmaktadır. Bu nedenle, kentte yaşayan nüfusun rekreasyonel ihtiyaçlarına yönelik hizmet sunacak alanlar sınırlı kalmakta ve bu durum bölge halkını rekreasyonel talepler için milli parka yöneltmektedir.

Milli Park içerisinde ziyaretçilerin günübirlik rekreasyon ihtiyaçlarını karşılamaları için genellikle insan faaliyet etkilerinin daha çok hissedildiği alanlar olan İçmeler Mahallesi'nde iki (GB-1 ve GB-2), Günnücek-Aktaş mevkileri arasında bir (GB-3) ve Adaağzı mevkinde bir (GB-4) olmak üzere toplam dört günübirlik kullanım alanı bulunmaktadır (Şekil 2).

Marmaris Milli Parkı Uzun Devreli Gelişme Planı (2020) kapsamında, Milli Park içinde ziyaretçilerin çadırlı konaklama ihtiyaçlarının karşılanması amacıyla, Adaağzı mevkiinde Nimara Adası'na ulaşan asfalt yolun doğusunda çadırlı kamp alanı önerilmiştir (Şekil 2). Bu alanda çadırlar, idari birim, hizmet birimi, sıhhi tesis (tuvalet, mutfak vb. kullanımları içeren), uyarı, tanıtım ve bilgilendirme panoları, çeşme, çöp kutuları, duş, soyunma kabinleri ile otopark kullanımlarının bulunabileceği alanlar öngörülmüştür. Milli parkta öngörülen çadırlı kamp alanı mevcutta faaliyeti bulunmayan bir alan olup, planlanma aşamasında olduğu bilinmektedir. Milli park alanı içerisinde çadırlı konaklama imkanının mevcutta bulunmaması, planlanan alanın faaliyete geçmesiyle birlikte bu açığı kapatarak milli parkın rekreasyonel değerlerine katkı sağlayacak niteliktedir.

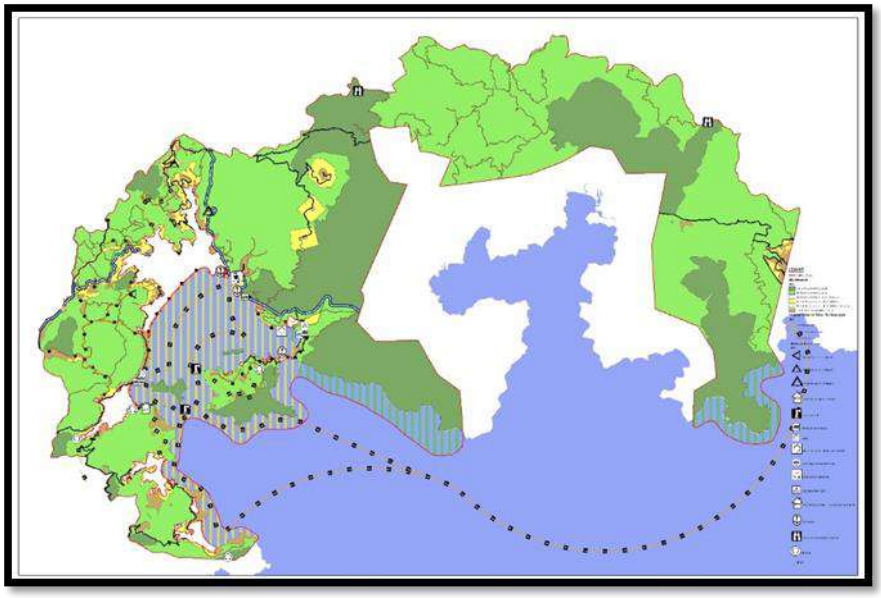
Milli Park içinde ziyaretçilere bungalov konaklama olanağı sağlanması amacıyla, Adaağzı mevkinde, Gökburun Tepe'nin güneyinde, mevcutta kır evlerini barındıran alan, bungalov kamp alanı öngörülmüştür (Şekil 2). Ancak kır evleri kamp alanının mevcutta herhangi bir kullanıma söz konusu olmadığı gözlemlenmiştir.

Marmaris Milli Parkı Uzun Devreli Gelişme Planı (2020)'nda Milli Park alanı içerisinde İçmeler yerleşmesinin doğusunda yer alan, geçmişte eğitim ve dinlenme tesisinin bulunduğu bilinen alanda, denizel biyoçeşitliliğin ve kirliliğin araştırılması, izlenmesi ve tanıtılması amacıyla denizel biyoçeşitlilik araştırma merkezi oluşturulması önerilmiştir. Bu merkezde toplantı salonu, araştırma laboratuvarı, kütüphane, deniz müzesi, idari birimler, eğitim birimleri, konaklama üniteleri, yeme-içme birimleri ile otopark alanına yer verilerek planlama yapılabileceği öngörülmüştür. Mevcut durumunda ise henüz faaliyette olmayan bir alandır.

Günnücek Sığla Ormanı

Milli Parkın kuzeyinde bulunan ve Marmaris-Aksaz Karayolu ile ulaşım sağlanan Günnücek Sığla Ormanı 26 ha'dır. Yöresel olarak halk arasında Sığla Ağacı Günnük Ağacı denildiği için, alana Günnücek adı verilmiştir. 1. Derece Doğal Sit Alanı statüsü olan alanda, Marmaris Milli Park Müdürlüğü idari binası, Doğa Eğitim Merkezi, personel lojmanı ve otoparkının yer aldığı ziyaretçilere günübirlik kullanım olanağı sağlayan bir alandır (Şekil 3). Günnücek Sığla Ormanı, taban suyunun yüksek olması sebebiyle içerisinde özellikle Sığla ağaçlarını barındırması ile alana kendine özgü görsel peyzaj değeri bulunmaktadır. Bunun yanısıra, alan içerisinde kızılçam ve Akdeniz defnesi yaygın olarak görülmektedir. Mevcut alan içerisinde doğal güzelliklerin izlenebileceği güzergahlar belirlenerek planlanmış, toplamda uzunluğu yaklaşık 1 km olan ahşap yürüyüş yolları bulunmaktadır (Şekil 4). Tür çeşitliliği ile aromaterapi etkisi bulunan alanda, planlanan ahşap yürüyüş yolları ile ziyaretçilere rekreasyonel alan kullanımı yaratılmıştır. Günnücek Sığla Ormanı içerisinde alana adını veren Sığla Ağacının ziyaretçilere tanıtımının yapılabilmesi maksatlı mevsimsel döngüsü, yayılış alanlarını vb. özellikleri içeren bilgilendirme levhalarına yer verilmiştir.

Alan içerisinde Marmaris Milli Parkı'nın kaynak değerlerinin yerinde tanıtıldığı Biyoçeşitlilik Yolu yer almaktadır. Biyoçeşitlilik yolu güzergahında, tanıtımı yapılmak istenen türlerin hemen yanı başında ahşap tabelalar tasarlanmış ve ilgili tür hakkında açıklayıcı bilgilere yer verilmiştir. Bu alanın tasarlanmasıyla, hem Marmaris Milli Parkı'nın kaynak değerleri ziyaretçilere tanıtılarak farkındalık oluşması amaçlandığı hem de ilgili teknik personel tarafından öğrenim seviyelerine göre öğrencilere biyoçeşitlilik eğitimlerinin yerinde verildiği bir alan kullanımı yaratılmıştır. Yine alan içerisinde yer verilen Doğa Eğitim ve Sergi Alanında, milli parkın flora ve fauna türlerinin tanıtıldığı ahşap test panoları yer almaktadır (Şekil 5).



Şekil 2. Marmaris Milli Parkı Mevcut Rekreasyonel Kullanımları



Şekil 3. Günnücek Sığla Ormanı vaziyet planı.



Şekil 4. Günnücek Sığla Ormanında ahşap yürüyüş yolları



Şekil 5. Günnücek Sığla Ormanı biyoçeşitlilik yolu ile doğa eğitim ve sergi alanı

Günnücek Sığla Ormanı içerisinde derelerin denize döküldüğü alanda küçük dere yatakları doğal olarak gölet oluşturmuştur. Alan içerisinde planlanan ahşap yürüyüş yolu ile bağlantı sağlanan gölet, deniz yönüne dökülürken alana özgü estetik bir değer katmıştır. Görsel peyzaj değeri yüksek olan gölet kenarında yaklaşık 45 m²'lik ahşap bir platform ve ahşap oturma birimleri tasarlanmış olup, ziyaretçilere sunulan rekreasyonel imkanlar artırılmıştır (Şekil 6).



Şekil 6. Günnücek Sığla Ormanı ahşap yürüyüş yolu ve ormanı göleti

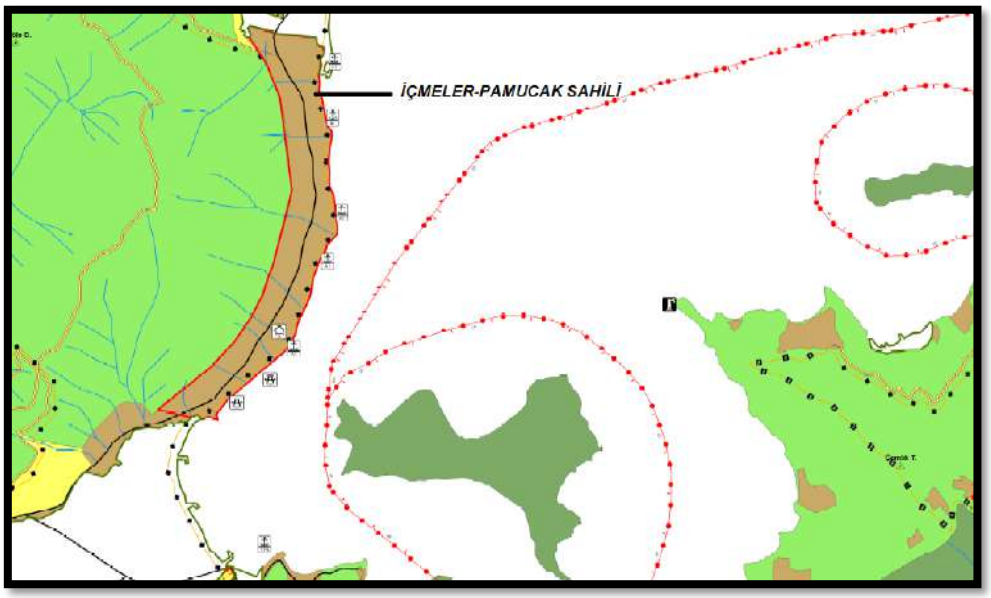
Günnücek Sığla Ormanı doğal ortamın ziyaretçilere sunduğu rekreasyonel kaynak değerin yanında, yeni alan kullanım planlanmalarıyla doğa yürüyüşleri, botanik ve kuş gözlemciliği, bisiklet turu, oryantiring gibi doğa temelli rekreatif faaliyetlere imkan sağlamaktadır (Şekil 7).



Şekil 7. Günnücek Sığla Ormanı sahili sığla köprüsü, ahşap platform ve iskele ile sahili (MMPM Arşivinden)

Pamucak-İçmeler Sahili

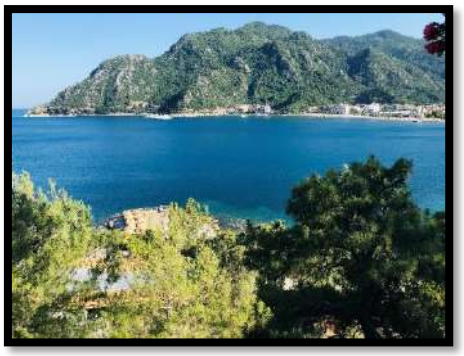
Milli Parkın batı yönünde yer alan Pamucak-İçmeler sahili turizm merkezi sınırı içerisinde yer aldığından, alan kullanımları turizm ağırlıklı rekreasyonel faaliyetlerden oluşmaktadır (Şekil 8).



Şekil 8. Pamucak-İçmeler Sahili Vaziyet Planı.

Milli Park alanı içerisinde ziyaretçilerin günübirlik rekreasyon ihtiyaçlarını karşılamaları için genellikle insan faaliyet etkilerinin daha çok hissedildiği alanlarda belirlenen günübirlik kullanım alanlarından iki tanesi (GB-1 ve GB-2) çalışma alanı içerisinde yer almaktadır. Bu alanlarda; alanın özelliklerine göre kır lokantası/kır kahvesi, büfe, piknik masası, çöp bidonu, çeşme, yağmur barınağı, tuvalet, ocak, çocuk oyun alanı, tanıtım ve bilgilendirme panoları, otopark, seyyar yöresel ürün satış stantları, açık alan aktivite alanları, duş, gölgelik, soyunma kabini gibi temel ihtiyaçlara yönelik ünitelere yer verilmesi öngörülerek, rekreasyonel kullanım alanlara hizmet edecek nitelikte kullanımlar desteklenmiştir.

Günübirlik kullanım alanı (GB-1)'nda mevcut olarak İçmeler sahil güzergahında bir büfe ve plaj işletmeciliği bulunmaktadır. Ziyaretçiler günübirlik alan kullanımlarında temel ihtiyaçlarını mevcutta bulunan büfeden sağlamaktadır. Bu alanların özellikle yaz aylarında yoğun bir şekilde kullanıldığı gözlemlenmiştir. Üst yol kotunda bulunan günübirlik kullanım alanının (GB-2) seyir amaçlı önemli bir işlevi olduğu ve bölgede ihtiyacın sağlanması açısından önemli bir rekreasyonel alandır (Şekil 9).



Şekil 9. Pamucak-İçmeler Sahili günübirlik kullanım alanı (GB-2) seyir alanından görünüm.

Pamucak-İçmeler bölgesi, bulunduğu bölge itibariyle genel olarak içerisinde günübirlik sahil kullanımının yanında, turizme hizmet eden otel kullanımlarını bulundurmaktadır. Otel kullanımları genel olarak kıyı boyunca devam etmekte olup, otel önündeki kumsal alanlar da otel müşterilerinin kullanımındadır. Bölgede yine otellerin kullanımında olan beş iskele yer almaktadır. Alan içerisinde günübirlik kullanımlara açık olan halk plajı, sahil boyunca yürüyüş yolu ve bisiklet yolu (Şekil 10) yer almaktadır. Yine aynı güzergah üzerinde devam eden sahil güzergahında, Milli Park Müdürlüğü'nce Kültür Turizm Bakanlığı'na tahsis edilen ücretsiz halk plajı yapım işi devam etmektedir.

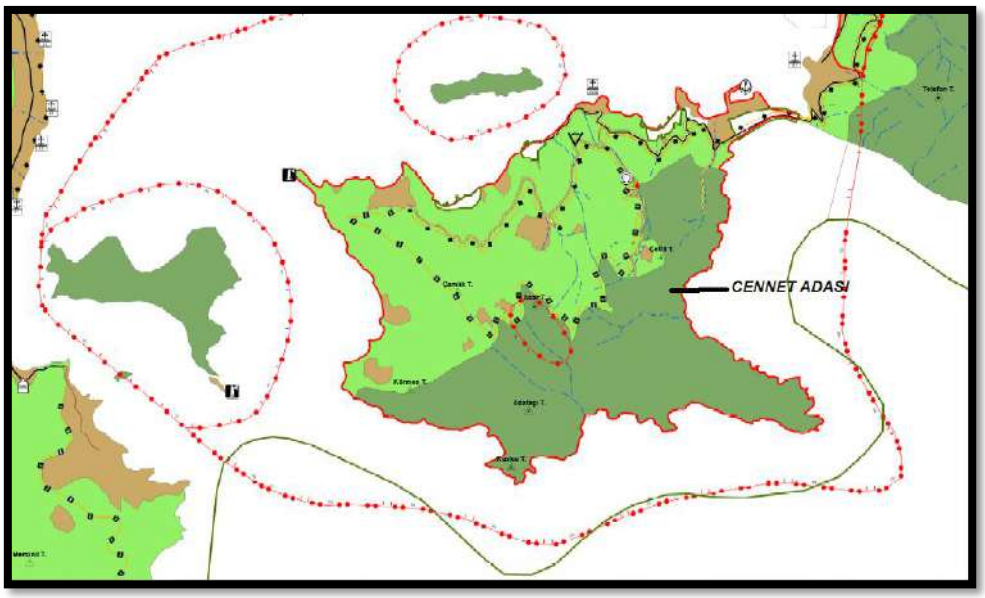


Şekil 10. Pamucak-İçmeler sahil yürüyüş yolu ve bisiklet yolu

Pamucak- İçmeler sahili deniz, güneş, kum üçlüsünden oluşan kitle turizminin yanı sıra ekoturizme de olanak sağlayan doğal yapısı ile yerli ve yabancı turistlerin ilgisini çeken bir bölgedir. Alan, konumu ve büyüklüğü açısından bölge için önemli bir rekreasyon alanı olarak öne çıkmaktadır.

Cennet Adası

Bakir kıyıları, yaban hayatı ve endemik türler açısından zengin olan Cennet adası, Marmaris Milli Parkı'nın güneyinde yer almakta ve Marmaris körfezinin önemli bir bölümünü kapsamaktadır (Şekil 11). Adanın kuzey ve batı yönünde özel mülkiyete konu taşınmazlar bulunmaktadır.



Şekil 11. Cennet Adası vaziyet planı.

Cennet Adası, yöre halkının "Yalancıboğaz" adını verdikleri yaklaşık 700 m uzunluğundaki tombolo ile ana karaya bağlanmaktadır. Cennet Adası'na ana kara ile tek bağlantı noktası olan tombolo, Milli Park sınırı dışında kalmaktadır (Şekil 12).



Şekil 12. Cennet Adasına ulaşım sağlanan tombolo ve yat marinası (MMPM Arşivi) ile giriş güzergahı

Cennet Adası'nın tamamı Turizm Merkezi sınırları içerisinde yer almakla birlikte 2. derece doğal sit alanı statüsü bulunmakta ve içerisinde yer alan Nimara Mağarası 1. Derece Arkeolojik Sit Alanı statüsü taşımaktadır. Nimara Mağarası, milli parkın yerli ve yabancı ziyaretçilerinin en sık ziyarette bulunduğu, doğal ve kültürel peyzaj değerlerinin bir arada izlenebildiği rekreasyonel değeri yüksek bir bölgedir. Nimara Mağarası mevcut orman yolu üzerinden devam eden yürüyüş tur güzergahı (TG-4), yaklaşık 12,5 km olup, ziyaretçi kullanımına açık bir alandır. Bu güzergah üzerinde doğa yürüyüş etkinlikleri yapılarak milli parkın kültürel ve doğal peyzaj değerlerini tanıma imkanı desteklenmektedir. Aynı zamanda bisiklet tur güzergahı da bu güzergahta yer almaktadır (Şekil 13).



Şekil 13. Cennet Adası yürüyüş tur güzergahı ve bisiklet yolu güzergahı

Cennet Adası içerisinde yer alan Küçükkargı mevkii, Marmaris yerleşmesi, körfez ve Bedir Adasının izlenebildiği manzara seyir terası bulunmaktadır. Yine aynı güzergahta Çamçuru mevki yakınından başlayarak Nimara Mağarası, Çetili Tepe, Asartepe ve Çamlık Tepe'den devam ederek Büyükkargı mevkine yakın bir noktada son bulan yaklaşık 6 km uzunluğundaki yürüyüş yolu güzergahı üzerinde gerçekleşen doğa yürüyüşleri ile milli parkın görsel peyzaj değerlerinin izlenebilmesine olanak sağlayan rekreatif olanaklar bulunmaktadır (Şekil 14).

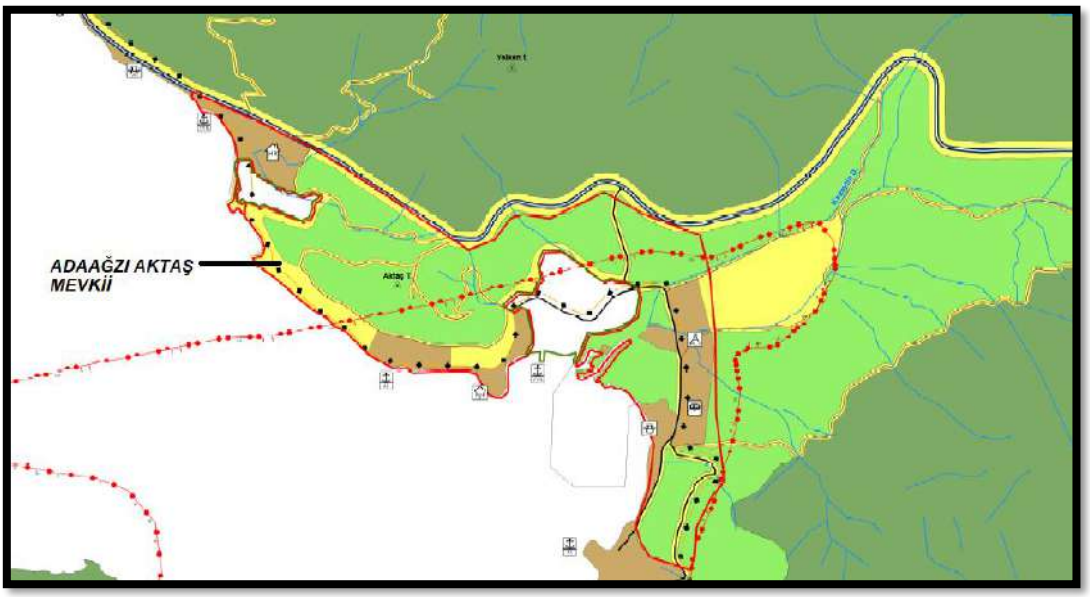


Şekil 14. Cennet Adası manzara seyir terası ve yürüyüş yolu güzergahı

Cennet Adası'nda bulunan ve tehlikede (EN) kategorisinde yer alan Marmaris semenderi (*Lyciasalamandra flavimembris*) bölge için büyük önem arz etmektedir. Ekim ayı sonu ile kasım ayı başlangıcına kadar gözlenebilen Marmaris semenderi milli parkın sunduğu rekreasyonel imkanlara ayrıcalık katmaktadır.
Ayrıca, Cennet adası içerisinde yer alan yürüyüş yolu ve tur güzergahlarında gerekli kurumlardan izin alınarak arıcılık faaliyetlerinin yapıldığı noktalar gözlemlenmiştir.

Adaağzı-Aktaş Mevkii
Milli park alanı içerisinde insan faaliyetlerinin en çok hissedildiği alan olarak bilinen Aktaş Mevkii, Marmaris girişinden Günnücek Sığla Ormanı güzergahı üzerinde Aksaz Deniz Üst Komutanlığına ulaşan yaklaşık 15 metre genişliğinde olan asfalt yolun çatallaşarak güney istikamette devam ettiği bölgede yer almaktadır. Milli park alanı içerisinde insan faaliyetlerinin en çok hissedildiği alanlar içerisinde kalan Aktaş Mevkii, ziyaretçilerin günübirlik faaliyetlerini gerçekleştirdiği bir bölgedir. Aktaş Mevkii ulaşım yol güzergahı, Marmaris Milli Parkı Uzun Devreli Gelişme Revizyon Planı (2020)'nda Aksaz yoluna devam eden yaklaşık 10. km'den bölünerek ulaşım sağlanması, mevcutta bulunan yolun ise araç trafiğine kapatılarak kullanımın sağlanması planlamıştır. Bu durum mevcutta yer

alan yolun araç trafiğine kapatılarak yalnızca yürüyüş tur güzergahı rotası istikametinde rekreasyonel faaliyetlerin gerçekleştirilmesi, alandaki kullanım değerinin arttıracak yönde olacağı tespit edilmiştir (Şekil 15).
Aktaş Mevkiinin tamamı Turizm Merkezi Sınırı içerisinde yer alırken bir kısmı ise 2. derece doğal sit statüsünde kalmaktadır. Alan içerisinde özel mülkiyetlerin yoğunlaştığı alanlar milli park alanı dışında bırakılmıştır. Marmaris Milli Parkı Uzun Devreli Gelişime Revizyon Planı(2020)'nda Aktaş Mevkii de milli parkın yönetim, denetim ve kontrol faaliyetlerinin sağlıklı bir şekilde yürütülebilmesi için hizmet birimleri önerilmiştir (Şekil 15).



Şekil 15. Adaağzı-Aktaş Mevkii vaziyet planı

Alan içerisinde Milli Park alanının daha iyi algılanması, kaynak değerlerinin korunarak tanıtılması ve gezi parkurlarının geliştirilmesi için belirlenen Tur Güzergahı-4 rotası bulunmaktadır. Günnücek Sığla Ormanı'ndan başlayarak Aktaş mevkii içerisinde devam etmekte ve Cennet Adası içerisinde son bulan Tur Güzergahı-4 rotası yaklaşık 12,5 km olarak planlanmıştır. Tur Güzergahı-4 mevcut yol güzergahından planlanmış ve milli parkın doğal kaynak değerlerinin izlenerek tanındığı rekreasyonel değeri yüksek olan bir güzergahtır.
Marmaris Milli Parkı Uzun Devreli Gelişime Revizyon Planı (2020)'nda Aktaş Mevkii de su sporlarının yapılmasına yönelik yat/tekne yanaşma yeri önerilmiş olup, alan planlama safhasındadır. Su sporları alan planlamasının son aşamasına gelinip hizmet verdiği noktaya varmasıyla birlikte milli parkın doğal güzelliklerinin içerisinde doğa temelli rekreatif olanak sağlanan bir alan kazandırılmış olacaktır.
Milli Park içinde ziyaretçilere bungalov konaklama olanağı sağlanması amacıyla, Adaağzı mevkinde, Gökburun Tepe'nin güneyinde, mevcutta kır evlerini barındıran alan, bungalov kamp alanı olarak önerilmiştir. Ancak, bungalov kamp alanında her ne kadar mevcut yapıların bulunduğu gözlemlense de, alanda herhangi bir işletmecilik faaliyeti bulunmadığından rekreasyonel alan kullanımı bulunmamaktadır. Bulunduğu konum itibariyle kıyıya kenarı olan alanda kıyı kesiminin taş duvar dolgu ile kaplanması kıyı doğal görünümü kaybetmiş vaziyettedir.
Bölgede Kırzeytin deresinden beslenerek oluşan doğal Sığla ormanı, doğal yayılım gösteren Kızılçam ormanı ile iç içe geçmiş alanlar bulunmaktadır. Taban suyu yüksek olan bölgede Sığla ağacının doğal yayılım gösterdiği iki alandan birisi olarak öne çıkmaktadır. Bu durumla bağlantılı olarak bölgenin doğal kaynak değerleri öneminin artması ile kontrolsüz rekreasyonel kullanımları da yoğunlaştırdığı bir bölge olarak da tanımlanabilir. Bu bölgeyi kuzeyinden sınırlayan Kırzeytin Deresi'nin oluşturduğu, milli parkın önemli jeomorfolojik özelliklerinden birisi olan delta, aynı zamanda balıklar için beslenme ve yumurtlama alanıdır.
Milli Park alanı içerisinde ziyaretçilerin günübirlik rekreasyon ihtiyaçlarını karşılamaları için çalışma alanı içerisinde iki günübirlik kullanım alanı bulunmaktadır. Aktaş bölgesinin tamamen denize kıyısının olması, bölge de özellikle otel bölgeleri dışında konaklama adına kamp alanının olmaması sebebiyle Aktaş bölgesine olan ilgi ve kullanımları arttırmakta, bu durum ziyaretçiler tarafından sıkça ziyaret edilen bir bölge olmasına sebep olmaktadır.
Milli park alanında günübirlik kullanım alanı olarak belirlenen bölgelerde de Marmaris Milli Park Müdürlüğü'nce kamp yapılamayacağı bilgisi ziyaretçilere verilerek bu durumun önüne geçilmektedir. Bu durum ise bazen ziyaretçilerin rekreasyonel aktivitelerini gerçekleştirememelerine ya da rekreasyonel aktivitelerin günübirlik gerçekleştirilememesine neden olmaktadır. Ziyaretçilerin Aktaş bölgesinde kamp yapabilecekleri belirlenen günübirlik kullanım alanlarında herhangi bir sosyal donatıya rastlanılmamış olup, ziyaretçiler kendi imkanları ile günübirlik rekreasyonel faaliyetlerini gerçekleştirmektedir.

Aktaş bölgesi konumu itibariyle bölge için geçiş bölgesi olarak da öne çıkmaktadır. Ziyaretçilere rekreasyonel faaliyet olarak bölgenin doğal güzellikleri içerisinde kamp alanı arayışını gidermek adına Milli Park Müdürlüğü'nce Adaağzı mevkinde, Nimara Adası'na ulaşan asfalt yolun doğusunda çadırlı kamp alanı ve hemen yanında karavanlı kamp yapılabilmesi önerilmiştir. Bu alanda çadırlar, idari birim, hizmet birimi, sıhhi tesis (tuvalet, mutfak vb. kullanımları içeren), uyarı, tanıtım ve bilgilendirme panoları, çeşme, çöp kutuları, duş, soyunma kabinleri ile otopark alanlarının yer alabileceği alanlar olarak planlama aşamasında olduğu bilinmektedir. Planlanan alanın kullanıma açılmasıyla ziyaretçilerin milli parkın doğal güzellikleri arasında çadırlı konaklama ihtiyaçlarının karşılanması gerçekleşirken, milli parkın rekreasyonel faaliyetleri de artmış olacaktır.

Milli Park Üzerindeki Rekreasyonel Baskılar

Günnücek Sığla Ormanı

Günnücek Sığla Ormanı dört mevsim yoğun olarak rekreasyonel amaçlı ziyaret edilmekte olup, rekreasyonel faaliyetlerden kaynaklanan çevre sorunlarını belirlemeye yönelik olarak her mevsim döneminde arazi gözlemleri yapılmıştır. Günnücek Sığla Ormanındaki sığla topluluklarının rekreasyonel baskıdan neredeyse en fazla etkilenen peyzaj değeri olduğu gözlemlenmiştir. Yine alan içerisinde Marmaris Milli Park Müdürlüğü idari binasının bulunması alandaki rekreasyonel aktiviteler ve koruma kontrol faaliyetlerinin ilgili personel tarafından sağlanması yönünden olumlu yönde katkı sağlamaktadır.

Marmaris ve yakın çevresinde planlanmış ve düzenlenmiş tek alan olan Günnücek Sığla Ormanı, bölgedeki artan rekreasyon taleplerini karşılayamaması sonucunda yoğun rekreasyonel baskıya maruz kalmaktadır. Bu durum alanda hakim olarak bulunan sığla topluluklarının topraktaki kompaktlaşma ve sıkışmalar sonucu zarar görmesine sebep olduğu gözlemlenmiştir. Marmaris Milli Park Müdürlüğü'nce her ne kadar Günnücek Sığla Ormanı'nın içerisinde yaklaşık 1 km lik uzunlukta ve yerden yaklaşık yer yer 40-50 cm yüksekliklerde ahşap yürüyüş yolları alandaki sığla topluluklarında oluşan rekreasyonel baskının azalması için tasarlansa da, geçmiş zamanlardan gelen kontrolsüz kullanımlar bugün ki topraktaki kompaktlaşma ve sıkışmaların oluşmasına sebep olmuştur.

Milli park hakkında yerel halkın düştüğü en belirgin yanılgı, milli parkın sadece Günnücek Sığla Ormanı'ndan ibaret olduğunun bilinmesi ve bundan dolayı alandaki ziyaretçi sayısının artışı aşırı rekreasyonel baskıya sebep olmaktadır.

Pamucak-İçmeler Sahili

Milli Parkın Pamucak-İçmeler sahili Turizm Merkezi sınırı içerisinde yer alması ile birlikte alan kullanımları turizm ağırlıklı rekreasyonel faaliyetlerden oluşması göz önüne alındığında rekreasyonel baskılarında turizm faaliyetlerinden kaynaklı gerçekleştiği anlaşılmıştır.

Marmaris Milli Park Müdürlüğü'nce alan içerisinde belirlenen alan kullanım fonksiyonlarının günübirlik kullanım ve konaklamalı kullanım niteliği taşıması rekreasyonel baskı oranını değiştiren bir etken oluşturmaktadır. Yapılan gözlemler neticesinde, ziyaretçiler tarafından yaz aylarında özellikle sahilin kontrolsüz kullanım yoğunluğu ile rekreasyonel baskı artmaktadır. Alan içerisinde Milli Park Müdürlüğü'nce Kültür Turizm Bakanlığı'na tahsis edilen ve mevcutta halk plajı yapım işi kapsamında uygulama süreci devam eden projenin tamamlanmasıyla birlikte ziyaretçiler tarafından oluşan kullanımlar sınırlandırılmış olacağından mevcut rekreasyonel baskının da sınırlandırılacağı beklenmektedir.

Turizm faaliyetlerinden kaynaklı rekreasyonel baskı alan içerisinde yer alan Günübirlik Kullanım Alanı-1 noktasının büfe ve plaj işletmeciliği işi kapsamında değerlendirildiğinde, büfe işletmecisinin hizmet sağlayabileceği kapasite kadar kullanım alanı sınırlaması oluştuğu ve böylelikle alandaki rekreasyonel kullanımı da sınırlandırmış olduğu gözlemlenmiştir.

Cennet Adası

Bakir kıyıları, yaban hayatı ve endemik türler açısından zengin olan ve Marmaris körfezinin önemli bir bölümünü kapsayan Cennet adasında yapılan gözlemler sonucunda alanın ender ekolojik özelliklere sahip olması bağlamında turizm merkezi sınırı içerisinde yer alması dikkat çekmektedir. Alan içerisinde özel mülkiyete konu alanların bulunduğu alanlar ve bunun dışında yine çalışma alanı içerisinde olup milli park dışında bırakılan özel mülkiyet alanları yer almaktadır. Özel mülkiyetlerin alan içerisinde ortaya çıkardığı rekreasyonel baskılar alan kullanımlarının turizme hizmet eden otel kullanımlarının olmasından kaynaklı ulaşım sağlanan yolun milli park alanı içerisinde önemli güzergahlardan ilerlemesi ile ilgilidir.

Cennet Adası içerisindeki özel mülkiyet alanlarının ilgili kurum olan Marmaris Milli Park Müdürlüğü'nden zorunlu temel ihtiyaçlarını karşılaması adına içme suyu isale hattı, enerji nakil hattı, haberleşme hattı veya ulaşım yolu gibi kullanımlar için izin taleplerinin söz konusu olmasıyla, milli parkın önemli peyzaj değerlerini bölerek ilerlemesine veya ender ekosistem özelliklerini de zarar verecek bir etki yaratmaktadır. Özellikle bölgede yalnızca milli park içerisindeki yayılışı Cennet Adası içinde olan ve tehlikede (EN) kategorisinde yer alan Marmaris semenderi yaşam alanı üzerinde ciddi bir tehdit unsuru oluşturacaktır.

Özellikle yaz aylarında ziyaret edilen bu alanda, rekreasyonel faaliyetlere hizmet edecek nitelikte olan manzara seyir terası etrafında çevre kirliliğine sürekli olarak rastlanılmaktadır.

Alanın içerisinde yer alan tur güzergahı-4 noktasında uygulanan granit küptaş yer döşemesi her ne kadar doğal malzeme olduğu için uygulama yapılsa da, uygulama kısmında bordürler için kullanılan beton malzeme alanın kendine özgü peyzaj kalitesini olumsuz yönde etkilemektedir.
Cennet Adası içerisinde yer alan Nimara Mağarası, milli parkın yerli ve yabancı ziyaretçilerinin en sık ziyarette bulunduğu, doğal ve kültürel peyzaj değerlerinin bir arada izlenebildiği rekreasyonel değeri yüksek olan bu bölgede yapılan gözlemler neticesinde, ziyaretçilerin böylesine önemli bir kültürel değerin önemini bilmemesi sebebiyle mağara içerisinde ateş yakıldığına dair görüntülerle karşılanmış, çevre kirliliklerinin olduğu, mağara duvarlarında bulunan resim ve yazılar yazıldığı tespit edilmiştir. İlgili kurum olarak bulunan Marmaris Kültür Turizm Ofisi tarafından bu gibi sorunların önüne geçilemediği ve bu sebeple alanın tel çitlerle ziyaretçi girişine kapatıldığı bilgisine erişilmiştir. Bu durum doğal kaynak değerlerinin korunması yanında kültürel kaynak değerlerinin de korunması ve gelecek nesillere aktarılması konusunda tehlike arz etmektedir.

Adaköy-Aktaş Mevkii

Araştırma kapsamında Milli park alanı içerisinde insan faaliyetlerinin en çok hissedildiği alan olan Adaköy-Aktaş Mevkii, ziyaretçilerin günübirlik faaliyetlerini sıkça gerçekleştirdiği bir bölge olması ile her ne kadar alan günübirlik alan kullanım alanı tanımı yer alsa da doğal kaynakları dışında herhangi bir günübirlik kullanım alanı özelliği taşımayan fonksiyonu olduğu için ziyaretçiler tarafından kontrolsüz ve alan kapasitesinin üzerinde rekreasyonel faaliyetlere açıktır. Bu durum alandaki ziyaretçi kullanımlarını sınırlandırmayan bir faktör olarak saptanmış, rekreasyonel baskıyı arttıran bir husus olarak ortaya çıkmıştır.
Ziyaretçilerin Adaköy-Aktaş Mevkiiyi milli park sınırları içerisinde kaldığı bilincinde olmayıp, denize kıyısının da olması nedeniyle yaz mevsiminde sıkça çadır kurarak konaklama yaptıkları bir alan haline dönüştürmektedir. Bu durum alandaki üst örtünün tahribine veya zaman zaman kontrolsüz kullanımlardan kaynaklı yangın vb. olayların yaşanmasına sebep olmaktadır. Alanda, özellikle yaz aylarında konaklama amaçlı rekreasyonel faaliyette bulunmak isteyen ziyaretçilere Marmaris Milli Park Müdürlüğü personeli tarafından milli park alanında bu tür konaklama faaliyetlerin yapılamayacağı bilgisi verilerek koruma faaliyetleri yapılmaya devam edildiği tespit edilmiştir.
Çalışma alanı içerisine bağlantı yol güzergahının varlığı ile deniz kıyısındaki günübirlik kullanımlarını artırırken alanın araç trafiğinden kaynaklı baskı altında olduğu tespit edilmiştir. Milli Park Müdürlüğü tarafından bahsi geçen güzergahın araç trafiğine kapatılması ile alanın rekreasyonel baskısını olumlu yönde etkileyeceği düşünülmektedir.
Su sporları alan planlamasının devam ettiği alanda mevcut olarak ziyaretçiler tarafından kontrolsüz biçimde kullanımlar söz konusudur. Bu kontrolsüz kullanımlar beraberinde çevre kirliliği sorunlarını da beraberinde getirdiği gözlemlenmiştir. Alan içerisinde ziyaretçilerin araçlarını kumsala kadar yakınlaştırarak alan kapasitesinin üzerinde rekreasyonel faaliyetlerde bulunma durumları alanın özgün peyzaj değerlerini ciddi derece etkilemiş, sığla topluluklarının da olduğu bu alanın rekreasyonel baskılarının arttığı ortaya çıkmıştır.
Bungalov kamp alanı bölgesi olarak belirlenen alanda mevcutta herhangi bir faaliyet gerçekleşmemesine rağmen, kıyı kesiminin taş duvar dolgu ile kaplanması ile rekreasyonel baskının devam ettiği bir durum söz konusudur.

Sonuç ve Öneriler

Milli parklar, sahip oldukları eşsiz doğal, kültürel, tarihi, topoğrafik veya jeolojik özellikleri nedeniyle korunan, aynı zamanda rekreasyon alanı olarak planlanan ve halkın yararına sunulan alanlardır. Kontrolsüz kullanımları sonucunda, rekreasyon kaynaklarının doğal ve kültürel karakterinde bozulmalar meydana gelmekte ayrıca rekreasyonel deneyim kalitesinde düşüşler yaşanmaktadır. Oysa milli parkların koruma altına alınmasındaki temel maksat alanın sahip olduğu doğal ve kültürel kaynak değerlerinin bozulmadan gelecek nesillere aktarılabilmesidir. Günnücek Sığla Ormanı'nın rekreasyonel baskılarını azaltıcı nitelikte öncelikli olarak alan kullanım kapasite hesaplarının yapılarak ziyaretçi yönetim planlamasının gerçekleştirilmesi ile ziyaretçi sayısının kontrol altında tutulması, alan kapasitesinin aşılmayacağı bir sistemle yönetilmesi ve bu sayede rekreasyonel baskının azaltılabileceği düşünülmektedir.
Milli park hakkında yerel halkın, yerli ve yabancı ziyaretçilerin düştüğü en belirgin yanılgı milli parkı yalnızca Günnücek Sığla Ormanı olarak bilmeleridir. Milli parkın sınırları konusunda herhangi bir fikirleri bulunmamaktadır. Diğer belirgin bir yanılgı da körfezin milli park olduğunun bilinmemesidir. Bu durum, yetkili kurumlarca iş birliği sağlanarak alanın korunan alan olduğunu belirten, doğal ve kültürel kaynak değerlerini anlatan bilgilendirme ve tanıtım materyalleri kullanılarak farkındalık oluşturarak çözülebilir.

Günnücek Sığla Ormanı içerisinde yer verilen biyoçeşitlilik tanıtım materyallerinin tasarlandığı noktalar çoğaltılarak, doğa eğitimlerinin düzenli olarak programlanması ve daha çok kitleye hitap edilmesi beklenmektedir. Ayrıca Marmaris ilçesinin turizm şehri olması da göz önüne alınarak milli park içerisindeki konaklama tesislerinde konaklama yapan ziyaretçilere bulundukları alanın milli park olduğunu bildiren tanıtım levhaları veya bilgilendirme broşürleri ile aktarılması gerektiği düşünülmektedir.
Pamucak İçmeler sahilinde planlaması devam eden halk plajında ve bunun gibi uygulamalarda mutlak suretle planlama aşamasında alanın taşıma kapasitesinin belirlenmesi, uygulama esnasında bu durumunda göz ardı edilmemesi gerekmektedir.

Milli park içerisinde planlanan yürüyüş yolları ve tur güzergahlarının milli parkın kaynak değerlerinin tanınabilirliği ve rekreasyonel değerine katkı sağlaması açısından milli park ziyaretçilerini bilgilendirme, yönlendirme, tanıtım amaçlı tabelalara yer verilmesi gerekmektedir. Nimara Mağarasında gözlemlenen rekreasyonel baskılara çözüm olacak nitelikte, yetkili kurumlarca iş birliği yapılarak alanın güvenliğinin ve yoğun ziyaretçi dönemlerinin kontrolünün sağlanması gerekmektedir.

Çalışma kapsamında rekreasyonel alan kullanım tanımlaması yapılan alanların, rekreasyonel faaliyet için gerekli fiziki olanaklarının olmadığı saptanmıştır. Bu bağlamda, Marmaris Milli Parkı doğal, kültürel ve rekreasyonel kaynak değerlerine sahip olduğundan koruma alanlarının korunarak devamlılığının sağlanması, koruma-kullanma dengesi içerisinde gelecek kuşaklara bir miras olarak bırakılabilmesi amacıyla, koruma altına alınan alanların uzun devreli gelişme planlarında strateji ve hedeflerin uygulanabilmesi büyük önem arz etmektedir. Bu amaçla, Marmaris Milli Parkının tüm kaynak değerleri ulusal ve uluslararası kabul görmüş standartlar ve uygulamalarla sürdürmek, uzun devreli gelişme revizyon planındaki strateji ve hedeflere yönelik uygulamaları hayata geçirmek, uygulamada karşılaşılan problemleri gidermek ve faaliyetlerin daha etkin ve verimli yürütülmesini sağlamak maksadıyla görev alanlarının/sınırlarının yeniden belirlenerek Bakanlığımız Makamının 18.11.2014 tarihli ve 254 sayılı Olur'u ile, Marmaris Milli Park Müdürlüğü'ne bağlı olarak Adaağzı Milli Park Şefliği ve İçmeler Milli Park Şefliği kurulmuştur.

Ayrıca, bu çalışma 2020 yılı içerisinde yürütülmüştür. Ancak, 2021 yılı içerisinde Marmaris Milli Parkı sınırları içerisinde ve çalışma alanı sınırlarının görsel peyzaj kalitesini ortaya koyan iki farklı bölgede, farklı tarihlerde orman yangını meydana gelmiştir. 27 haziran 2021 tarihinde 38 ha büyüklüğünde ormanlık alan zarar görürken, 29 temmuz.2021 tarihinde ise 2516 ha büyüklüğünde bir orman varlığı zarar görmüştür. 2021 yılı içerisinde yaşanan orman yangınlarıyla mücadele kapsamında Valilik Makamınca 04 ağustos 2021 tarihli ve 2021/2 sayılı kararı gereğince; 6831 sayılı Orman Kanunun 74. Maddesi ve 5442 sayılı İl idaresi Kanununun 9. ve 66. Maddeleri gereğince Muğla İl sınırları içerisindeki ormanlık alanlara 1 ekim 2021 tarihine kadar görevli personel dışındaki kişilerin girmesi ve il sınırları içerisindeki ormanların çevrelerinde mola verilmesi, piknik yapılması, mangal, semaver ve ateş yakılması yasaklanmıştır. Yine, Valilik Makamının 30 mayıs 2022 tarih ve 2022/2 sayılı kararı ile sınırları belirtileri ormanlara ve ormanlık alanlara girişler 1 haziran-31 ekim 2022 tarihleri arasında yetkili makamların iznine tabi tutulmuştur. Bu kararı ile belirtilen sahaların çevresinde ve içinden geçen yollarda, orman kenarlarında etkinlik ve piknik yapmak, ateş yakmak ve konaklamak yasaklanmıştır.

Söz konusu orman yangınlarının milli parkın sahip olduğu doğal kaynak değerler üzerinde, özellikle turizm amaçlı rekreasyonel faaliyetlerin olduğu bölgede gerçekleşmesi, ileriki çalışmalarda milli parkın rekreasyonel durumunun ve üzerindeki rekerasyonel baskıların tekrar değerlendirilmesinin ne kadar büyük önem arz ettiğini göstermektedir.

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A Study on Morphological Characteristics of Some Angiosperm Ornamental Plant Seedlings

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Abstract

The aim of this study was to examine the morphological growth of containerized seedlings of some angiosperm ornamental plants that are frequently used in urban plantation. For this purpose, shoot height, root collar diameter and number of branches were determined in 30 saplings for 10 species grown in Antalya Forest Nursery. According to TSE (1988) seedling quality class, 1+0 aged jujube and orchid tree species were included in the quality seedling class. In the seedlings of 2+0 aged tree species, the almond showed higher performance in terms of both the shoot height and root collar diameter compared to the other species. In addition, positive correlations were found between seedling height and root collar diameter in Mediterranean laurel, walnut, jujube, almond and buckthorn species.

Key Words: *Angiosperm, Quality Seedling, Antalya, Ornamental Plant*

Bazı Kapalı Tohumlu Süs Bitkisi Fidanlarının Morfolojik Özellikleri Üzerine Bir Araştırma

Özet

Bu çalışmanın amacı, kent ağaçlandırmalarında sıklıkla kullanılan bazı kapalı tohumlu süs bitkilerinin tüplü fidanlarının morfolojik gelişimlerini incelemektir. Bu amaçla Antalya Orman Fidanlığı'nda yetiştirilen her tür için 30 fidanda fidan boyu, kök boğazı çapı ve dal sayısı karakterleri belirlenmiştir. TSE (1988) fidan kalite sınıfına göre, 1+0 yaşlı hünnap ve orkide ağacı türleri kaliteli fidan sınıfında yer almışlardır. 2+0 yaşlı ağaç türlerinin fidanlarında ise, badem türü hem fidan boyu hem de kök boğazı çapı bakımından diğer türlere göre daha yüksek performans göstermiştir. Ayrıca, Akdeniz defnesi, ceviz, hünnap, badem ve iğde türlerinde fidan boy ile kök boğazı çapı arasında pozitif yönlü ilişkiler bulunmuştur.

Anahtar Kelimeler: *Kapalı Tohumlu Ağaçlar, Kaliteli Fidan, Antalya, Süs Bitkisi*

Giriş

Günümüzde insan nüfusunun artmasıyla birlikte yapılaşma da hızla artmaktadır. Gün geçtikçe artan yapılaşmanın yanında ortaya çıkan çevre sorunları kent ağaçlandırılması ve yönetiminin giderek önem kazanmasına neden olmaktadır. Önceden ağaçların kent ekosistemine ve kent insanına sağladığı hizmet ve katkılar doğal kaynakların aşırı ve bilinçsizce tüketilmesinden kaynaklı göz ardı edilmiş olsa da şu anda kentlerde ve kırsal peyzaj alanlarında insanların ilgisini fazlasıyla çekmektedir.

Ağaçlar kentlerin biçimi için hayati öneme sahiptirler, kentsel yapıdan ayrılamazlar ve bütün bir kenti birbirine bağlayan tasarımsal ögelerdir (Urban, 2008). Ekosisteminde ağaç bulunmayan kent yarım kalmış bir kent olarak nitelendirilebilir. Kent içerisindeki beşerî yapısal unsurlar ne kadar modern ve özenilmiş olsa dahi ağaçsız bir kent içinde bulundurduğu insanların psikolojisini olumsuz yönde etkileyecektir (Ata, 2015). Ağaçlar birçok açıdan insan hayatını etkiler, türlerine göre sahip oldukları estetik, sağlık, kültür ve işlevsel değerleri sayesinde kentlerde kullanımı önem arz etmektedir. Kentin doğayla bütünleşmesini sağlarlar. Bulundukları çevrenin ekosistemini belirler ve kendilerine has mikro klimalar oluştururlar. Kent içerisinde iklimin düzenlenmesi, yaz ve kış aylarında harcanan enerjinin kullanımının azalmasında önemli rol oynarlar böylece hava kirliliğinin azalmasını sağlarlar (Dirik ve Ata, 2005).

Kentlerde kullanılması gereken ağaç türlerinin fidanları kalite bakımından üstün olması gerekmektedir. Kaliteli fidanın önemli özelliklerinden birisi morfolojik özelliklerdir (Gezer ve Yücedağ, 2013). Bilir ve ark. (2009) tarafından fidan boyu ve kök boğaz çapı önemli morfolojik özellikler olarak belirtilmiştir. Kent ağaçlandırmalarında kalite fidanların kullanılmasıyla sadece fidanların hayatta kalması sağlanmayacak, aynı zamanda ülke ekonomisi zarar verilmemiş olacaktır. Bu bağlamda, bu çalışmada kent ağaçlandırmalarında sıklıkla kullanılan bazı kapalı tohumlu süs bitkilerinin fidanlarının fidanlık koşullarında morfolojik gelişimleri incelenmiştir.

Materyal ve Yöntem

Çalışma Antalya Orman Fidanlığı'nda (30° 31′ doğu, 36° 36′ kuzey) yürütülmüştür. Denizden yüksekliği ortalama 40-50 m'dir. Fidanlık güney tarafından çevre yoluna bağlanması nedeniyle ulaşım kolaylığına sahiptir. Fidanlığın toplam alanı 162 000 m²'dir. 83 200 m²'si fidan üretim alanıdır (Şekil 1).



Şekil 1. Antalya Orman Fidanlığı konumu

Fidanlığın pH değeri ortalama 8.3 olup, orta alkali toprak grubuna girmektedir. Her ne kadar azot miktarı az olsa da, fosfor ve sodyum mineralleri yeterli düzeydedir. Antalya'da ortalama yıllık yağış miktarı 1060 mm, ortalama sıcaklık değeri 18,8 °C ve ortalama güneşlenme süresi ise 8,2 saattir (URL-1, 2022).
Araştırmada altı 1+0 ve dört 2+0 yaşlı olmak üzere 10 süs bitkisine ait tüplü fidanlarda ölçümler gerçekleştirilmiştir (Tablo 1). Türlerin tohumları ekim işleminden önce ağzı kapalı hava ve ışık almayan galvanizli kaplar içinde saklanmıştır. Tohum ekimleri aralık-ocak aylarında yapılmıştır. Ekim derinliği her tür için tohum büyüklüğünün 3 katı olacak şekilde ayarlanmıştır. Büyüme ortamı olarak kullanılan tüplerin boyutları 15x30 cm'dir. Tüp materyali 5 birim toprak, 2 birim hayvan gübresi, 2 birim humus ve 1 birim dere kumu karışımıdır. Fidanlara denge gübresi verilmiş, rutin sulama ve ot alma işlemleri yapılmış ama malçlama ve çapalama işlemleri yapılmamıştır.

Tablo 1. Çalışmada kullanılan türlerin orijinleri ve fidan yaşları

Türkçe adı	**Latince adı**	**Orijini**	**Kullanılan fidan yaşı**
Akdeniz defnesi	*Laurus nobilis* L.	Antalya-Manavgat	1+0
Ceviz	*Juglans regia* L.	Elazığ-Keban	
Gülibrişim	*Albizia julibrissin* Willd.	Antalya-Merkez	
Hünnap	*Ziziphus jujuba* Mill.	Isparta-Sütçüler	
Keçiboynuzu	*Ceratonia siliqua* L.	Antalya-Gazipaşa	
Orkide ağacı	*Bauhinia variegata* L.	Antalya-Merkez	
Badem	*Prunus amygdalus* L.	Isparta-Eğirdir	2+0
Erguvan	*Cercis siliquastrum* L.	Antalya-Merkez	
İğde	*Elaeagnus angustifolia* L.	Isparta-Yalvaç	
Tespih ağacı	*Melia azedarach* L.	Manisa-Akhisar	

Tür başına 30 fidanda ölçümler yapılmıştır. Her fidanın boyu, kök boğazı çapı ve dal sayısı morfolojik özellikleri belirlenmiştir. Fidan boyu cetvel yardımıyla 1 mm hassasiyette, KBÇ ise fidanın toprak altı ile toprak üstü kısmının birleştiği yerdeki çapı olup, 0.01 mm hassasiyetli elektronik kumpas yardımıyla saptanmıştır.
Elde edilen verilere tek-yönlü varyans analizi, Duncan testi ve korelasyon analizleri uygulanmıştır. Analizler için SPSS programı kullanılmıştır. Analizler bitkilerin yaşı dikkate alınarak yapılmıştır.

Bulgular ve Tartışma

1+0 yaşlı türler içinde en yüksek fidan boyuna (42,5 cm) ceviz, kök boğazı çapı (6,5 mm) ve dal sayısına hünnap (12) sahip olmuştur. En düşük boy keçiboynuzunda (18,2 cm), kök boğazı çapı cevizde (1,1 mm) ve dal sayısı ceviz, gülibrişim ve keçiboynuzu türlerinde (1) belirlenmiştir. Tüm morfolojik özellikler üzerine tür faktörü 0,001 önem düzeyinde etkili bulunmuştur (Tablo 1; Şekil 2). 1+0 yaşlı ceviz fidanlarında önceki bir çalışmada (Yıldız, 2001) bu çalışmadaki fidan boyundan daha az, kök boğazı çapından daha fazla değerler elde edilmiştir. Keçiboynuzu fidanları üzerine yapılan bir araştırmada (Şahin ve ark., 2004) 1+0 yaşlı fidanların ortalama 20,2 cm boy ve 6,2 mm kök boğaz çapı yaptığı tespit edilmiştir.
Kapalı tohumlu orman ağacı fidanları için Türk Standartlar Enstitüsü'nün belirlemiş olduğu kalite sınıflarına göre (Anonim, 1988), 1+0 yaşı bir fidanın boyu 30 cm'den büyük ve kök boğazı çapı 4 mm'den büyük olması gerekmektedir. Buna göre, ortalama fidan boyları bakımından ceviz, hünnap ve orkide ağacı, ortalama kök boğazı çapları bakımından ise Akdeniz defnesi, hünnap ve orkide ağacı kaliteli fidan sınıfına girmektedir. Görüldüğü üzere, ceviz türü her ne kadar fidan boyu bakımından kaliteli fidan sınıfına girmiş olsa da, kök boğazı çapı bakımından sınıfın dışında kalmıştır. Özpay ve Tosun (1993) ile Yücedağ ve Gailing (2012)'nin belirttikleri üzere, ağaçlandırmalarda fidanlarda daha yüksek yaşama oranı ve daha iyi bir büyümenin büyük fidanlardan elde edilebileceğini de unutmamak gerekir.

Tablo 1. Morfolojik özellikler üzerine 1+0 yaşı türlerin etkisi

	Morfolojik Özellikler		
Türler	**Boy (cm)**	**Kök Boğazı Çapı (mm)**	**Dal Sayısı**
Akdeniz defnesi	28,5c[1]	4,0bc	2b
Ceviz	42,5a	1,1d	1c
Gülibrişim	20,6d	3,6c	1c
Hünnap	32,5b	6,5a	12a
Keçiboynuzu	18,2d	3,5c	1c
Orkide ağacı	41,0a	4,3b	2b
Ortalama	30,6	3,8	3
Min-Mak	10-55	1-9	1-19
F	66,7	120,2	273,1
P	0,000	0,000	0,000

[1]: sütunlarda benzer harflerle gösterilen ortalamalar önemli derecede farklı değildir (p<0,05)

2+0 yaşlı türler arasında en yüksek fidan boyuna (75,9 cm) iğde, kök boğazı çapına (9,1 mm) badem ve dal sayısına (14) iğde türleri sahip olmuştur. En düşük fidan boyu (34 cm) erguvanda, kök boğazı çapı (1,4 mm) iğdede ve dal sayısı (2) erguvan ve tespih ağacı türlerinde ortaya çıkmıştır. Tüm morfolojik özellikler üzerine tür faktörü yine 0,001 önem düzeyinde etkili bulunmuştur (Tablo 2; Şekil 2).

Tablo 2. Morfolojik özellikler üzerine 1+0 yaşı türlerin etkisi

	Morfolojik Özellikler		
Türler	**Boy (cm)**	**Kök Boğazı Çapı (mm)**	**Dal Sayısı**
Badem	67,2b[1]	9,1a	4b
Erguvan	34,0d	4,5b	2c
İğde	75,9a	1,4c	14a
Tespih ağacı	58,5c	5,4b	2c
Ortalama	58,9	5,1	5
Min-Mak	21-95	1-65	1-19
F	92,9	10,5	383,3
P	0,000	0,000	0,000

[1]: sütunlarda benzer harflerle gösterilen ortalamalar önemli derecede farklı değildir (p<0,05)



Şekil 2. Badem, Erguvan ve Tespih Ağacı fidanlarına ait görünüm

Akdeniz defnesi, ceviz, hünnap, badem ve iğde türlerinde fidan boy ile kök boğazı çapı arasında pozitif yönlü ilişkiler bulunmuştur. Erguvan ve tespih ağacı türlerinde fidan boyu ile dal sayısı arasında pozitif yönde bir ilişki vardır. Öte yandan, hiçbir türde kök boğazı çapı ile dal sayısı arasında bir ilişki bulunmamıştır (Tablo 3). Benzer şekilde, Yücedağ ve Gailing (2012) tarafından dört farklı kapalı tohumlu orman ağacı fidanlarında yapılan çalışmada da, tüm türlerde fidan boyu ile kök boğazı çapı arasında kuvvetli ve önemli ilişkiler tespit edilmiştir. Aynı zamanda, Aydın orijinli fıstıkçamı fidanlarında morfolojik özellikleri araştıran bir çalışmada da (Bilir ve ark., 2010) fidan boyu ile kök boğazı çapı arasında ilişkiler bulunmuştur.

Tablo 3. Türe göre fidan morfolojik özellikleri arasındaki ilişkiler

		Boy	Kök Boğazı Çapı	Dal Sayısı
Akdeniz defnesi	Boy	-		
	Kök Boğazı Çapı	0,544**	-	
	Dal Sayısı	-0,098ns	0,120ns	-
Ceviz	Boy	-		
	Kök Boğazı Çapı	0,366*	-	
	Dal Sayısı	0,279ns	0,041ns	-
Gülibrişim	Boy	-		
	Kök Boğazı Çapı	0,281ns	-	
	Dal Sayısı	-0,26ns	-0,022ns	-
Hünnap	Boy	-		
	Kök Boğazı Çapı	0,594**	-	
	Dal Sayısı	-0,022ns	0,020ns	-
Keçiboynuzu	Boy	-		
	Kök Boğazı Çapı	0,359ns	-	
	Dal Sayısı	-0,021ns	0,019ns	-
Orkide ağacı	Boy	-		
	Kök Boğazı Çapı	0,266ns	-	
	Dal Sayısı	-0,022ns	0.040ns	-
Badem	Boy	-		
	Kök Boğazı Çapı	0,432*	-	
	Dal Sayısı	0,137ns	0,027ns	-
Erguvan	Boy	-		
	Kök Boğazı Çapı	-0,285ns	-	
	Dal Sayısı	0,543**	-0,034ns	-
İğde	Boy	-		
	Kök Boğazı Çapı	0,799**	-	
	Dal Sayısı	0,271ns	0,270ns	-
Tespih ağacı	Boy	-		
	Kök Boğazı Çapı	-0,225ns	-	
	Dal Sayısı	0,681**	-0,209ns	-

İlişki 0.05 (*) ve 0,01 (**) düzeylerinde önemli ya da önemsizdir (ns).

Günümüzde insan nüfusunun artmasıyla birlikte kentlerde ağaçlandırma ihtiyacı giderek artmaktadır. Kullanılacak fidanların kalite standartları bakımından dengeli bir gelişim sergilemeleri önem taşımaktadır. Bu bağlamdan bu çalışmanın sonuçlarına göre, 1+0 yaşlı ağaç türlerinden hünnap ve orkide ağacı kaliteli fidanlar vermiştir. 2+0 yaşlı ağaç türlerinden ise kalite sınıflaması olmadığından, hem fidan boyu hem de kök boğazı çapının diğer türlere göre daha yüksek olması bakımından badem ağacı yüksek performans göstermiştir.

Teşekkür
Antalya Orman Fidanlığı personeline emsalsiz yardım ve destekleri için teşekkür ederiz.

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The Effects of Demographic Characteristics on Plant Preference of People Living in Detached Houses: The Case of Fethiye, Turkey

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Abstract

The aim of this study was to determine the plant preferences of the people living in a detached house in Fethiye and the demographic factors affecting their preferences. For this purpose, a face-to-face questionnaire was applied to a total of 100 people. According to the results of the study, it was revealed that the majority of the participants preferred diffuse-scattered and fragrant ornamental plants in their gardens, they wanted to deal with the garden, they wanted the visual function of the plants and they wanted the plants to frame the landscape as a design element. It was determined that the most existing species in their gardens are olive and lemon, and the most preferred species are lavender and redbud. The men participants stated that they did not buy ornamental plants or they provided them free of charge and they wanted to grow more vegetables. It was revealed that 36-55 aged participants mostly wanted to deal with garden, while 26-45 aged participants did not buy ornamental plants. It has been determined that officers did not buy more seedlings, while the retired participants provided seedlings from either free of charge or private nurseries. In conclusion, for the sustainability of the Fethiye urban ecosystem, the use of species suitable for urban ecology with their aesthetic and functional characteristics should be increased.

Key Words: *Fethiye, Detached House, Ornamental Plant, Preference, Demography*

Müstakil Evde Yaşayan İnsanların Bitki Tercihi Üzerine Demografik Özelliklerin Etkileri: Fethiye Örneği

Özet

Bu çalışmanın amacı, Fethiye'de müstakil evde yaşayanların bitki tercihlerini ve tercihleri üzerine etkili demografik faktörleri belirlemektir. Bu amaçla, toplam 100 kişiye yüz yüze anket uygulanmıştır. Çalışmanın sonuçlarına göre, katılımcıların çoğunluğunun bahçelerinde yayılıcı-dağınık formlu ve güzel kokulu süs bitkilerini tercih ettikleri, bahçeyle uğraşmak istedikleri, bitkilerde görsel işlevini istedikleri ve tasarım ögesi olarak bitkilerin manzara çerçeveliyici olmasını istedikleri ortaya çıkmıştır. Bahçelerinde en çok mevcut türlerin zeytin ve limon, en çok tercih etmek istedikleri türlerin ise lavanta ve erguvan olduğu belirlenmiştir. Erkekler süs bitkisi almadıklarını ya da ücretsiz temin ettiklerini ve daha çok sebze yetiştirmek istediklerini belirtmişlerdir. 36-55 yaşlı katılımcıların daha çok bahçe ile uğraşmak istedikleri, bunun yanında 26-45 yaşlı katılımcıların ise süs bitkisi almadıkları ortaya çıkmıştır. Memurların daha çok fidan almadığı, emeklilerin ise ya ücretsiz ya da özel fidanlıklardan fidan temin ettikleri saptanmıştır. Sonuç olarak, Fethiye kent ekosisteminin sürdürülebilirliği için estetik ve işlevsel özellikleriyle birlikte kent ekolojisine uygun türlerin kullanımının yaygınlaştırılması gerekmektedir.

Anahtar Kelimeler: *Fethiye, Müstakil Ev, Süs Bitkisi, Tercih, Demografi*

Giriş

İnsanların doğadan uzaklaşması, doğaya olan hasretin ve çevre sorunlarının ortaya çıkmasının sebebi kentleşmenin başlayıp hızlıca ilerlemesidir. Kentleşmeyle birlikte, peyzaj tasarımlarında kullanılan dış mekan süs bitkileri tercihi çok fazla artmıştır. Dış mekan süs bitkilerinin seçiminde ve yetiştirilmesinde insanlar tarafından tercih edilme düzeyleri ve ihtiyaç duyulması önemli unsurlardır. Süs bitkileri kullanıldıkları alana estetik açıdan katkı yapmalarının yanında, sosyal, kültürel, insan ve çevre sağlığı ile turizm açılarından da çok fazla fayda sağlamaktadırlar. Ayrıca, peyzaj çalışmalarında bitkilerin tercih edilmesinde estetik özellikler başta olmak üzere bitkilerin fonksiyonel ve ekolojik özellikleri önem arz etmektedir (Acar ve Sarı, 2010).

Günümüzde süs bitkileri kentsel dokunun oluşmasında en önemli unsurlardır (Aslan ark., 2013). Tasarım ilkeleri çerçevesinde süs bitkileri kompozisyon oluşturacak şekilde kullanılır. Yan yana gelişlerinden, kullanım amaçlarına kadar birçok kompozisyonda bu ilkeler rol oynamaktadır (Taşçıoğlu ve Kuzucu, 2019). Konut ve yakın çevresinin insanlara huzur ve mutluluk verebilecek şekilde süs bitkileriyle tasarlanması gerekmektedir (Taşkan, 2014). Bitkisel tasarımlarda süs bitkilerinin renk, doku, çiçek, form, meyve ve mevsimlik renk değişimleri gibi özelliklerinin yanısıra, biyolojik onarım, erozyon kontrolü, rüzgâr, gölgeleme ve gürültü perdesi oluşturma gibi özelliklerinden de yararlanılmaktadır (Özer ve ark., 2009).

Bugüne kadar Alanya (Yücedağ ve ark., 2018), Burdur (Yücedağ ve ark., 2019), Antalya (Kaya ve ark., 2018) ve Malatya (Aslan ve ark., 2013) kentlerinde kent insanın ev bahçelerindeki bitki tercihi üzerine çalışmalar yürütülmüştür. Ancak, insanların ev bahçelerindeki bitki tercihi üzerine demografik özelliklerin etkilerini inceleyen bir çalışma mevcut değildir. Bu nedenle, bu çalışmada hem Fethiye kent merkezinde müstakil ev

sahiplerinin dış mekân süs bitki tercihleri hem de bu tercihleri üzerine demografik özelliklerin etkilerini ortaya koymak amaçlanmıştır. Çalışmada ulaşılan sonuçların hem Fethiye'de hem de Türkiye'nin benzer ekolojik koşullara sahip diğer kentlerinde yapılacak olan bitkisel tasarım çalışmalarına katkı sağlaması hedeflenmektedir.

Materyal ve Yöntem

Çalışma Muğla ilinin Fethiye ilçesinde (36°37' kuzey, 29°6' doğu) yürütülmüştür (Şekil 1). Akdeniz Bölgesi'nin batısında yer alan Fethiye'nin yüzölçümü 3059 km²'dir. Muğla il merkezi de dahil en geniş yüzölçüme sahip ilçedir. Doğu ve güneydoğusu Antalya ili, güneyi, güneybatısı ve batısı Akdeniz, kuzeybatısı Dalaman ilçesi, kuzeyi Denizli ve Burdur illeriyle çevrilidir (URL-1, 2021). Fethiye ilçesinin toplam nüfusu 170 379'dur (TÜİK, 2021).



Şekil 1. Çalışma alanının konumu

Fethiye'de karakteristik Akdeniz İklim Tipi görülmektedir. Fethiye ve yakın çevresinin yer şekilleri iklim üzerinde etki eden asıl faktördür. Arazinin çok engebeli olması farklı klimatolojik ortamlar yaratmaktadır. İklime etki eden dağların uzanış yönü ve yükseklikleri Fethiye'de insanın temel faaliyetlerine etki ettiği gibi iklim, toprak ve bitki örtüsü gibi faktörlerin kısa mesafelerde değişmesine neden olmaktadır. Yöredeki dağların uzanışı rüzgâr yön ve hızını da etkilemektedir (URL-2, 2021). Fethiye'de yıllık ortalama sıcaklık 21 ºC'dir. Fethiye'de yıllık yağış 882 mm miktarıdır (URL-3, 2022).

Fethiye'de müstakil evde yaşayan 100 kişiye 2020 yılının aralık ayı içerisinde yüz yüze anket uygulaması gerçekleştirilmiştir. Anket formunun hazırlanmasında Yücedağ ve ark. (2019)'nın yapmış oldukları çalışmadan yararlanılmıştır. Anket demografik özellikler, bitkilerde tercih edilen özellikler, formlar ve işlevleri, bahçelerinde mevcut olan türler ve kendi bahçelerinde tercih etmek istedikleri otsu ve odunsu süs bitki türleri üzerine soruları kapsamaktadır.

Elde edilen verilere öncelikle frekans analizi yapılmıştır. Çalışmanın verileri normal dağılım göstermediği için bazı değişkenlerin demografik özellikler açısından ortalamalarının eşit olup olmadığı parametrik olmayan yöntemlerden Mann-Whitney U ve Kruskal Wallis H testleriyle analiz edilmişlerdir. İstatistiksel analizlerde SPSS programı kullanılmıştır.

Bulgular ve Tartışma

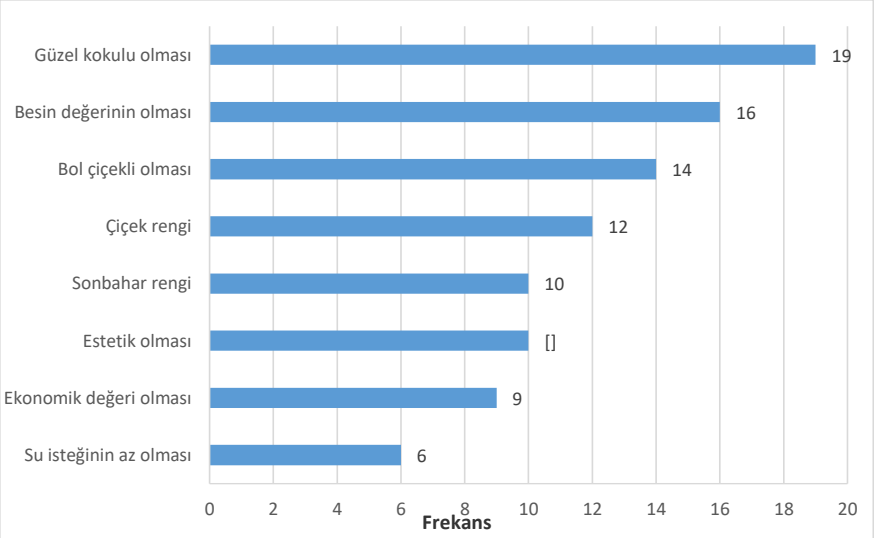
Katılımcıların 53'ü erkek, 47'si ise kadındır. Katılımcıların çoğunluğunu 36-45 orta yaş grubundaki önlisans ve lisans mezunu ev sahibi katılımcılar oluşturmaktadır. Katılımcıların 64'ü evli, 36'sı bekardır. Çoğunluğu diğer meslek grubunu seçmesiyle birlikte, ikinci sırada emekli katılımcılar yer almıştır (Tablo 1).

Katılımcıların 65'inin bahçeyle uğraşmak istediği saptanmıştır (Tablo 1). Bu bulguya benzer şekilde, Yücedağ ve ark. (2018) Alanya'da katılımcıların %87'sinin mümkün olduğunda bahçe işleri ile uğraşmak istediklerini belirtmişlerdir.

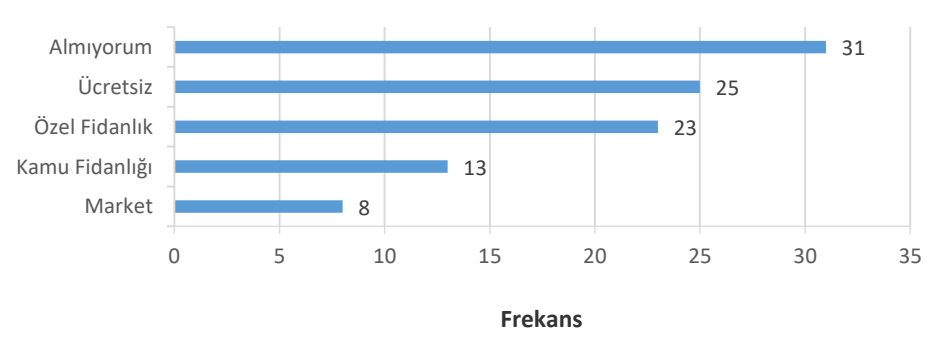
Katılımcılar tarafından süs bitkilerinde en çok tercih edilen özellik güzel kokulu olması, en az tercih edilen ise su isteğinin az olması olarak ifade edilmiştir (Şekil 2). Benzer şekilde, Taşçıoğlu ve Kuzucu (2019) tarafından Kilis kentinde yapılan bir araştırmada da bitkilerle ilgili tercih edilen en önemli özellik olarak kokulu olması bulunmuştur. Son yıllarda dünyada ve Türkiye'de iklim değişikliğinin ve buna bağlı olarak küresel ısınmanın yaşandığı gerçeğine rağmen, katılımcıların az su isteği olan bitkileri en son olarak tercih etmesi oldukça ilginçtir.

Tablo 1. Katılımcıların demografik özellikleri ile bahçeyle uğraşma durumları

Cinsiyet	**f**	**Medeni Durum**	**f**
Kadın	47	Evli	64
Erkek	53	Bekar	36
Yaş		**Meslek**	
18-25	7	Öğrenci	2
26-35	17	Memur	22
36-45	29	İşçi	4
46-55	25	Ev hanımı	14
56-65	12	Emekli	22
66 ve üstü	10	Diğer	30
Eğitim Durumu		**Mülkiyet Durumu**	
İlkokul	-	Kiracı	40
Ortaokul	1	Ev Sahibi	60
Lise	21	**Bahçe ile Uğraşma İsteği**	
Önlisans	24	Evet	65
Lisans	42	Hayır	35
Lisanüstü	12		



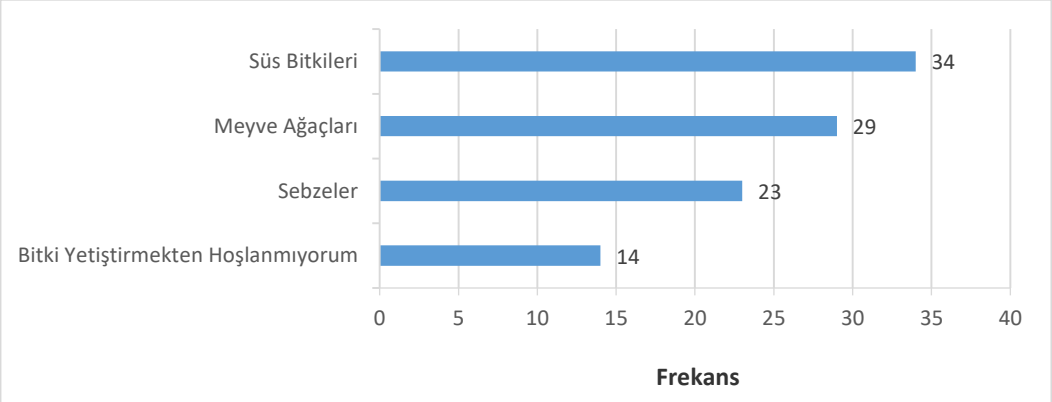
Şekil 2. Katılımcıların Süs Bitkilerinde Tercih Ettikleri Özellikler



Şekil 3. Katılımcıların Süs Bitkilerini Temin Etme Durumları

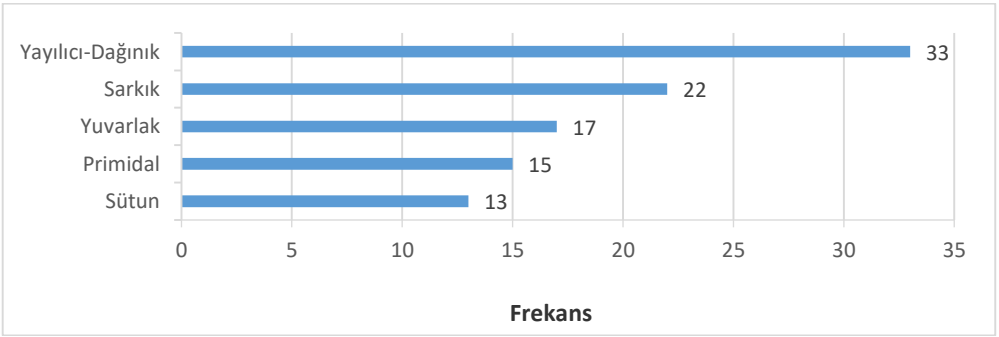
Katılımcıların süs bitkilerinin temini incelendiğinde, çoğunlukla süs bitkisi almadıkları ya da ücretsiz olarak sağladıkları sonucu ortaya çıkmıştır (Şekil 3). Bu çalışmada 36 katılımcı süs bitkisini fidanlıklardan temin etmektedir. Benzer şekilde, Erzurum kentinde yapılan bir araştırmada da (Yılmaz ve Zengin, 2003), kent halkının %34'lük kısmı fidanlıklardan sağlamaktadır.

Katılımcılar birinci sırada süs bitkilerini, ikinci sırada ise meyve ağaçlarını bahçelerinde yetiştirmek istemektedirler (Şekil 4). Kaya ve ark. (2018) Antalya kentinde ve Yılmaz (2006) Tekirdağ kentinde yürüttükleri çalışmalarda elde ettikleri sonuçlar bu çalışmanın bulgularıyla benzerlik göstermektedir.



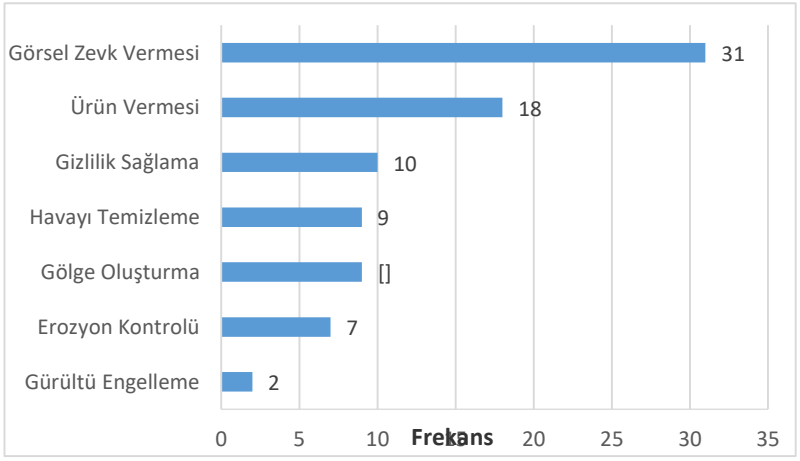
Şekil 4. Katılımcıların En Çok Yetiştirmek İstedikleri Bitkiler

Katılımcılar süs ağaçlarında en çok yayılıcı-dağınık, en az ise sütun formlarını tercih etmektedirler (Şekil 5). Bu sonuçlara karşılık, Yücedağ ve ark. (2018) Alanya kentinde katılımcıların %42'sinin salkım formlu bitkileri tercih ettikleri sonucuna ulaşmışlardır. Bunun yanında, Yılmaz (2006) Tekirdağ'da katılımcıların çoğunluğunun bitkilerin formları konusunda hiçbir fikri olmadığını belirtmiştir.



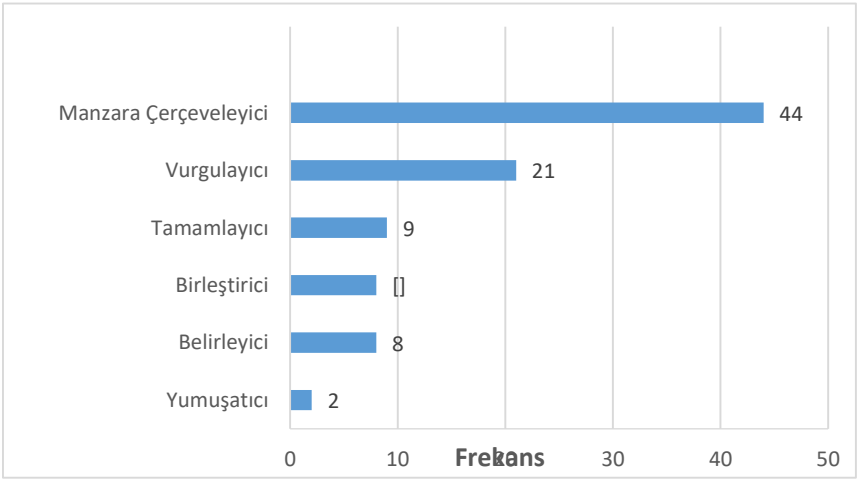
Şekil 5. Katılımcıların Süs Ağaçlarında En Çok Tercih Ettikleri Formlar

Katılımcıların süs bitkilerinde en çok görsel zevk verme işlevini tercih etmişlerdir. Buna karşılık, ilginç şekilde bitkilerin ekolojik hizmetlerinden olan havayı temizleme, gölge oluşturma, erozyon kontrolü gibi işlevlerini fazla tercih etmemişlerdir (Şekil 6). Bu çalışmanın bulgularına karşılık, Aslan ve ark. (2013) Malatya kentinde katılımcıların büyük oranda gölge yapan türleri tercih ettiklerini bulmuşlardır.



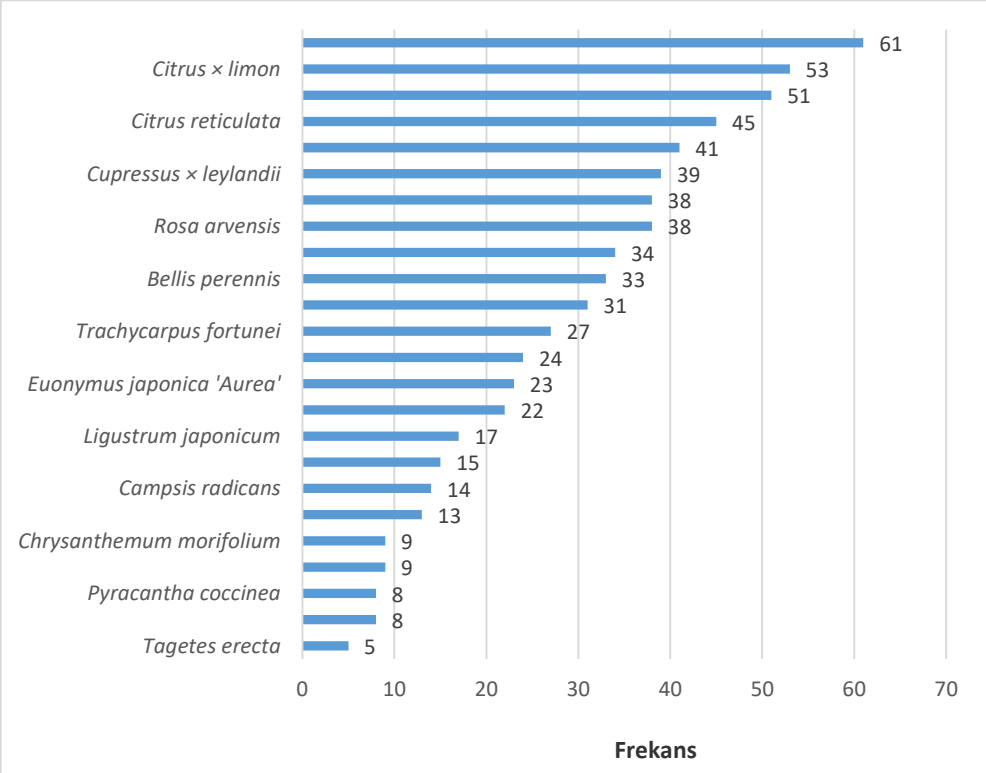
Şekil 6. Katılımcıların Süs Bitkilerinde Tercih Ettikleri İşlevler

Katılımcılar bitkisel tasarımda en çok manzara çerçevelemesi, en az ise yumuşatıcı olma ögelerini tercih etmişlerdir (Şekil 7). Yılmaz (2006) Erzurum kentinde yürüttüğü çalışmada katılımcıların manzara çerçeveleme tasarım ögesini ikinci sırada tercih ettiğini bulmuştur.



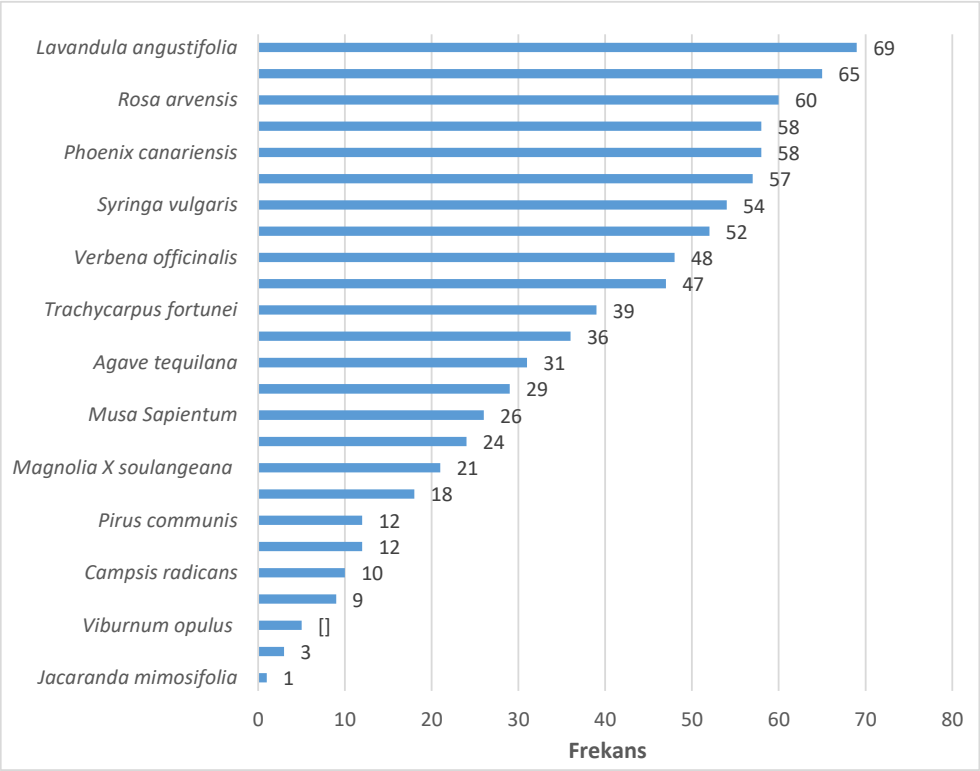
Şekil 7. Katılımcıların Bitkisel Tasarımda Tercih Ettikleri Ögeler

Katılımcılar bahçelerinde birinci sırada *Olea europaea* (zeytin), ikinci sırada *Citrus x limon* (limon) türlerinin mevcut olduğunu ifade etmişlerdir. En az mevcut türün ise *Tagetes erecta* (Kadife çiçeği) olduğu ortaya çıkmıştır (Şekil 8).



Şekil 8. Katılımcıların Bahçelerinde Mevcut Türler

Katılımcıların bahçelerinde yetiştirmek için birinci sırada *Lavandula angustifolia* (Lavanta) türünü, ikinci sırada *Cercis siliquastrum* (Erguvan) tercih etmişlerdir. En az tercih edilen tür ise *Jacaranda mimosifolia* (Jakaranda) türüdür (Şekil 9).



Şekil 9. Katılımcıların Bahçelerinde Tercih Etmek İstedikleri Türler

Bahçe ile uğraşma ve süs bitkisi temini üzerine cinsiyet, yaş ve meslek etkili bulunmuştur. En çok yetiştirmek istediği bitki üzerine ise sadece cinsiyet etkili olmuştur (Tablo 2). Buna göre, kadınlar erkeklere kıyasla daha çok bahçe ile uğraşmak ve en fazla da süs bitkisi yetiştirmek istemektedirler. Erkekler süs bitkisi almadıklarını ya da ücretsiz temin ettiklerini belirtmişlerdir. Erkekler ise daha çok sebze yetiştirmek istemektedirler. 36-55 yaşlı katılımcıların daha çok bahçe ile uğraşmak istedikleri, bunun yanında 26-45 yaşlı katılımcıların ise süs bitkisi almadıkları ortaya çıkmıştır. Memurların daha çok fidan almadığı, emeklilerin ise ya ücretsiz ya da özel fidanlıklardan fidan temin ettikleri saptanmıştır.

Tablo 2. Demografik özelliklerin katılımcıların bitki tercihi üzerine etkileri

		Bahçe ile uğraşma[1]	**Süs bitkisi temini**	**En Çok yetiştirmek istediği bitki**
Cinsiyet	MW-U	700	649	915
	Z	-4,258	-3,995	-2,086
	p	**0,000*** **	**0,000*** **	**0,037***
Yaş	X^2	17,208	16,850	0,907
	sd	5	5	5
	p	**0,004****	**0,005****	0,970ns
Meslek	X^2	31,474	18,634	6,963
	sd	5	5	5
	p	**0,000*** **	**0,002****	0,223ns

[1]Demografik özellik ilgili tercih üzerine 0.05 (*), 0,01 (**) ve 0,001 (***) düzeylerinde önemli ya da önemsizdir (ns).

Sonuç olarak, Fethiye'de müstakil evde yaşayan insanların bahçelerinde daha çok süs bitkilerinin ön plana çıkmasını istedikleri ve boş zamanlarında bahçeyle uğraşmak istedikleri ortaya çıkmıştır. Katılımcıların çoğunun süs bitkilerinde tercih ettikleri en önemli özellik güzel kokulu olması, süs ağaçlarında en çok tercih ettikleri form yayılıcı-dağınık olması, süs bitkilerinde tercih ettikleri en öne çıkan işlevin görsel zevk vermesi, bitkilerin tasarımında tercih ettikleri en öne çıkan öge ise manzara çerçeveleyici olmasıdır. Katılımcıların bahçelerinde en çok mevcut olan türler zeytin ve limon, en çok tercih etmek istedikleri türler ise lavanta ve erguvan olmuştur.
Bu sonuçlara göre, müstakil bahçeye sahip kişilerin dış mekân bitki tercihlerinin dikkate alınarak ilgili gruplar tarafından kentin yeşil dokusunun zenginleştirilmesi yönünde gerekli çalışmaların yapılması büyük önem taşımaktadır. Bu bağlamda bu çalışmanın sonuçları konut bahçelerinin bitkisel tasarım çalışmalarında oldukça yararlı olacaktır. Nitekim kullanıcıların istek ve görüşleri doğrultusunda şekillenen mekanların daha yoğun ve işlevsel bir kullanıma sahip olacağı aşikârdır.

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ID: 612

Development of an Antimicrobial Topical Skin Cream with Using Wood Apple (*Limonia acidissima* L.) Pulp Against *Staphylococcus aureus, Pseudomonas aeruginosa* and *Candida albicans*

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Abstract

Skin inhabiting microbes mostly non-pathogenic and commensals on the skin. Among them Staphylococcus aureus, Pseudomonas aeruginosa, and Candida albicans often responsible for symptomatic skin infections. Cellulites, impetigo, ecthyma, red lesions and candidiasis are some of the common microbial skin diseases caused by skin pathogens. Wood apple (Limonia acidissima L.) is an underutilized fruit in Sri Lanka and, all parts of this plant have medicinal value. Considering the high therapeutic value, the aqueous extract of wood apple pulp was used. Antibacterial activity against Staphylococcus aureus, Pseudomonas aeruginosa and antifungal activity against Candida albicans was evaluated by using the standard well diffusion method. Above tested bacterial and fungal species were suspended in 3 mL of sterile distilled water separately and 10^8 CFU/mL population count was prepared. Aliquots of 100 µL of each suspension were inoculated and uniformly spread on Muller Hinton agar plates separately in triplicates. Wells were filled aseptically placing 50 µL of wood apple extracts, antimicrobial compounds specifically as the positive control for bacteria and fungi and sterile distilled water as the negative control. The plates were incubated at 37 °C for 24 - 48 hours and the diameter of the growth inhibition zones around the wells were measured. Furthermore, minimum inhibition concentrations of each extract were also evaluated. Comparisons were performed using one-way ANOVA followed by Tukey's Pairwise Comparisons. The antimicrobial topical skin cream was prepared using 0.5 g mL^{-1} of wood apple pulp with sterile distilled water, mixed with the formulated standard ingredients. The results revealed that the aqueous extracts of wood apple pulp concentrations range from 0.15 g mL^{-1} to 1g mL^{-1} showed the antimicrobial potential of above skin pathogens variably ranged inhibition zone diameter 16 mm to 34 mm. The antimicrobial effect of the formulated cream against these pathogens was repeatedly tested. Further testing procedures needed to be followed before recommending wood apple topical antimicrobial skin cream as a marketable product.

Keywords: *Skin pathogens, Wood apple, Anti-microbial activity, Topical skin cream*

ID: 614

Revisiting The Food Security And Nutrition Status Of Farming Households After Covid-19 Lockdown In Nigeria

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Abstracts

Despite the global challenges of high food insecurity, covid-19 set-in which is said to have contributed to the phenomenon. However, most recent studies were conducted during the COVID-19 lockdown, indicating a need to assess households' food security after the lockdown. Therefore, this study investigated rural households' (who are mostly farmers) food security status and dietary diversity as a proxy for nutrition status in Nigeria. Two hundred and forty farming households were randomly selected for the study. The data collected was analysed using descriptive statistics, the USDA 18 food security questionnaire core module, the household dietary diversity score, and logit regression. The results revealed that the majority of the farming households were food insecure (66.3%) and malnutrition was also prevalent among rural farming households as 62.9 per cent had a low dietary diversity score. The positive determinants of household food security were access to credit, cooperative membership, income, and marital status. While household size negatively influenced rural household food security. This study calls for development agents' and governments' intervention to reduce the high level of food insecurity and malnutrition among rural farming households through the provision of financial support and awareness creation on family planning.

Keywords*: Covid-19 pandemic, dietary diversity, farmers, food insecurity, rural households*

ID: 615

A Review: Assessment of Moringa oleifera Seed Purification Role in Drinking Water

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Abstract

Water has supreme importance in the universe, but unfortunately contaminated with various sources. Water purification is a major problem in all over the world and specially in the developing countries like Pakistan. For purification natural coagulants (i.e. Moringa oleifera) are beneficial and has advantage to chemical methods of water purification as biodegradable and easily available. *Moringa oleifera* seed has protein that act as purifying and coagulating agent in water, almost 37% of this is presented in the seed. As hardness, turbidity and acid-base ratio is most important quality parameter of drinking water and *Moringa oleifera* seed protein is more effective in purifying the turbid water as; it reduces the turbidity 98% and hardness 90% of water. *Moringa oleifera* seed also has antimicrobial effect as; disinfectant in drinking water, retard the reproduction process of bacteriophage in water and also removed 90% *Total coliforms* from water. This study aims to assess the purification method of *Moringa oleifera* seed. In the current it has a great demand for developing countries to use this cheap and eco-friendly method of purification.

Key word: *Water, Purification, Contamination, M. oleifera.*

ID: 616

Sunflower Growth, Yield And Nutrient Uptake As Influenced By Different Nitrogen Levels

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Abstract
This study was undertaken to assess the influence of different nitrogen levels on sunflower's growth, yield and nutrient uptake. The selected variety was hybrid Hysun 33. There were six levels of nitrogen *viz*. (i) T_1 (0 kg N ha^{-1}), (ii) T_2 (60 kg N ha-1), (iii) T_3 (90 kg N ha-1), (iv) T_4 (120 kg N ha^{-1}), (v) T_5 (150 kg N ha^{-1}), (vi) T_6 (180 kg N ha^{-1}) and the experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. Different levels of nitrogen showed significant effect on growth, yield and nutrient uptake of sunflower. Individually nitrogen had significant effect on growth and yield parameters such as plant height, head diameter, stem diameter, grain yield, stover yield, thousand-grain weight except leaf numbers plant^{-1}. The highest plant height, head diameter, stem diameter, grain yield, stover yield, thousand grain weight was recorded from T_6 (180 kg N ha^{-1}) where the lowest from T_1 (0 kg N ha^{-1}). Similarly, the nutrient uptake such as N, P and K significantly affected by nitrogenous fertilizer. The highest N, P and K uptake of sesame was found at T_6 (180 kg N ha-1) where the lowest from T_1 (0 kg N ha-1). We can summarize that there is a synergistic interaction of N with sunflower growth, yield and nutrient (N, P, K) uptake.
Keywords: *Nitrogen fertilizer, Sunflower, Growth parameters, Grain yield, Stover yield, Nutrient uptake.*

Introduction

Sunflower (*Helianthus annuus L.*) is the perpetual herb. It is a widely used oilseed crop around the world. Sunflower seeds are palatable and it is a decent wellspring of protein, nutrients, calcium, nitrogen and iron. Its seed contains 40-45% non-unstable oil and about 55% linoleic corrosive. Aproximate piece of sunflower seed is protein 20.8%, lipid 54.8%, starches 18.4%, debris 3.9% (Gopalan, 1982). In past, sunflower was developed willfully in our nation. Later on, a couple of individuals began developing it industrially. Considering the suitability of sunflower cultivation, it would be a fruitful endeavor in the beachfront regions of Bangladesh. At that point when the saltiness expands after the assault of super violent winds like Sidr and Aila, it is the most proper time to begin sunflower development. Sunflower is better adjusted to districts of delayed dry spell; because of its capacity to extricate put away soil water in the more profound soil profile (Nahar, 2015).
Yet, Nitrogen assume a basic job in augmentation of harvest yields (Massignam *et al*., 2009) and improves the yield just as nature all things considered (Ullah *et al*., 2010). Moreover, higher paces of N increments photosynthetic procedures, leaf zone creation, leaf territory length just as net absorption rate (Ahmad *et al*., 2009; Munir *et al*., 2007). Improvement and development of leaf area, crop growth rate and radiation interception are affected by the utilization of nitrogen (Nasim *et al*., 2012). The advancement of individual leaf zone and complete leaf region of harvest plant and eventually contributing towards higher grain yield (Rafiq *et al*., 2010). Numerous analysts (Bange *et al*., 2000) inferred that N builds grain yield by influencing the development and improvement of sunflower.

Materials and Methods

A field experiment was conducted at field laboratory of Soil, Water and Environment Discipline, Khulna University, Khulna to assess the influence of different nitrogen levels on sunflower's growth, yield and nutrient uptake. The experiment was designed with six levels of nitrogen such as (i) T_1 (0 kg N ha^{-1}), (ii) T_2 (60 kg N ha^{-1}), (iii) T_3 (90 kg N ha^{-1}), (iv) T_4 (120 kg N ha^{-1}), (v) T_5 (150 kg N ha^{-1}), (vi) T_6 (180 kg N ha^{-1}). The treatments were replicated three times. The test crop was sunflower (hybrid Hysun 33). Fertilizers such as TSP (160 kg ha-1), MoP (150 kg ha-1), Gypsum (150 kg ha-1), Zn Sulphate (8 kg ha-1) and Boric acid (10 kg ha-1) used as basal dose recommended by Azad et al. (2017). The unit plot size was 2 m x 1m following Randomized Complete Block Design (RCBD). Seeds were treated with fungicide Vitavex-200 before 24 hours of sowing at the rate of 3 g kg^{-1} seed and were soaked overnight before sowing. After seedling emergence, the vacant hills were filled up by resowing. The growth performance was measured and recorded at day 45, 65, 85, 105. After harvesting, the plant sample was prepared to evaluate the yield parameters and measured the nutrient uptake.

Analytical procedure

The particle size analysis of the soil was done by hydrometer method as described by Day (1965). Textural classes were determined using Marshall's Triangular Coordinate systems. Soil pH was determined electrochemically with the help of glass electrode pH meter using soil to water ratio of 1:2.5 as suggested by Jackson (1962). The EC of the soil was measured by at a soil: water ratio of 1:5 with the help of EC meter and then converted into 1:1 ratio as suggested U.S. Salinity Laboratory Staff (1954). The CEC of the soil was determined by Distillation method (Chapman, 1965). Soil organic carbon was determined by Walkley and Black's wet oxidation method as outlined by Jackson (1973). Exchangeable and water soluble calcium was determined by complexometric titration method (Schwarzenbach and Ackermann, 1947). Plant samples were digested with HNO_3-$HClO_4$ (2:1) as suggested by Jackson (1973) for the determination of N, P and K. The N and P were determined by Micro kjeldhal method and yellow colour method (Jackson, 1973) respectively. K was measured by Flame analyzer (JENWAY).
Nutrient uptake was calculated from nutrient contents using the following formula:
Uptake = [Nutrient content (%) × Yield (kg/ha)]/100

Statistical analysis

Analysis of variance was carried out using ANOVA technique (Gomez and Gomez, 1984) and mean values were compared by Duncan's Multiple Range Test (DMRT) by Statistix 10.

Results and Discussion

The experiment was conducted to study the Sunflower growth, yield and N, P, K uptake as influenced by different nitrogen levels. This chapter contains analytical results, statistically analysis of the results, presentation and discussion of the results.

General properties of soil

Some general properties of soil are given in Table 1.
Table 1. Properties of the soil of the experimental field

Parameters		**Value**
Particle size analysis	Sand	24%
	Silt	47%
	Clay	29%
Soil texture		Clay Loam
Soil pH		7.82
Soil EC (dS m^{-1})		0.1
Soil organic carbon (%)		1.22
Soil CEC (cmol kg^{-1})		25.83
K (cmol kg^{-1})		0.95
Ca (cmol kg^{-1})		28
Na (cmol kg^{-1})		1.15

Growth Parameters

Plant height

The consecutive plant height at day 45, 65, 85, 105 presented in Fig. 1 show that the effect of different N level on sunflower plant height was significant. The highest plant height was 50.47cm at day 45, 136.33cm at 65, 190.67 cm at day 85 and 202.33 cm at day 105 recorded from T_6 (180 kg N ha^{-1}). At the same time, the lowest plant height was 37.03 cm at day 45, 90.33 cm at 65, 144.00 cm at day 85 and 158.67 cm at day 105 recorded from T_1 (0 kg N ha^{-1}). These results are similar with the findings of Solemani *et al*. (2012) who concluded that with the increasing nitrogen rates, the height of plants increases.

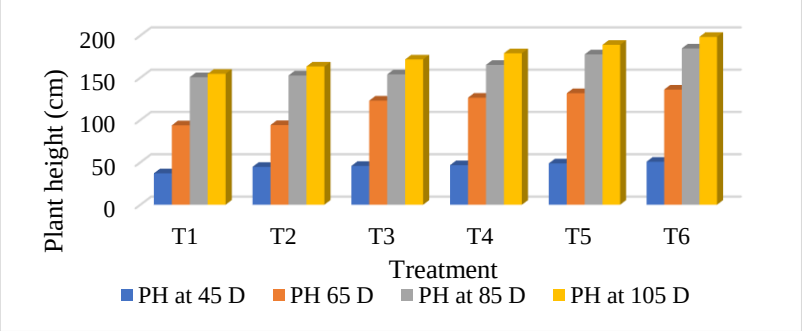

Fig. 1. Plant height with different N treatments in different days.

Leaf numbers

The consecutive leaf numbers of sunflower at day 45, 65, 85, 105 presented in Fig. 2 show that the effect of different N level on leaf numbers of sunflower was not significant. In 45 day, the leaf number was higher in treatment T_1 (0 kg N ha^{-1}) and T_3 (90 kg N ha^{-1}). In 65 day, the leaf number was higher in T_4 (120 kg N ha^{-1}) and T_5 (150 kg N ha^{-1}). In 85 day, the highest leaf number was found in T_3 (90 kg N ha^{-1}) and the lowest leaf number was found in T_2 (60 kg N ha^{-1}). In 105 day, the highest leaf number was found in T_1 (0 kg N ha^{-1}) and T_5 (150 kg N ha^{-1}).

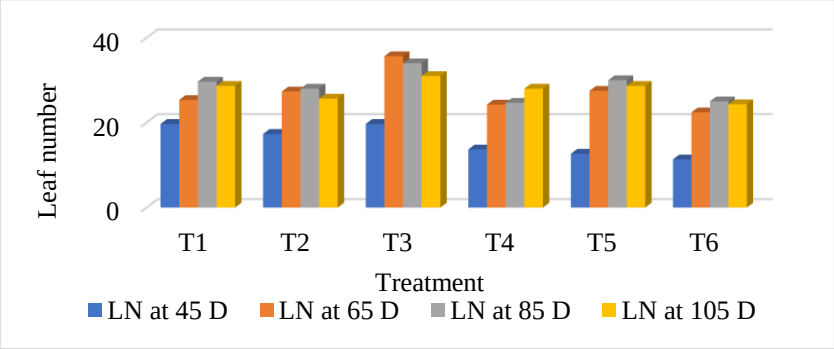

Fig. 2. Leaf number with different N treatments in different days.

Head diameter

Results (Fig. 3) show that the response of different N levels on sunflower head diameter was statistically significant. It was observed that the highest head diameter was 22.67 cm which was recorded from T_6 (180 kg N ha^{-1}) and lowest head diameter was 17 cm recorded from T_1 (0 kg N ha^{-1}). The improvement of the head diameter may be accredited to more vegetative growth due to fertilizer etc. These results collaborated the findings of Sadiq *et al*. (2000) and Iqbal and Ashraf (2006) who have shown positive effects of nitrogen on head diameter of sunflower crop.

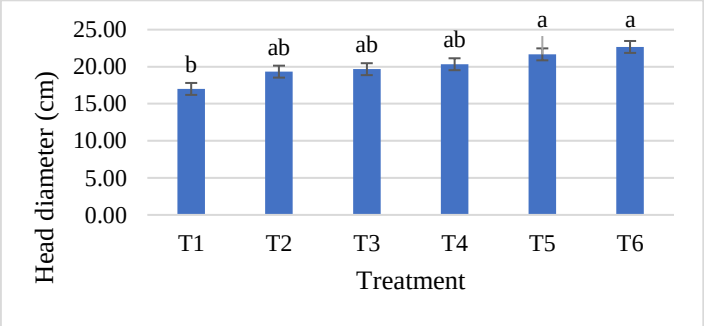

Fig. 3. Sunflower head diameter with different N treatments.

Stem diameter

Results (Fig. 4) delineate that the response of different N levels on sunflower stem diameter was statistically significant. It was observed that the highest stem diameter was 8.33cm which was recorded from T_6 (180 kg N ha^{-1}) and lowest stem diameter was 6.53cm recorded from T_1 (0 kg N ha^{-1}).

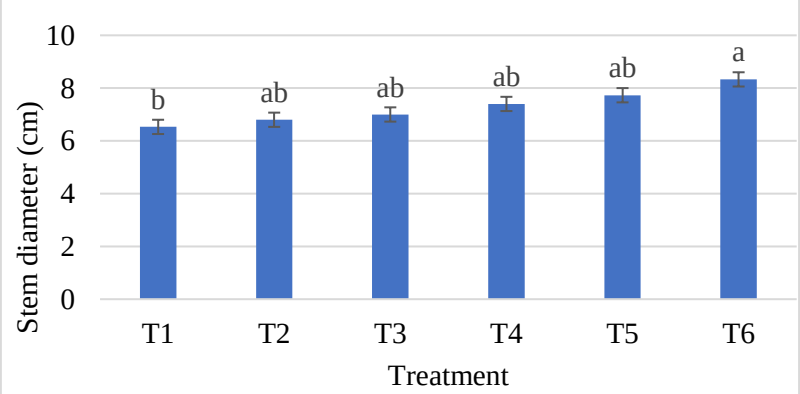

Fig. 4. Sunflower stem diameter with different N treatments.

Yield parameters

The yield performance of sunflower under different N levels was significantly affected which is shown in Table 2.

Table 2: Yield of sunflower as affected by different N application

Treatments	Grain Yield	Stover Yield	Thousand grain weight (gm)
	Kg ha^{-1}		
T_1 (0 kg N ha^{-1})	1554.4c	1130.93b	45.3c
T_2 (60 kg N ha-1)	1803.47bc	1476.93ab	47.83c
T_3 (90 kg N ha-1)	2037.33bc	1506.93ab	61.9b
T_4 (120 kg N ha^{-1})	2204.00b	1986.53a	61.07ab
T_5 (150 kg N ha^{-1})	2912.67a	2207.07a	62.6ab
T_6 (180 kg N ha^{-1})	2953.33a	2209.20a	68.87a

Grain yield

The mean grain yield of sunflower statistically different under different N levels. The highest (2953.33 kg ha^{-1}) grain yield was recorded from T_6 (180 kg N ha^{-1}) and lowest (1554.4 kg ha^{-1}) grain yield was recorded from T_1 (0 kg N ha^{-1}). Similarly, Abdel- Motagally and Osman (2010) has stated that grain yield of sunflower is attributed with increasing N rates.

Stover yield

The mean stover yield of sunflower statistically different under different N levels. The highest (2209.20 kg ha^{-1}) stover yield was recorded from T_6 (180 kg N ha^{-1}) and lowest (1130.93 kg ha^{-1}) stover yield was recorded from T_1 (0 kg N ha^{-1}). Nasim et al. (2011) have also earlier demonstrated positive effect of N fertilizer on dry matter production. This may be due to N effects on cell elongation, as well as N being the principal component of proteins, enzymes, hormones, vitamins, chlorophyll and it accelerates the meristematic activity of plant which leads to progressive increases in internode length, protein synthesis and photosynthetic area leading to higher plant height and dry matter production.

1000-grain weight

The thousand-grain weight of sunflower at different nitrogen levels was significantly affected. Among different N levels, Maximum thousand-grain weight (68.87 g) was recorded from T_6 (180 kg N ha^{-1}). The minimum thousand-grain weight (45.3 g) was recorded from T_1 (0 kg N ha^{-1}).

Nutrient uptake

The nutrient uptake of sunflower under different N levels was significantly affected which is shown in Table 3.

Nitrogen uptake (N)

Grain: The nitrogen uptake by sunflower grain was significantly increased with the increasing levels of N application. The maximum (23.57kg ha^{-1}) nitrogen uptake by sunflower grain was observed at T_6 (180 kg N ha^{-1}) and the minimum (5.88 kg ha^{-1}) nitrogen uptake by sunflower grain was observed at T_1 (0 kg N ha^{-1}). The recorded highest grain N uptake (23.57kg ha^{-1}) under T_6 (180 kg N ha^{-1}) was significantly higher than all other treatments.

Stover: The nitrogen uptake by sunflower stover was significantly increased with the increasing levels of N application. The maximum stover N uptake (59.65 kg ha^{-1}) was recorded from T_6 (180 kg N ha^{-1}). The minimum stover N (13.80 kg ha^{-1}) of sunflower stover was observed at T_1 (0 kg N ha^{-1}).

Table 3: Nutrient uptake of sunflower as influenced by different N levels

Treatments	N		P	K
	Uptake (Kg ha^{-1})			
	Grain	Stover	Total	Total
T_1 (0 kg N ha^{-1})	5.88 e	13.80 f	162.63 f	72.35 d
T_2 (60 kg N ha-1)	8.33 d	29.83 e	237.93 e	94.49 c
T_3 (90 kg N ha-1)	10.27 d	34.66 d	247.74 d	96.41 c
T_4 (120 kg N ha^{-1})	12.96 c	46.48 c	320.03 c	148.28 b
T_5 (150 kg N ha^{-1})	19.57 b	53.19 b	494.16 b	164.74 a
T_6 (180 kg N ha^{-1})	23.57 a	59.65 a	605.98 a	164.90 a

Phosphorus (P) uptake: Different N levels significantly influenced P uptake by sunflower. The maximum P uptake (605.98 kg ha^{-1}) by sunflower was recorded from T_6 (180 kg N ha^{-1}) and the minimum phosphorus uptake (162.63 kg ha^{-1}) was recorded from T_1 (0 kg N ha^{-1}). This could be attributed to the fact that there is a synergistic effect i.e. positive interaction between N and P uptake (Zubillaga *et al*., 2002).

Potassium (K) uptake: The potassium uptake was significantly increased with the increasing levels of N application. The highest K uptake (164.90 kg ha^{-1}) by sunflower was observed from T_6 (180 kg N ha^{-1}) where the lowest K uptake (72.35 kg ha^{-1}) was observed from T_1 (0 kg N ha^{-1}). This could be attributed to the fact that there is a synergistic effect i.e. positive interaction between N and K uptake (Zubillaga *et al*., 2002).

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The Effect of Using Drawn Combs on Colony Weight Gain and Honey Yield

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Abstract
Using the drawn empty combs during the main nectar flow is expected to increase honey yield. However, there is no available data to what extent an increase in honey yield occurs when drawn empty combs are used instead of comb foundations. This investigation aimed to determine the effect of using drawn combs during main nectar flow on colony weight gain and honey yield. The investigation was carried out with 42 colonies at the apiary of the Animal Science Department at Ankara University in the spring and summer seasons of 2017. The colonies were randomly allocated into two groups. The supers with drawn empty combs were added to 21 colonies in one group, while comb foundations in supers were added to 21 in the other group. Before adding super to each colony, the initial colony weight (the weight of empty hive + the weight of broodnest combs + the weight of colony population) and the total number of adult bees were determined. The honey supers were added to the hives as the colonies required space throughout the nectar flow. The final colony weight, the weight gain, the weight of harvested combs, and the net honey yield of each colony were determined during the harvesting of honeycombs. The statistical analysis (ANOVA) of the data demonstrated that the mean values of initial colony weight, the weights of broodnest combs and adult bee population and the number of adult bees were not significantly different between colonies that received either drawn combs or comb foundations. The mean values of the final colony weight at harvest (126.0 kg and 113.4 kg), the colony weight gain (82.7 kg and 70.9 kg), the weight of harvested combs (70.7 kg and 58.3 kg) and the net honey yield (58.8 kg and 49.2 kg) were significantly higher ($P<0.01$) in drawn comb group than in comb foundation group. The use of drawn combs in the supering process resulted in a 17%, 21% and 20% increase in the colony weight gain, the harvested comb weight and the net honey yield, respectively.
Key Words: *Apis mellifera, Honey bee colony, Drawn comb, comb foundation, weight gain, Honey yield*

Kabartılmış Petek Kullanımının Koloni Ağırlık Kazanımı ve Bal Verimine Etkisi

Özet
Ana nektar akımı döneminde bal arısı kolonilerine kabartılmış boş kullanımının veriminde artış sağlaması beklenir. Ancak, temel petek yerine kabartılmış petek kullanımının bal verimi artışına katkısını ortaya koyan veri yoktur. Bu araştırma; ana nektar akımında kolonilere kabartılmış petek vermenin koloni ağırlık kazanımı ve bal verimine etkisini belirlemek amacıyla yürütülmüştür. Ankara Üniversitesi Ziraat Fakültesi Zootekni Bölümü arılığında 2017 yılı üretim sezonunda 42 koloni rasgele 2 gruba ayrılmış, bir gruptaki 21 koloniye kabartılmış petekli ballıklar, diğer gruptaki 21 koloniye ise temel petekli ballıklar yerleştirilmiştir. Her koloniye ballık ekleme işlemi öncesi koloni başlangıç ağırlığı (boş kovan ağırlığı + kuluçkalık peteklerin ağırlığı + ergin arı populasyonu ağırlığı) ve ergin arı sayısı saptanmıştır. Nektar akımı boyunca kolonilerin gelişimi izlenerek ballık ekleme işlemi sürdürülmüştür. Bal hasadı sırasında her koloni tartılarak hasat öncesi son ağırlık, her kolonin ağırlık kazanımı, hasat edilmiş her peteğin ağırlığı ve net total bal verimi saptanmıştır. Varyans analizine (ANOVA) göre; temel petek verilmiş koloniler ile kabartılmış petek verilmiş kolonilerin koloni başlangıç ağırlığı, kuluçkalık peteklerinin ağırlığı, ergin arı populasyonu ağırlığı ve ergin arı sayısı ortalama değerleri arasındaki farklar önemsizdir. Hasat öncesi son ağırlık (126.0 kg ve 113.4 kg), koloni ağırlık kazanımı (82.7 kg ve 70.9 kg), hasat edilmiş peteklerin ağırlığı (70.7 kg ve 58.3 kg) ve net bal verimi (58.8 kg ve 49.2 kg) ortalama değerleri ise kabartılmış petek verilmiş kolonilerde temel petek verilmiş kolonilerden daha yüksek ($P<0.01$) bulunmuştur. Kabartılmış petek kullanımı; koloni ağırlık kazanımının %17, hasat edilmiş peteklerin ağırlığının %21 ve net bal veriminin %20 artmasına neden olmuştur.
Anahtar Kelimeler: *Apis mellifera, Bal arısı, Kabartılmış petek, Temel petek, Ağırlık kazanımı, Bal verimi*

ID: 620

Effects of Ultrasonication on Probiotics and Prebiotics in Dairy Technology

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Abstract

There is a growing consumer interest in functional foods to help prevent chronic disorders such as cardiovascular diseases, cancer, chronic respiratory diseases and diabetes, which are closely related to human diet. In this context, foods containing probiotics and prebiotics gain importance. Probiotics and prebiotics are frequently used ingredients in dairy products due to their functional effects. Probiotics are live microorganisms, which confer health benefits such as prevention of gastrointestinal diseases, enhancement of the immune system, reduction of serum cholesterol level and blood pressure, and anti-carcinogenic activity, on the host when administered in adequate numbers. Prebiotics are non viable and non digestible ingredients that are selectively utilized by host microorganisms conferring a health benefit and increasing the effect of probiotics. Ultrasound is an innovative and promising technology in the dairy industry that can improve the viability and functionality of probiotic bacteria , and can facilitate access to probiotics by changing the prebiotic structure. Ultrasound application promotes probiotic viability by increasing the membrane permeability of bacteria. Thus, the transport of nutrients necessary for cell growth is facilitated across the membrane. In addition, the extracellular release of intracellular enzymes, especially β-galactosidase, as a result of the increase in membrane permeability accelerates both transgalactosylation and lactose hydrolysis and releases some components characterized as growth factors. Consequently, the growth of probiotic bacteria is promoted. Ultrasound can also change the prebiotic structure by breaking its polymerized chains and releasing components. So, they become more easily assimilated by probiotic cultures and contribute to the increase of probiotic viability.

Key Words: *Ultrasound, Probiotic, Prebiotic, Functional Dairy Products*

Introduction

Foods are not only for satisfy hunger and for deliver essential nutrients but also they prevent the development of nutrition-related diseases. Therefore, the functional foods containing probiotics are mostly preferred by the health-conscious consumers (Sarkar, 2010). According to the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO), probiotics are defined as live microorganisms, which when administered in adequate amounts, confer a health benefit on the host (FAO/WHO, 2002). There is a growing demand on functional foods including probiotics. The health benefits of probiotics have been reported in numerous studies (Ghasempour et al., 2020; Irin et al., 2018; Manovina et al., 2021).

Probiotics act as biological agents that modify the intestinal microbiota to provide healthy digestive function and provide therapeutic benefits for the host. Human gut has an important role in host health especially in defense function, and impact brain-gut responses. Promoting the intestinal microflora for beneficial bacteria is essential to maintain the presence of natural probiotic bacteria and to provide protection against newly ingested microorganisms, especially pathogens (Kalip and Atak, 2018). Diseases in which probiotics are effective and benefical are given Figure 1 (Ahmed and Koul, 2021; Irin et al., 2018; Manovina et al., 2021). In addition, probiotics have anti-microbial and anti-tumor effects, and also they can decrease the side effects of chemotherapy (Śliżewska et al., 2021; Tian et al., 2019).

It is indicated that foods should contain more than 10^6 cfu/g probiotic bacteri to exert a probiotic effect. The viability of probiotic cultures, especially in fermented milks, depends on several factors such as acidity, pH, dissolved oxygen content, redox potential and hydrogen peroxide (Dinkçi et al., 2019; Özer et al., 2005). In addition, it is stated that prebiotics are used to encourage the growth and activity of probiotics in foods (Vinderola et al., 2011). Prebiotics are non-viable and non-digestible ingredients that are selectively utilized by host microorganisms conferring a health benefit and increasing the effect of probiotics (Akalın and Erisir, 2008).

Alongside its health benefits and nutritional value, there is a growing consumer interest for food quality. Thus, new safe and effective food production methods come to the fore to meet the consumer demand for high quality foods. Ultrasound is one of these methods (Akdeniz, 2022).

Ultrasound

Ultrasound is a form of energy generated by sound waves with frequency which exceeds the hearing limit of the human ear, typically higher than 20 kHz. It is considered as green technology since it is environmentally friendly as sound waves are non-toxic. It is also safe, simple, fast, cost-effective, and energy-efficient. High-power ultrasound, which has a frequency between 20-100 kHz and intensity between 10-1000 W/cm2, creates mechanical, chemical and biochemical effects in liquid foods through acoustic cavitation (Higuera-Barraza et al., 2016; Huang et al., 2017).



Fig. 1. Diseases that probiotics are beneficial

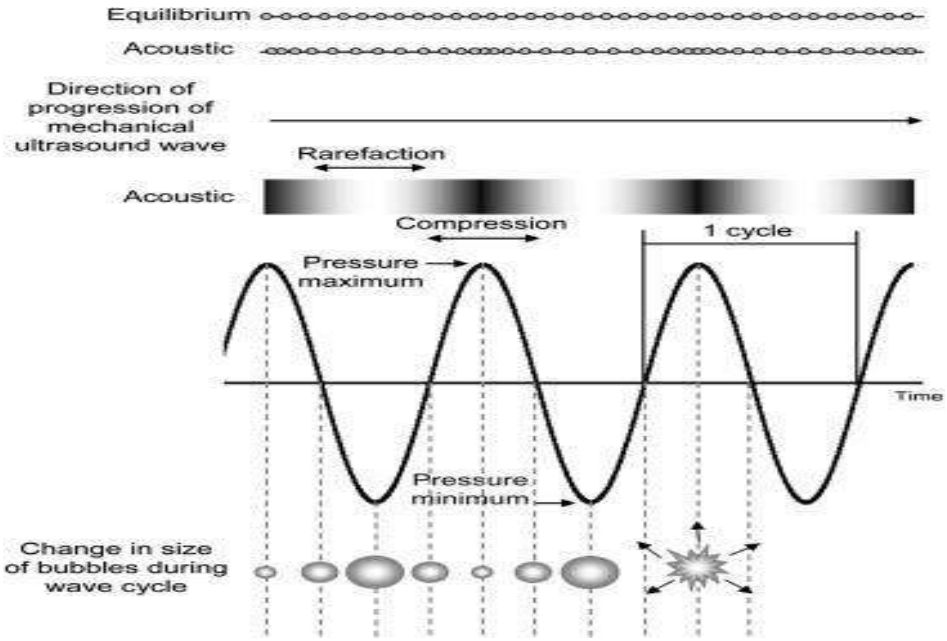

Fig. 2. Ultrasonic cavitation (Soria and Villamiel, 2010).

In liquid foods, acoustic cavition occurs as a result of the interaction between ultrasonic waves, liquid, and dissolved gas. As shown in Fig. 2, the cavitation bubbles grow due to the compression and rarefaction. When they reach a critical size, they violently collapse (Soria and Villamiel, 2010). The explosion of cavitation bubbles generates high temperature and pressure regions (Akdeniz and Akalın, 2019). As a consequence, acoustic streaming, shock waves, microjets, turbulence, and shear forces are created (Ashokkumar, 2011).

Effect of Ultrasound on Milk Fermentation

Fermentation process is one of the long and energy-consuming steps in fermented dairy products manufacture. Therefore, it is important to shorten the fermentation time without adversely affecting the quality of the final product (Abesinghe et al., 2019). There are studies showing that ultrasound accelerates the fermentation process (Abesinghe et al., 2019; Nguyen et al., 2009; 2012). It is stated that ultrasound increases enzymatic activity. This is attributed to the increase in membrane permeability of probiotic bacteria. So, the intracellular enzyme β-galactosidase accelerates lactose hydrolysis by being released out of the cell (Guimaraes et al., 2019; Nguyen et al., 2009; 2012).

Effects of Ultrasound on Probiotic Bacteria Viability and Prebiotics

It is an innovative and promising technology in the dairy industry that can improve the viability and functionality of probiotic bacteria and can facilitate access to probiotics by changing the prebiotic structure (Guimaraes et al., 2019). Ultrasound application promotes probiotic viability by increasing the membrane permeability of bacteria. Thus, the transport of nutrients necessary for cell growth and also removal of waste products are facilitated across the membrane. In addition, the extracellular release of β-galactosidase, which is the intracellular enzyme, as a result of the increase in membrane permeability releases some components characterized as growth factors. Consequently, the growth of probiotic bacteria is promoted (Nguyen et al., 2009). Akdeniz (2022), Gurram (2007), Niamah (2019) and Nguyen et al. (2009) found that ultrasound application stimulated the growth of probiotic bacteria, especially bifidobacteria.

Ultrasound can also change the prebiotic structure by breaking its polymerized chains and releasing components. So, they become more easily assimilated by probiotic cultures and contribute to the increase of probiotic viability (Guimaraes et al., 2019).

Conclusion

Ultrasound applications attract the attention of dairy industry. It has a high potential for use in the manufacture of probiotic fermented milk products. It increases the membrane permeability of probiotic bacteria. Thus, probiotic bacteria viability is promoted by increased amount of nutrients which they can use. Moreover, it could change the prebiotic structure, so that probiotic cultures can more easily reach prebiotics which increase the effect of probiotics. It is promising for functional dairy products including probiotics, since it increases the viability of probiotic bacteria.

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Morinda Longissima Effect On Inflammation In Carrageenan- Induced Paw Edema In Mice - Histological Study

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Abstract

Inflammation is a biological process of the immune system to harmful stimuli, such as toxicants or pathogens, it is part of the defense mechanism of the body. Drug discovery from natural sources is going through a renaissance, despite the fact that natural product-derived compounds occupy a much greater chemical space than those created through synthetic chemistry methods. Medicinal plants possess characteristics that aids in treating diseases or improving people's health conditions. The anti-inflammatory activity of *Morinda longissima* aqueous extract was evaluated in mice. Paw edema induced by carrageenan was carried out as described (Winter et *al*., 1962). Mice were separated into five groups. The treated groups were pre-treated with 100, 200 and 300 mg/kg of *Morinda longissima* by gavage and 50 mg/kg of Diclofenac as standard group. The 5th group was the inflammatory control (non-treated). All groups were injected with 1 % carrgennan into the right paw after one hour. For histology evaluation, skin fragments from right paw were fixed in 10% buffered formalin. The paw tissues were stained with Harris's hematoxylin and eosin. The microscopic observation of paw edema showed that treatment with 200 and 300 mg/kg presented less inflammatory cells and edema formation than the inflammatory control group. The results suggested *Morinda longissima* as a promising source of natural anti-inflammatory constituent for application in pharmaceutical industries.

Keywords: *Inflammation, Carragennan, Morinda longissima, Histology, Mice.*

ID: 622

Properties of Buffalo Milk Raised in Kutahya Region

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Abstract
Buffalo milk is an animal food that contains high levels of food components such as milk fat, casein, serum proteins, lactose, mineral substances and vitamins, consists of particles of different sizes and has many health benefits. Due to the rich composition of buffalo milk, buffalo milk stands out as an important food source for nutrition at the point of meeting the essential components for a healthy diet. In this study, the nutritional values of the milk obtained from the buffaloes bred in the Perli neighborhood of Kutahya province were examined, the nutritional values and physicochemical quality parameters of the buffalo milk were determined. It was emphasized that buffalo milk should be used more widely in food production with reference to its rich fatty acids content, but it was understood that the disadvantage of high production costs limited the use of buffalo milk as a raw material source in dairy products. In this study, dry matter ratio, protein, lactose, fat, mineral matter and fatty acids amounts were calculated in buffalo milk samples and the results were interpreted. The nutritional contents of buffalo milk samples are respectively; Fat-free dry matter was determined as 10.27%, protein 4.48%, fat 6.5%, lactose 5.22%, mineral substance contents; Na 247.599 mg/kg, K 1095.62 mg/kg, Ca 1624.51 mg/kg, Mg 150.098 mg/kg, P 857.155 mg/kg, Fe 0.327 mg/kg, Zn 6.304 mg/kg. The ratio of total saturated fatty acids was 80.14%, monounsaturated fatty acid ratio was 14.47%, polyunsaturated fatty acid ratio was 0.93%. In conclusion, when the data obtained are interpreted, it has been determined that buffalo milk contains higher levels of components in terms of nutritional value compared to other milks, and it has been found that buffalo milk will have a very important effect on human metabolism, and useful results will be obtained in the preparation of healthy food products and in special diets.
Key Words: *Buffalo milk, food, nutritional value.*

Kütahya Yöresinde Yetiştirilen Manda Sütünün Özellikleri

Özet
Manda sütü süt yağı, kazein, serum proteinleri, laktoz, mineral maddeler ve vitaminler gibi gıda bileşenlerini yüksek seviyelerde içeren ve birbirinden farklı büyüklüklerdeki taneciklerden oluşan, sağlığa birçok faydası bulunan bir hayvansal gıdadır. Manda sütünün bileşiminin zengin olması nedeniyle sağlıklı beslenme için elzem olan bileşenlerin karşılanması noktasında manda sütü, beslenme için önemli bir gıda kaynağı olarak öne çıkmaktadır. Bu çalışmada Kütahya ilindeki Perli mahallesinde yetiştirilmiş olan mandalardan elde edilen sütlerin besin değerleri incelenerek, manda sütünün besin değerleri ile fizikokimyasal kalite özellikleri saptanmış, manda sütünün beslenme için oldukça önemli olduğu, kaliteli ürün üretiminde hammadde olarak kullanılabileceği belirlenmiştir. Manda sütünün yağ asitleri içeriğince zengin olması referans alınarak gıda üretiminde daha yaygın kullanılması gerektiği vurgulanmış, ancak üretim maliyetlerinin yüksek olması dezavantajının manda sütünün süt ürünleri üretiminde hammadde kaynağı olarak kullanımını sınırlandırdığı anlaşılmıştır. Bu araştırmada manda sütü örneklerinde kuru madde oranı, protein, laktoz, yağ, mineral madde ve yağ asitleri miktarları hesaplanmış ve elde edilen sonuçlar yorumlanmıştır. Manda sütü örneklerinin besin içerikleri sırasıyla; yağsız kuru madde % 10,27, protein % 4,48, yağ % 6,5, laktoz % 5,22 olarak tespit edilirken, mineral madde içerikleri; Na 247,599 mg/kg, K 1095,62 mg/kg, Ca 1624,51 mg/kg, Mg 150,098 mg/kg, P 857,155 mg/kg, Fe 0,327 mg/kg, Zn 6,304 mg/kg seviyelerinde bulunmuştur. Toplam doymuş yağ asidi miktarları oransal olarak % 80,14, tekli doymamış yağ asidi oranı % 14,47, çoklu doymamış yağ asidi oranı % 0,93 şeklinde tespit edilmiştir. Sonuç olarak, elde edilen veriler yorumlandığında, manda sütünün diğer sütlere göre besin değeri açısından daha yüksek seviyelerde bileşenler içerdiği tespit edilmiş olup manda sütünün insan metabolizmasına oldukça önemli etkide bulunacağı, sağlıklı gıda ürünlerinin hazırlamasında ve özel diyetlerde kullanımı durumunda da faydalı sonuçlar alınacağı bulgularına ulaşılmıştır.
Anahtar Kelimeler: *Manda sütü, gıda, besin değeri.*

ID: 624

Effect of hazelnut husk compost on physiological properties of pepper under drought stress

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Abstract
In today's conditions, the effect of increasing urbanization, industrialization, population and global warming the pollution and decrease of fresh water resources have become a concern in agricultural production. For this reason, the practice of deficit irrigation, in which production is carried out, has emerged with the approach of saving irrigation water by irrigating at levels less than the amount of water needed by the plant. However, under these conditions, the lack of sufficient moisture balance in the soil affects the plant physiology negatively and reduces the yield and quality as a result of preventing development and growth. Under these conditions, various organic wastes applied to the soil act as a regulating agent for soil properties and increase moisture retention in the soil. Organic wastes that support plant yield increase also contribute to environmental sustainability within the scope of waste management. In this context, the changes in the physiological properties of the pepper plant as a result of the application of varying levels of compost obtained from hazelnut husk to the soil under different drought levels were investigated in this study. As a result of the study, it was determined that chlorophyll content, leaf area and leaf relative water content decreased and electrolyte leakage increased due to increased drought, while chlorophyll content, leaf area and leaf relative water content increased and electrolyte leakage decreased with increasing hazelnut husk compost doses. The results were found to be recommendable as it showed the physiological properties of pepper improve in hazelnut husk applied to the soil in the deficit irrigation approach to be made in arid and semi-arid regions where water resources are insufficient. However, it can be also suggested that more comprehensive and long-term field studies should be carried out on this subject.
Key Words: *Deficit irrigation, Drought, Hazelnut husk compost, Pepper, Physiological properties*

Introduciton

Water is one of the most valuable natural resources. However, due to anthropogenic effects such as increasing urbanization, industrialization, population and global warming, this resource is getting polluted and decreasing day by day. As a result of many studies, it is stated that water scarcity will increase significantly in the coming years, water wars will occur, production will be disrupted and various economic problems will arise (Calzadilla et al. 2011; Ercin and Hoekstra 2014; Hoekstra 2014). Burak and Margat (2016) stated that the global water need for 2050 will increase by 33% on average compared to 2010, and they pointed out that this situation is particularly concerning in arid and semi-arid regions. The lack of water in almost half of the world, especially in arid and semi-arid regions, increases the severity of these concerns (Calzadilla et al. 2011).

The Food and Agriculture Organization states that the agricultural sector constitutes the largest portion of the world's fresh water use compared to other sectors. Although the water usage rates of the countries differ between the sectors and the water consumption rates of the countries in agricultural production decrease according to the level of development, agricultural production is still a sector with high water input (Moghaddam et al. 2017). Thus, this situation reveals the necessity of carrying out agricultural production with less water use. However, in conditions where the amount of water needed by the plant cannot be met and is insufficiently met, the plant yield decreases by changing the physiological and chemical properties of the plant (Amiri et al. 2017). Comlekcioglu and Simsek (2017) stated that when the amount of water needed by the pepper plant is insufficiently met, 25% water saving is achieved, but the proportional decrease in the yield of pepper is 23%.

The deficit irrigation approach, in which production is carried out by providing water to the plant at levels lower than the amount needed by the plant, is a water-saving application. However, the decreased yield in deficit irrigation needs to be improved. This is a desirable approach in agricultural production as it covers the content of protecting-improving yield with less water. Various organic residues applied to the soil can meet this desirable approach by retaining soil moisture for a longer period and also supporting soil and plant fertility (Kul et al. 2021). In addition, within the scope of re-evaluation of wastes, environmental management can be supported and waste management can be provided in an intensive way. In this study, which was carried out by considering these valuable positive contributions, it was aimed to improve the physiological properties of pepper that support the yield by applying varying proportions of hazelnut husk compost to the soil under drought stress.

Materials and Methods

The experiment was carried out in the greenhouse, as plant material in Demre pepper cultivar (cv. Vural F1, *Capsicum annuum* L.), under varying levels of hazelnut husk compost [D0: 0% of hazelnut husk compost as control, and D1: 1% of hazelnut husk compost, D2: 2% of hazelnut husk compost and D3: 3% of hazelnut husk compost as on a dry weight basis (w/w)] at different irrigation water levels [I0: 100% irrigation level (full irrigation), I1: 67% irrigation level (33% deficit irrigation) and I2: 33% irrigation level (67% deficit irrigation)] with three replications, in 4-liter pots (diameter: 18 cm, height: 17 cm) in a total of 36 pots. During the experiment, the mean temperature and humidity in the greenhouse were 25±4°C and 46±6%. In the experiment, the places of the pots were randomly changed in each irrigation to equalize the effect levels of the pots.

According to some analyzes of the soil prior to the experiment, it was determined that the soil had a clay loam texture (sand: 35%, silt: 21%, clay: 44%) and the pH, electrical conductivity, organic matter and total nitrogen values of the soil were 7.70, 0.65 dS m^{-1}, 1.11% and 0.09%, respectively. The hazelnut husk obtained from the heap kept in the natural environment in a hazelnut orchard was composted in an aerobic condition according to the sequential heap composting method, and the pH, electrical conductivity, organic matter and nitrogen values the hazelnut husk compost were determined as 6.31, 2.31 dS m^{-1}, 75.7% and 1.35%, respectively.

Air-dry soils were sieved through a 4 mm sieve and mixed with hazelnut husk compost in the specified proportions (D0, D1, D2, D3) in the greenhouse conditions and transferred to pots. Then the pepper seedlings were transferred to the pots and the first irrigation was carried out equally for all pots by completing the pot weight in the current moisture in the control treatment (D0) to the pot weight in the field capacity. In the next process, until the harvest period, the irrigation was carried out according to the specified irrigation water levels (I0, I1, I2) at three-four-day intervals with the approach of completing the pot weight in the current moisture determined in the control treatment to the pot weight in the field capacity.

The chlorophyll content, leaf area, leaf relative water content and electrolyte leakage values were determined by measuring and analyzing at the time of harvest. To determine the changing shade of green in the leaves depending on the chlorophyll content, the chlorophyll content was carried out as a result of SPAD measurements with a chlorophyll meter (Konica Minolta, SPAD-502) by taking ten measurements from the randomly selected mature leaves of the plant in each pot and determining the mean. Leaf area was determined by measuring mature leaves of the plant in each pot with a leaf area meter (LI-3000C). The weights of five fresh leaf samples taken from each pot were determined (FW) and the turgor weights of the same samples were obtained by keeping them in distilled water for four hours (TW) and then dry weights were determined after they were kept in an oven at 70°C for 48 hours (DW) and finally, leaf relative water content was determined using the equation: $100 \times [(FW - DW) / (TW - DW)]$ (Benešová et al. 2012). For the electrolyte leakage determined based on the measurement of the electrolyte coming out of the leaf cells, disc samples with a diameter of 10 mm were taken from five leaves from each pot and placed in 50 ml glass vials, 30 ml of distilled water was added on them, and the electrical conductivity value was measured after they were kept at room temperature for 24 hours. Then, the same samples were kept in a water bath at 95°C for 20 minutes and cooled to room temperature and the electrical conductivity was measured again. Finally, electrolyte leakage was determined by proportioning the first electrical conductivity measurement value to the second electrical conductivity measurement value (Yildirim et al. 2022).

The data obtained were evaluated with the General Linear Model analysis via the SPSS program and the significant means were compared with the Duncan multiple comparison test via some program.

Results and Discussion

The effect of irrigation and hazelnut husk compost treatments ($p<0.001$) on the chlorophyll content of pepper were found to be significant (Figure 1). While chlorophyll content decreased with decreasing irrigation water level, increased with increasing hazelnut husk compost doses. Chlorophyll values are an important indicator of the degree of water stress (Bauerle et al. 2004). As a result of the plant closing its stomata under insufficient irrigation conditions, carbon dioxide inflow is weakened and photosynthetic activity is prevented (Comlekcioglu and Simsek 2017). Decreased chlorophyll content with increasing severity of drought stress further decreases as a result of inhibition of shoot development and growth functions (Guo et al. 2015). Plants grown in drought conditions have lower chlorophyll content than plants managed under adequate irrigation conditions (Carroll et al. 2017). Decreased chlorophyll content with increasing severity of drought stress further decreases as a result of inhibition of shoot development and growth functions (Guo et al. 2015). Plants grown in drought conditions have lower chlorophyll content than plants managed under adequate irrigation conditions (Carroll et al. 2017). Comlekcioglu and Simsek (2017) also reported that low irrigation water levels significantly reduced the leaf chlorophyll index values of pepper. Nitrogen, a component of chlorophyll, increases the chlorophyll content of plants by supporting the increase in chlorophyll in leaves (Liu et al. 2018). In this study, it is thought that hazelnut husk compost supports the increase of chlorophyll with nitrogen contribution to the plant. In addition, considering that iron has an important contribution in chloroplast formation and protein development stage (Yerli et al. 2020), the iron contribution of hazelnut husk compost to pepper may have also supported the increase in chlorophyll content.

According to Alaboz et al. (2017) also reported that organic improvers applied to the soil during drought stress have a positive contribution to increasing the chlorophyll content.

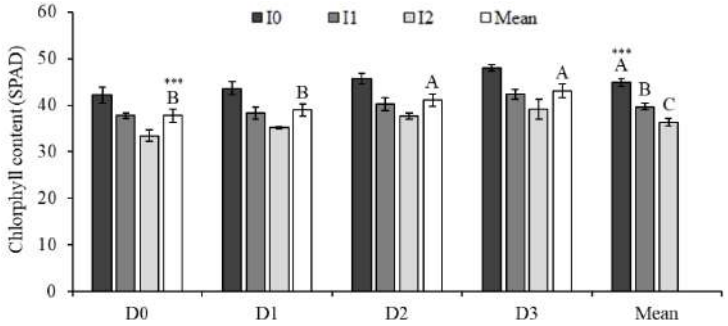

Figure 1. The effect of hazelnut husk compost treatments on the chlorophyll content of pepper under drought stress (I0, I1 and I2 represent 100%, 67% and 33% irrigation water levels, respectively, and D0, D1, D2 and D3 represent 0%, 1%, 2% and 3% hazelnut husk compost doses, respectively, and *** represent p<0.001).

The effect of irrigation (p<0.001) and hazelnut husk compost treatments (p<0.01) on the leaf area of pepper were found to be significant (Figure 2). While leaf area decreased with decreasing irrigation water level, increased with increasing hazelnut husk compost doses. Insufficient moisture conditions in the soil reduce the plant's ability to feed from the soil, reducing the physical development parameters (Camoglu et al. 2011). Kusvuran et al. (2011) reported that as a result of drought stress, physiological parameters related to growth such as green parts of the plant, root and stem fresh and dry weights, plant height and diameter, number of leaves and leaf area are adversely affected. Tekin et al. (2016) stated that depending on the decreasing irrigation water level in the pepper plant, the physical properties of the pepper weakened so that the economic yield of the pepper would decrease. However, different organic or chemical fertilizers increase the physical properties of pepper (Ozkan et al. 2013). Amiri et al. (2017) stated that the reduced leaf area under irrigation water stress conditions can be improved with the contribution of organic materials added to the soil. This can be explained by improving the nutritional balance of pepper. In addition, the nitrogen additive provides a better development opportunity by improving the physiological properties of the plant (Aminifard et al. 2012). In this study, it is thought that hazelnut husk compost supports the increase of leaf area with nitrogen contribution to the plant. Similarly, Shrestha et al. (2013) stated that the leaf area of the pepper increased with the nitrogen contribution of the compost applied to the soil in pepper cultivation.

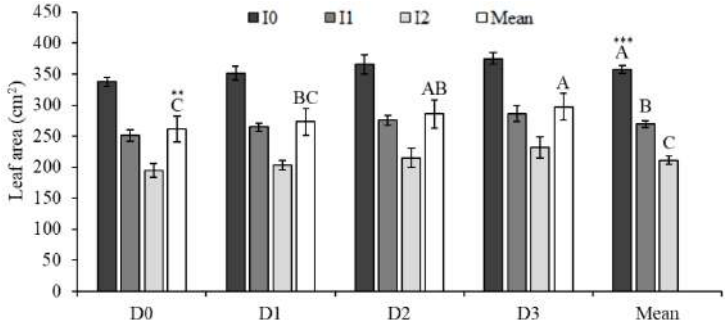

Figure 2. The effect of hazelnut husk compost treatments on the leaf area of pepper under drought stress (I0, I1 and I2 represent 100%, 67% and 33% irrigation water levels, respectively, and D0, D1, D2 and D3 represent 0%, 1%, 2% and 3% hazelnut husk compost doses, respectively, and ** and *** represent p<0.01 and p<0.001).

The effect of irrigation (p<0.001) and hazelnut husk compost treatments (p<0.01) on the leaf relative water content of pepper were found to be significant (Figure 3). While leaf relative water content decreased with decreasing irrigation water level, increased with increasing hazelnut husk compost doses. The stomata of plants grown in drought conditions close and leaf temperatures increase (Ozturk 2015). Although the plant tries to conserve the water in the leaf with increasing leaf temperatures, water loss from the leaves occurs with increasing water stress. Decreased leaf area and number and shoot growth result in less leaf relative water content (Yildirim et al. 2022). Omami and Hammes (2006) reported that leaf relative water content decreases under increasing drought conditions and this decrease is associated with a decrease in the osmotic potential of the plant. Various organic regulators applied to the soil under water stress conditions can improve the leaf relative water content as a result of increasing the water holding capacity of the soil by improving the soil physical properties (Kul et al. 2021). Akhtar et al. (2014) stated that biochar added to the soil as an organic regulator in drought conditions increases the leaf relative

water content of the plant with the contribution of organic matter and nutrients. In this study, it is thought that the leaf relative water content increases due to the ease of water uptake of the plant as a result of the improvement of soil physical properties with the organic matter contribution of hazelnut husk compost. Organic matter at a sufficient level supports the plant to take nutrients and water more easily (Pühringer 2016). In addition, the addition of organic matter provides a better root development to the plant (Srinivas et al. 2015) may have facilitated the uptake of water and nutrients from the soil. Thus, the pepper plant with increased drought resistance may have exhibited higher leaf relative water content.

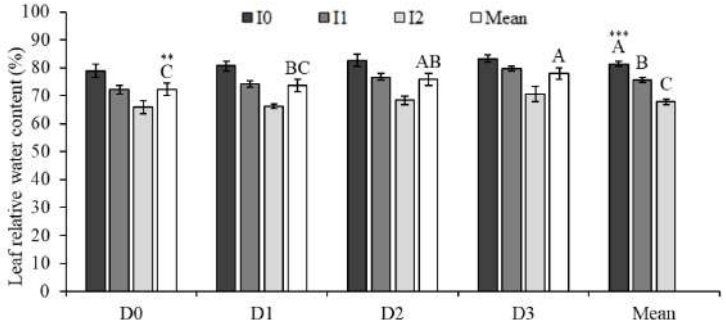

Figure 3. The effect of hazelnut husk compost treatments on the leaf relative water content of pepper under drought stress (I0, I1 and I2 represent 100%, 67% and 33% irrigation water levels, respectively, and D0, D1, D2 and D3 represent 0%, 1%, 2% and 3% hazelnut husk compost doses, respectively, and ** and *** represent $p<0.01$ and $p<0.001$).

The effect of irrigation ($p<0.001$) and hazelnut husk compost treatments ($p<0.01$) on the electrolyte leakage of pepper were found to be significant (Figure 4). While electrolyte leakage increased with decreasing irrigation water level, decreased with increasing hazelnut husk compost doses. Water stress disrupts the functionality of the plant's cell membrane system, causing membrane damage and thus an increase in electrolyte leakage (Yildirim et al. 2021). Plants growing in water deficiency close their stomata and leaf temperatures increase, and membrane systems are damaged with increasing temperature, and cell death occurs with increasing water stress (Ozturk 2015). Therefore, the effect of drought on electrolyte leakage can be evaluated as related to the decrease in the relative water content of the leaf (Figure 3). In addition, decreasing photosynthesis rate as the plant closes its stomata under drought conditions is also effective on electrolyte leakage (Bhardwaj et al. 2021). Similarly, Masoumi et al. (2010) also stated that electrolyte leakage increased as a result of damage to cell membrane systems due to increased drought stress. In this study, it is thought that the electrolyte leakage of hazelnut husk compost decreases with the increase of leaf relative water (Figure 3). In this study, it is thought that electrolyte leakage decreases with increasing leaf relative water (Figure 3) with hazelnut husk compost treatments. Similarly, Rahbarian et al. (2014) stated that leaf relative water decreases and electrolyte leakage increases under drought stress conditions, but the increase in electrolyte leakage decreases as a result of the increase in leaf relative water of manure applied to the soil. Nadeem et al. (2017) reported that the increase in electrolyte leakage in drought-managed plants can be reduced by the compost treatments applied to the soil.

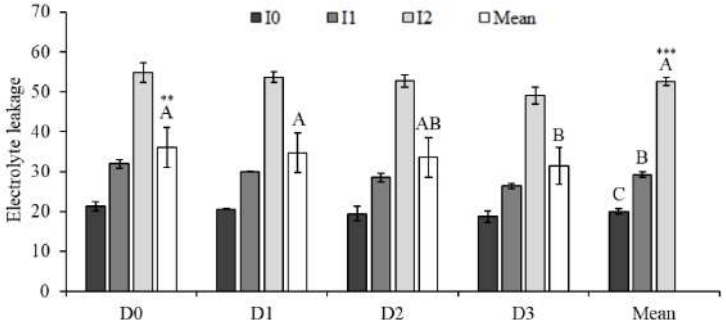

Figure 4. The effect of hazelnut husk compost treatments on the electrolyte leakage of pepper under drought stress (I0, I1 and I2 represent 100%, 67% and 33% irrigation water levels, respectively, and D0, D1, D2 and D3 represent 0%, 1%, 2% and 3% hazelnut husk compost doses, respectively, and ** and *** represent $p<0.01$ and $p<0.001$).

Conclusion

As a result of this study, in which the effects of varying levels of hazelnut husk compost treatments at different irrigation water levels on the chlorophyll content, leaf area, leaf relative water content and electrolyte leakage contents of pepper, it was determined that chlorophyll content, leaf area and leaf relative water content decreased

and electrolyte leakage increased due to increased drought, while chlorophyll content, leaf area and leaf relative water content increased and electrolyte leakage decreased with increasing hazelnut husk compost doses. The data obtained showed that hazelnut husk compost improves the physiological properties of pepper in regions where water resources are insufficient or in the deficit irrigation approach to saving water but conducting more comprehensive and long-term field studies on this subject was found to be a recommendable as a result of this study.

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ID: 625

Evaluation of the neuroprotective activity of *Passiflora Edulis Seeds* on Alzheimer's disease "In Vivo Study"

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Abstract

Alzheimer's disease is a neurodegenerative disease that causes a progressive and definitive deterioration of nerve cells leading to a clinical picture of dementia. Medicinal plants are currently considered a promising source for identifying new therapies. The aim of this study is to evaluate *in vivo* the neuroprotective effect of the ketone extract of *Passiflora edulis* seeds. The mice received *Passiflora edulis* extract at 100 and 200 mg/kg intragastrically for 45 days followed by induction of Alzheimer's disease by D-galactose at 120mg/kg (intraperitoneal) and aluminum chloride ALCL3 at 100 mg/kg (oral). The reference used in this study is rivastigmine, considered an anti-Alzheimer's. The results of the behavioral tests showed a significant improvement ($p<0.01$) in learning and memory capacity of Alzheimer's mice treated at 100 and 200 mg/kg (ALZ-ED1) (ALZ-ED2) respectively. The histological study confirmed these results, an improvement in aberrant cyto-architecture of the brain, showed decrease in the senile plaques and neurons in degeneration in the cerebral cortex of the treated mice .Finally, this current research allows us to affirm a possible neuroprotective activity of *Passiflora edulis seeds* including antidepressant and nootropic properties.

ID: 626

Acceleration the Growth of Dahlia (*Dahlia sp.*) Plants Grown with a Growth Retardant with Gibberellic Acid

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Abstract

In the production of ornamental plants, especially in the cultivation of potted ornamental plants, attention should be paid to the quality of seedlings so that the production can be of higher quality. Today, commercial seedling enterprises, it is aimed to produce strong seedlings with sufficient rooting, and no risk of disease and pests. However, sometimes small-sized seedlings appear in this seedling production. Although some cultural practices are preferred against this problem, growth retardants are generally preferred due to their effective results. In this study, 0, 25, 50, and 100 ppm doses of paclobutrazol were applied to dahlia seeds. In order to eliminate the possible retarding effects of paclobutrazol, GA_3 was applied by spraying on leaves at doses of 0, 100, and 200 ppm, 1 week after planting the seedlings in pots. In this study, the effects of paclobutrazol on seedling height and germination rate on the 25th and 40th days were examined as a first stage. In the second stage, plant height (cm), plant stem diameter (mm), flower diameter (mm), flower number (piece), number of leaves (piece), spad value, fresh biomass (g), dry biomass (g), root fresh weight (g), root dry weight (g), root length (cm), time from seed to harvest (days) and time from seedling to harvest (g) were investigated. At the end of the study, 25 ppm paclobutrazol application showed better results compared to control (4.68 cm-67.59%) at seedling height (5.08 cm) and germination rate (80.56%). As the doses of paclobutrazol increased, there was a decrease in the specified parameters. In the second stage, although there were no statistical differences in terms of plant growth in the seedlings treated with paclobutrazol alone, 50 ppm paclobutrazol application plant height (47.87 cm) and plant stem diameter (6.55 mm), 0 ppm paclobutrazol application root wet weight (7.02 g) and 50 ppm paclobutrazol application. The application showed the best results in root length (22.70 cm). In GA3 applications at different concentrations, the 100 ppm GA_3 application gave the best results in terms of plant growth compared to other applications. With the combination of paclobutrazol and GA_3 applications, 50 ppm paclobutrazol and 100 ppm ga3 applications were more effective in plant growth. It was concluded that 25 ppm paclobutrazol can be used for height control of seedlings in terms of growth and flowering, and 100 ppm GA_3 should be applied to eliminate possible retarding effects and quality plant growth.

Key Words: *Paclobutrazol, Plant Growth Regulator, Diameter, Plant Height, Biomass*

Büyüme Geciktirici ile Yetiştirilen Dahlia Bitkilerinin Giberellik Asit ile Büyümesinin Hızlandırılması

Özet

Süs bitkileri üretiminde özellikle saksılı süs bitkileri yetiştiriciliğinde üretimin daha kaliteli olabilmesi için fide kalitesine dikkat edilmelidir. Günümüzde ticari fide işletmelerinde yeterli köklenme sağlanmış, hastalık ve zararlı riski bulunmayan ve güçlü fidelerin üretilmesi hedeflenmektedir. Ancak bu fide üretiminde bazen küçük boyutlu fideler ortaya çıkmaktadır. Bu soruna karşı bazı kültürel uygulamalar tercih edilsede de genellikle etkili sonuçları sayesinde büyüme geciktiriciler tercih edilmektedir. Bu çalışmada, dahlia tohumlarına 0, 25, 50 ve 100 ppm dozlarında paclobutrazol uygulaması yapılmıştır. Paclobutrazolun sağladığı olası geciktirici etkilerini ortadan kaldırmak amacıyla fidelerin saksılara dikiminden 1 hafta sonra 0, 100 ve 200 ppm dozlarında yapraktan püskürtülerek GA_3 uygulaması yapılmıştır. Bu çalışmada, ilk aşama olarak paclobutrazolun 25. ve 40. gündeki fide boyuna etkilerine ve çimlenme oranına bakılmıştır. İkinci aşamada ise bitki boyu (cm), bitki gövde çapı (mm), çiçek çapı (mm), çiçek sayısı (adet), yaprak sayısı (adet), spad değeri, yaş biyokütle (g), kuru biyokütle (g), kök yaş ağırlığı (g), kök kuru ağırlığı (g), kök uzunluğu (cm), tohumadan hasada kadar geçen süre (gün) ve fideden hasada kadar geçen süreler (g) incelenmiştir. Çalışma sonunda, fide döneminde, fide boyunda (5.08 cm) ve çimlenme oranında (%80.56) 25 ppm paclobutrazol uygulaması kontrole göre (4.68 cm-%67.59) iyi sonuçlar göstermiştir. Paclobutrazol dozları arttıkça belirtlen parametrelerde düşüşler yaşanmıştır. İkinci aşamada ise, tek başına paclobutrazol uygulanan fidelerin bitki gelişimi açısından istatistiksel farklılıklar olmamasına ragmen 50 ppm paclobutrazol uygulaması bitki boyu (47.87 cm) ve bitki gövde çapında (6.55 mm), 0 ppm paclobutrazol uygulaması kök yaş ağırlığı (7.02 g) ve 50 ppm paclobutrazol uygulaması ise kök uzunluğunda (22.70 cm) en iyi sonuçları göstermiştir. Farklı konsantrasyonlardaki GA_3 uygulamalarında ise 100 ppm GA_3 uygulaması diğer uygulamalara kıyasla bitki gelişimi açısından en iyi sonuçları vermiştir. Paclobutrazol ve GA_3 uygulamalarının kombine edilmesiyle bitki gelişiminde ağırlıklı olarak 50 ppm paclobutrazol ve 100 ppm GA_3 uygulamalari daha etkili olmuştur. Fidenin büyüme ve çiçeklenme açısından boy kontrolünde 25 ppm paclobutrazol kullanılabileceği, kaliteli bitki gelişimi ve olası geciktirici etkileri ortadan kaldırmak için 100 ppm GA_3 uygulanması gerektiği sonucuna varılmıştır.

Anahtar Kelimeler: *Paclobutrazol, Bitki Büyüme Düzenleyici , Çap, Bitki Boyu, Biyokütle*

ID: 627

Effects of Different Levels of Compost and Fertilization Applications on the Growing Media on Gerbera (*Gerbera jamesonii sp.*) Plant Growth and Flowering

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Abstract

Different rates of compost (0-20% and 40%) and different EC levels (EC 750 µS/cm – EC 1100 µS/cm and EC 1450 µS/cm) were applied to the growing medium. In the study, which was carried out for two years (2021-2022), a factorial arranged randomized blocks experimental design was used to evaluate the effects of the applications and it was carried out with 3 replications. In the study, flower stalk length (cm), flower stalk thickness (mm), flower diameter (mm), plant height (cm), branch weight (g), spad value, vase life (days), root length (cm), gerbera plant root fresh weight (g) and root dry weight (g) parameters were investigated. At the end of the study, when the effects of different compost ratios on plant growth were examined, it was determined that no compost application (0%) was applied to the flower stalk length, flower stalk thickness, flower diameter, branch weight, spad value, vase life, root length, root fresh weight, root dry weight, and yield parameters.) environments, the best results were obtained. When the effect of different fertilization levels was examined, the best results were found at the EC 1100 µS/cm fertilization level in flower stalk length, flower diameter, branch weight, vase life, root length, root dry weight, and yield parameters. As a result of combining compost and fertilization applications at different rates, it was observed that 0% compost application had a positive effect on flower stem length, flower stem thickness, flower diameter, branch weight, and vase life parameters compared to other applications in growing environments with an EC level of 0.75. It is the most beneficial in growing environments with 40% compost application at plant height and 1100 µS/cm EC level, 0% compost application at spad value and root length, and EC level 1100 µS/cm, 0% EC level at root wet weight and 1450 µS/cm EC level. good results have been obtained. When the two-year data were compared, it was determined that the growth and flowering of the gerbera plant were better in the second year with the effect of its development and applications. As a result, it has been determined that the increase in the compost ratio in gerbera restricts plant growth in general. In fertilization applications, it was observed that the EC level of 1100 µS/cm had a more positive effect on plant growth compared to other applications.

Key Words: *Sustainable Agriculture, Biodegradable, Vase Life, Flower Stalk Length, Yield*

Yetiştirme Ortamına Farklı Seviyelerde Kompost ve Gübreleme Uygulamalarının Gerbera (*Gerbera jamesonii sp.*) Bitkisinin Büyüme ve Çiçeklenmesine Etkileri

Özet

Yetiştirme ortamına farklı oranlarda kompost (%0- %20 ve %40) ve farklı EC seviyelerine sahip (EC 750 µS/cm – EC 1100 µS/cm ve EC 1450 µS/cm) gübreleme uygulamaları yapılmıştır. İki sene yürütülen çalışmada (2021-2022) uygulamaların etkilerini değerlendirmek amacıyla faktöriyel düzenlenmiş tesadüf blokları deneme deseni kullanılmıştır ve 3 tekerrürlü olarak yürütülmüştür. Çalışmada gerbera bitkisinin çiçek sap uzunluğu (cm), çiçek sap kalınlığı (mm), çiçek çapı (mm), bitki boyu (cm), dal ağırlığı (g), spad değeri, vazo ömrü (gün), kök uzunluğu (cm), kök yaş ağırlığı (g) ve kök kuru ağırlığı (g) parametreleri incelenmiştir. Çalışmada sonunda, farklı kompost oranlarının bitki gelişimine etkisi incelendiğinde, çiçek sap uzunluğu, çiçek sap kalınlığı, çiçek çapı, dal ağırlığı, spad değeri, vazo ömrü, kök uzunluğu, kök yaş ağırlığı, kök kuru ağırlığı ve verim parametrelerinde kompost uygulaması yapılmayan (%0) ortamlarda en iyi sonuçlar elde edilmiştir. Farklı gübreleme düzeylerinin etkisine bakıldığında ise, EC 1100 µS/cm gübreleme seviyesinde, çiçek sap uzunluğu, çiçek çapı, dal ağırlığı, vazo ömrü, kök uzunluğu, kök kuru ağırlığı ve verim parametrelerinde en iyi sonuçlar saptanmıştır. Farklı oranlarda kompost ve gübreleme uygulamalarının kombine edilmesi sonucunda ise, çiçek sap uzunluğu, çiçek sap kalınlığı, çiçek çapı, dal ağırlığı ve vazo ömrü parametrelerinde %0 kompost uygulaması ve EC düzeyinin 0.75 olduğu yetiştirme ortamlarında diğer uygulamalara kıyasla olumlu etki yaptığı görülmüştür. Bitki boyunda %40 kompost uygulaması ve EC düzeyinin 1100 µS/cm, spad değerinde ve kök uzunluğunda %0 kompost uygulaması ve EC düzeyinin 1100 µS/cm, kök yaş ağırlığında ise %0 kompost uygulaması ve EC düzeyinin 1450 µS/cm olduğu yetiştirme ortamlarında en iyi sonuçlar elde edilmiştir. İki yıllık veriler kıyaslandığında ise gerbera bitkisinin gelişim özelliği ve uygulamalarında etkisiyle ikinci yılda büyüme ve çiçeklenmenin daha iyi olduğu saptanmıştır. Sonuç olarak, gerberada kompost oranının artması genel itibariyle bitki gelişimini kısıtladığı tespit edilmiştir. Gübreleme uygulamalarında ise EC düzeyinin 1100 µS/cm olması bitki gelişimi açısından diğer uygulamalara kıyasla daha olumlu etki yaptığı görülmüştür.

Anahtar Kelimeler: *Sürdürülebilir Tarım, Biyolojik Olarak Parçalanabilir, Vazo Ömrü, Çiçek Sap Uzunluğu, Verim*

ID: 628

The Effects of Different Rhizobacteria and Mycorrhiza Applications on Root Growth of Rose Cuttings

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Abstract

Growth regulators such as IBA are generally used to promote root formation of rose cuttings. However, today, within the scope of sustainable agricultural practices, research studies of new materials and methods alternative to synthetic chemicals in the plant production process are gaining momentum. At the beginning of such alternative applications are rhizobacteria (PGPR) and mycorrhizal fungi, which are increasingly used today. In this study, green cuttings taken from rose plants were prepared with a length of 12-15 cm. Rhizobacteria (Bacillus cereus (ZE-7) and Pseudomonas putida (ZE-12) and mycorrhiza (6000 ppm) were applied separately and both applications together. 10 seconds in mycorrhiza suspension, 30 minutes in rhizobacteria suspension, in the solution prepared for mycorrhiza + rhizobacteria applications) After waiting for 10 seconds (mycorrhiza) + 30 minutes (rhizobacteria), they were planted in the rooting medium. Perlite was used on the rooting table with fogging and underfloor heating. In the study, in order to determine the effects of applications on cuttings root growth; the number of rooted cuttings (%), callus formation (%)), decay rate (%), root number (number) and root length (cm) parameters were checked, the most suitable biological preparation was determined. As a result of the study, the highest rooting percentage was obtained in the ZE-12 application (19.44%), while was followed by the ZE-12 application, respectively. ZE-7 + ZE-12 application and mycorrhiza (6000 ppm) with a rooting percentage of 11.11, control group with 8.33%, ZE-7 with 5.56% followed the steps. While the highest decay rate (38.89%) was measured in the control group, the lowest decay rate was found in the ZE-7 application (8.33%). In the formation of calcification, the highest value (38.89%) was determined in the ZE-12 application. The number of roots varies between 4.33 pieces and 8.64 pieces. Root length varies between 3.05 cm and 11.87 cm. As a result, it was concluded that mycorrhizal and bacterial applications had a positive effect on rooting rate, callus and root number and these applications could be preferred for rooting with IBA.

Key Words: *Bacillus cereus, Pseudomonas putida,* mycorrhiza, cutting, rooting

Farklı Rizobakteriler ve Mikoriza Uygulamalarının Gül Çeliklerinde Kök Gelişimine Etkileri

Özet

Gül çeliklerinin kök oluşumunu teşvik etmek amacıyla genellikle IBA gibi büyüme düzenleyiciler kullanılmaktadır. Ancak, günümüzde sürdürülebilir tarım uygulamaları kapsamında, bitkisel üretim sürecinde sentetik kimyasallara alternatif yeni materyallerin ve yöntemlerin araştırma çalışmaları giderek hız kazanmaktadır. Bu tür alternatif uygulamaların başında ise, günümüzde kullanımı gittikçe yaygınlaşan rizobakteriler (PGPR) ve mikoriza mantarları yer almaktadır. Bu çalışmada, gül bitkilerinden alınan yeşil çelikler 12-15 cm uzunluğunda hazırlanmıştır. Çeliklere rizobakteriler (*Bacillus cereus* (ZE-7) ve *Pseudomonas putida* (ZE-12) ve mikoriza (6000 ppm) ayrı ayrı ve her iki uygulama birlikte yapılmıştır. Mikoriza süspansiyonunda 10 saniye, rizobakteri süspansiyonunda 30 dakika, mikoriza + rizobakteri uygulamaları için hazırlanan çözeltide ise 10 saniye (mikoriza) + 30 dakika (rizobakteri) bekletildikten sonra köklendirme ortamına dikilmiştir. Sisleme ve alttan ısıtma sistemi olan köklendirme masasında perlit kullanılmıştır. Çalışmada, uygulamaların çelik kök gelişimine etkilerini belirlemek amacıyla; köklenen çelik sayısı (%), kallüs oluşumu (%), çürüme oranı (%), kök sayısı (adet) ve kök uzunluğu (cm) parametrelerine bakılmıştır, köklenmede kullanılabilecek en uygun biyolojik preperat belirlenmiştir. Çalışma sonucunda; en yüksek köklenme yüzdesi ZE-12 uygulamasında (% 19.44) elde edilirken bunu sırasıyla %11.11'lik bir köklenme yüzdesi ile ZE-7 + ZE-12 uygulaması ve mikoriza (6000 ppm), %8.33 ile kontrol grubu, %5.56 ile ZE-7 uygulamaları takip etmiştir. Çürüme oranında ise en fazla çürüme (%38.89) kontrol grubunda ölçülürken en düşük çürüme oranı ise ZE-7 uygulamasında (%8.33) saptanmıştır. Kalüslenme oluşumunda ise en yüksek değer (%38.89) ZE-12 uygulamasında belirlenmiştir. Kök sayısı 4.33 adet ile 8.64 adet arasında değişmektedir. Kök uzunluğu ise 3.05 cm ile 11.87 cm arasında değişmektedir. Sonuç olarak, mikoriza ve bakteri uygulamaları köklenme oranı, kallüslenme ve kök sayısına olumlu etki yaptığı ve bu uygulamaların IBA ile de köklendirmede tercih edilebileceği sonucuna varılmıştır.

Anahtar Kelimeler: *Bacillus cereus, Pseudomonas putida,* mikoriza, çelik, köklendirme

ID: 629

The Effect of Compost, Bacteria, and Mycorrhiza Applications on the Phytochemical Contents of Edible Tulip Petals

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Abstract

Edible flowers have been in the human diet and culinary preparations since ancient times. Today, it is preferred by consumers thanks to its health benefits and nutritional effects. For these reasons, edible flowers are marketed as an innovative and promising product in the food industry, in the design and development of functional food and dietary supplements. In this study, the effects of bacteria and mycorrhiza applications on media containing compost at different rates (0%-20% and 40%) were examined. In the study, tulip bulbs were immersed in bacterial suspensions with 0.3 absorbances (Abs) value for 30 minutes and in 5000 ppm mycorrhizal suspension for 10 seconds, and then planted in plastic crates 20 cm deep x 40 cm wide x 60 cm long. Total phenol (µg GAE/g fw), TEAC (µmol TE/g fw), and total flavonoid (mg KE/L fw) contents in tulip petals harvested at the end of cultivation were investigated. At the end of the study, when only compost applications were compared, the highest TP (28682.63 µg GAE/g fw) and Total Flavonoid (1011.96 mg KE/L fw) were measured in the tulip petals taken from the environments with 40% compost, while the highest (0%) in the environments without compost. a high TEAC (9.46 µmol TE/g fw) value was measured. In bacteria and mycorrhiza applications, environments without microorganism application gave better results compared to the application environments. As a result of the combination of different compost ratios and bacterial applications, the highest TP (28833.42 µg GAE/g fw) and Total Flavonoid (1014.07 mg KE/L fw) contents were measured in petals taken from environments with 40% compost application and bacteria application, while the highest TEAC (9.80 mg) contents were measured. µmol TE/g fw) was measured in petals taken from media containing 40% compost and free of bacteria. When the effects of different compost ratios and mycorrhiza applications are compared, the highest TP (29944.53 µg GAE/g fw), TEAC (10.13 µmol TE/g fw), and Total Flavonoid (1083.52 mg KE/L fw) in environments with 40% compost rate and no mycorrhiza application. values were determined. As a result, it was concluded that as the compost ratios increase, the values increase, and the microorganisms are not effective in their phytochemical contents.

Key Words: *Total Phenol, Total Flavonoids, Biyo-agent, Biodegradable Wastes, Sustainable Agriculture*

Kompost, Bakteri ve Mikoriza Uygulamalarının Yenilebilir Lale Petallerinin Fitokimyasal İçeriklerine Etkisi

Özet

Yenilebilir çiçekler eski zamanlardan beri insan diyetinde ve mutfak hazırlıklarında yerini almaktadır. Günümüzde ise, sağlığa faydaları ve besleyici etkileri sayesinde tüketiciler tarafından tercih edilmektedir. Bu sebeplerden dolayı, yenilebilir çiçekler, gıda sanayisinde, fonksiyenel gıda, diyet takviyelerinin tasarı ve geliştirilmesinde yenilikçi ve gelecek vaat eden ürün olarak piyasa sunulmaktadır. Bu çalışmada, farklı oranlarda (%0-%20 ve %40) kompost içeren ortamlara bakteri ve mikoriza uygulamalarının etkilerine bakılmıştır. Çalışmada lale soğanları, 0.3 absorbans (Abs) değerine sahip bakteri süspansiyolarına 30 dakika ve 5000 ppm mikoriza süspansiyonuna 10 saniye daldırıldıktan sonra 20 cm derinliğinde x 40 cm genişliğinde x 60 cm uzunluğundaki plastik kasalara dikimi yapılmıştır. Yetiştiricilik sonunda hasat edilen lale petallerindeki toplam fenol (µg GAE/g fw), TEAC (µmol TE/g fw) ve toplam flavonoid (mg KE/L fw) içerikleri incelenmiştir. Çalışma sonunda, sadece kompost uygulamaları kıyaslandığında, %40 oranında kompost uygulanan ortamlardan alınan lale petallerinde en yüksek TP (28682.63 µg GAE/g fw) ve Total Flavonoid (1011.96 mg KE/L fw) ölçülürken, kompost içermeyen ortamlarda (%0) ise en yüksek TEAC (9.46 µmol TE/g fw) değeri ölçülmüştür. Bakteri ve mikoriza uygulamalarında ise, mikroorganizma uygulaması yapılmayan ortamlar, uygulama yapılan ortamlara kıyasla daha iyi sonuçlar vermiştir. Farklı kompost oranları ile bakteri uygulamalarının kombinesi sonucunda, en yüksek TP (28833.42 µg GAE/g fw) ve Total Flavonoid (1014.07 mg KE/L fw) içerikleri %40 kompost uygulaması ve bakteri uygulaması yapılan ortamlardan alınan petallerde ölçülürken, en yüksek TEAC (9.80 µmol TE/g fw) %40 oranında kompost içeren ve bakteri bulunmayan ortamlardan alınan petallerde ölçülmüştür. Farklı kompost oranları ile mikoriza uygulamalarının etkileri kıyaslandığında, %40 kompost oranı ve mikoriza uygulamasının bulunmadığı ortamlarda en yüksek TP (29944.53 µg GAE/g fw), TEAC (10.13 µmol TE/g fw) ve Total Flavonoid (1083.52 mg KE/L fw) değerleri saptanmıştır. Sonuç olarak, kompost oranlarının arttıkça değerlerde artışların gerçekleştiği, mikroorganizmaların ise fitokimyasal içeriklerinde etkili olmadığı sonucuna varılmıştır.

Anahtar Kelimeler: *Toplam Fenol, Toplam Flavonoid, Biyo-ajan, Biyoçözünebilir Atıklar, Sürdürülebilir Tarım*

ID: 630

The Effects of Some Herbal Additives Added to Ration on Calcium, Phosphorus, and Magnesium Levels in Serum of Broiler Breeding in Stocking Density

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Abstract

This study was carried out to determine the effects of different doses of curcumin (Cur) and resveratrol (Res) added in ration on serum calcium (Ca), phosphorus (P) and magnesium (Mg) levels of broilers exposed stocking density. A total number of 255 0-day-old male broiler chicks (*Ross 308*) were used in the study. The animals were divided into 5 groups; the control group was fed only basal diet but groups Cur250, Cur500, Res250 and Res500 had 250 mg/kg Cur, 500 mg/kg Cur, 250 mg/kg Res and 500 mg/kg Res, respectively, added to their ration. At the end of the study, 9 randomly selected animals from each group were slaughtered and blood was taken from the vena jugularis and used in the analysis. In the examinations, it was determined that serum Ca and Mg levels were statistically similar in all groups ($P > 0.05$). It was determined that the serum P level increased statistically significantly ($P < 0.05$) in the Cur250 group and was similar in the other groups. As a result, it was observed that the effects of the additives applied on serum mineral levels were limited according to the findings.

Key Words: *Broiler, Calcium, Herbal Additives, Phosphorus*

Yerleşim Sıklığı Uygulanan Broyler Rasyonuna İlave Edilen Bazı Bitkisel Katkıların Serumda Bazı Mineral Seviyeleri Üzerine Etkileri

Özet

Bu çalışma, yerleşim sıklığı uygulanan broylerlerin rasyonuna katılan farklı dozlardaki kurkumin (Kur) ve resveratrolun (Res) serumda kalsiyum (Ca), fosfor (P) ve magnezyum (Mg) seviyeleri üzerine etkilerini tespit etmek amacıyla yapıldı. Çalışmada 0 günlük yaşta toplam 255 adet erkek broyler civciv (Ross 308) kullanıldı. Çalışmada gruplandırma Kontrol, Kur250, Kur500, Res250 ve Res500 grupları olmak üzere 5 grup şeklinde dizayn edildi ve grupların bazal rasyonuna sırasıyla 0, 250 mg/kg Kur, 500 mg/kg Kur, 250 mg/kg Res ve 500 mg/kg Res katıldı. Çalışmanın sonunda her gruptan rastgele seçilen 9 adet hayvan kesilerek vena jugularisten kan alındı ve analizlerde kullanıldı. Yapılan incelemelerde serum Ca ve Mg seviyelerinin tüm gruplarda istatistiksel olarak bezer olduğu tespit edildi ($P > 0.05$). Serum P seviyesinin ise Kur250 grubundan istatistiksel olarak önemli oranda arttığı ($P < 0.05$), diğer gruplarda benzer olduğu belirlendi. Sonuç olarak elde edilen bulgulara göre uygulanan katkıların serum mineral seviyeleri üzerine etkisinin sınırlı olduğu görüldü.

Anahtar Kelimeler: *Broyler, Kalsiyum, Bitkisel Katkılar, Fosfor*

Giriş

Hayvansal üretimde, değişik yetiştirme koşullarına bağlı olarak meydana gelebilen stres düzeyi, hayvanların refah durumunu belirlemede kullanılan önemli ölçütlerden birisidir. Etçi piliç yetiştiriciliğinde yerleşim sıklığı, birim alanda yetiştirilen hayvan sayısı ya da üretim dönemi sonunda birim taban alanına düşen canlı ağırlık (kg/m^2) olarak tanımlanmaktadır. İşletmelerde karlılık için birim alanda yetiştirilen havyan sayısı oldukça önemli bir kriterdir. Yerleşim sıklığının artırılması, birim alanda üretilen toplam canlı ağırlığı dolayısıyla işletmenin karlılığını artırdığından, günümüzde yapılan entansif yetiştiricilikte etlik piliçler oldukça yüksek yoğunlukta yetiştirilmektedir. Bununla birlikte, yerleşim sıklığının gereğinden fazla artırılmasının hayvan refahı ve bireysel verim özellikleri üzerinde olumsuz etkiye sahip olduğu da bilinen bir gerçektir (Meluzzi ve Sirri, 2009).

Serum metabolitleri, tüm canlılarda olduğu gibi broylerde de metabolizmanın ve belirli doku ve organlardaki değişikliklerin önemli göstergeleridir (Ghazi ve ark., 2015). Çevresel ve beslenmeye bağlı birçok faktör canlılarda strese yol açabilmektedir. Hızlı bir gelişim gösteren broylerler normal çevresel şartlar altında da strese girebilir ve stres vücutta başta karaciğer olmak üzere birçok organı etkileyerek serum biyokimyasal parametrelerini etkileyebilir (Chen ve ark., 2021; Gumus ve Ozbilgin, 2022). Son zamanlarda dünya genelinde kullanılan kurkumin, resveratrol ve diğer birçok bitkisel katkıların sağlık üzerine olumlu etkilerinin olduğu belirtilmiştir (Umaya ve ark., 2021).

Zerdeçal *(Curcuma longa)*, tropik bölgelerde yetiştirilen *Zingiberaceae* familyasına bağlı bir bitki olup içerdiği, polifenolik bir bileşik olan curcumin, kanatlı endüstrisinde antikoksidiyal, antiinflamatuar, immünomodülatör, antimikrobiyal, antioksidan ve büyüme performansını desteklemek için yaygın olarak kullanılmaktadır (Ashry ve ark., 2021). Resveratrol, başta kırmızı üzüm olmak üzere çok çeşitli gıdalarda bulunan aktif bir doğal polifenolik bileşik olup başta antioksidan olmak üzere antitümör, antiinflamatuar, antiaging, anti-hiperlipidemik, kardiyoprotektif ve nöroprotektif özellikler gibi birçok biyolojik aktivitesi vardır (Alesci ve ark., 2022).

Broylerlerde yapılan çalışmada rasyona katılan resveratrolun serum Mg seviyesini üzerine olumlu etkisinin olduğu belirtilmiştir (Gumus ve Ozbilgin, 2022).
Bu çalışma, yerleşim sıklığı uygulanan broylerlerin rasyonuna katılan farklı dozlardaki resveratrol ve kurkuminin serumda biyokimyasal parametrelerden Ca, P ve Mg seviyeleri üzerine etkilerini tespit etmek amacıyla yapıldı.

Materyal ve Yöntem

Deneme dizaynı, Hayvan ve Yem

Bu çalışmada hayvanlar 28 gün süren besi denemesi boyunca Sivas Cumhuriyet Üniversitesi Veteriner Fakültesinde kapalı alanda üç katlı 120×60×80 cm ölçülerine sahip kafeslerde barındırıldı. Hayvan materyali olarak piyasadan temin edilen 0 günlük yaşta, toplam 255 adet erkek broyler civciv *(Ross 308)* kullanıldı ve hayvanlar eşit sayıda 5 gruba ayrıldı (her grup kendi içerisinde 17 adet broyler olacak şekilde 3 alt gruba ayrıldı). Çalışmada gruplandırma Kontrol, Kur250, Kur500, Res250 ve Res500 grupları olmak üzere 5 grup şeklinde dizayn edildi ve grupların bazal rasyonuna sırasıyla 0, 250 mg/kg Kur, 500 mg/kg Kur, 250 mg/kg Res ve 500 mg/kg Res ilave edildi. Çalışmanın 14. gününe kadar bütün hayvanlara konfor sıcaklığı (sıcaklık dereceli olarak 33 °C'den 22 °C'ye düşürüldü), 15. günden itibaren çalışmanın sonuna kadar (28. gün) tüm gruplara 22 ^{o}C sıcaklık uygulandı. Tüm gruplara 0-14. günler arası dönemde broyler başlangıç yemi (ham protein % 22.5 ve metabolik enerji 2960 kcal/kg), 14-28. günler arası broyler büyütme yemi (ham protein % 19.55 ve metabolik enerji 3150 kcal/kg) verildi. Yem ve su *ad libitum* olarak verildi. Çalışma süresince tüm hayvanlara günde 23 saat aydınlık, 1 saat karanlık uygulandı. Hayvanların rasyonları NRC (1994)'nin önerilerine göre formüle edildi.

Yem Katkıları

Resveratrol, 3,4',5-Trihydroxy-trans-stilbene, % 99.13 (HPLC), Katalog No:32060, Chem-Impex Int'l. Inc. USA. Kurkumin, % 95.11 (HPLC), Katalog No:22845, Chem-Impex Int'l. Inc. USA. Yem katkıları rasyona katılan gruplarda katıldığı miktar kadar mermer tozu miktarı azaltılmıştır.

Biyokimyasal Analizler İçin Kan Örneklerin Alınması ve Analizi

Çalışmanın son günü (28 günlük yaş) biyokimyasal analizlerde kullanılmak üzere her gruptan rastgele seçilen 9 adet (her alt gruptan 3 adet) broylerlerin vena jugularisinden kan alındı. Hayvanlardan antikoagulansız tüplere (Becton Dickinson Co. USA) yaklaşık 5 cc kadar alınan kanlar soğutmalı santrifüjde (Hettich 38R, Hettich Zentrifugen, Tuttlingen Germany) +4 °C'de 4000 rpm'de 10 dk santrifüj edilerek elde edilen serumlar analiz edileceği güne kadar -80 C°'de saklandı

Serum örneklerinde Ca, P ve Mg seviyeleri ticari test kitleri kullanılarak otomatik analizörde (Mindray BS-200, P.R. China) ölçüldü.

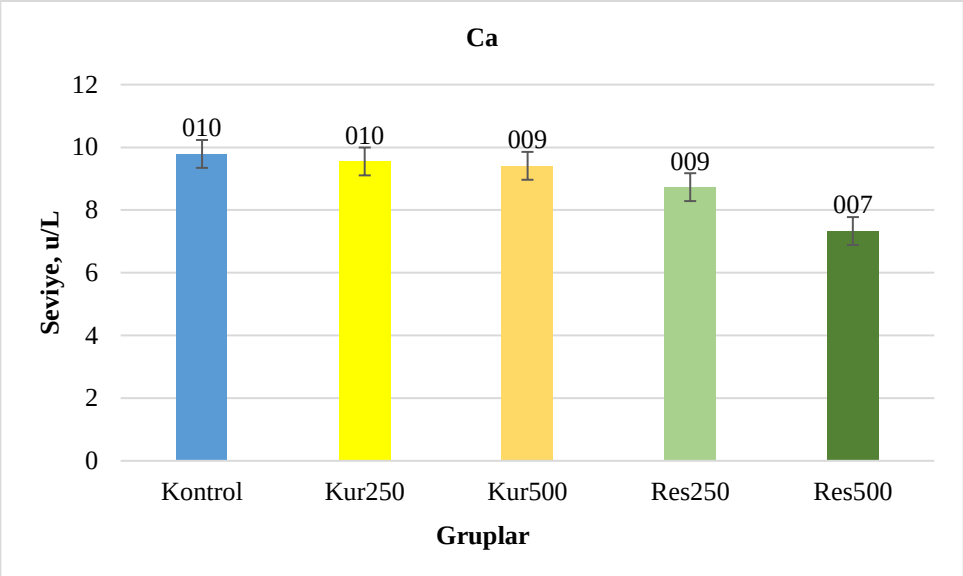
İstatistiksel Analizler

Elde edilen veriler SPSS istatistik paket programı kullanılarak değerlendirildi (SPSS, 2011). Gruplardan elde parametreler ile ilgili veriler arasında istatistiksel farklılığın olup olmadığını saptamak için tek yönlü ANOVA testi, hangi gruplar arasında farklılığın olduğunu belirlemek için Duncan testi uygulandı ($P < 0.05$).

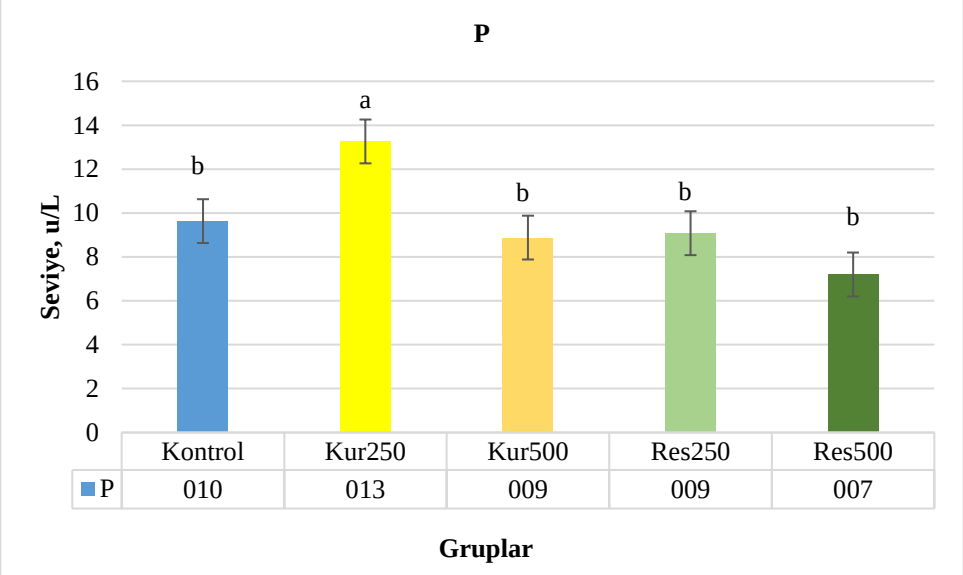
Bulgular ve Tartışma

Broyler rasyonuna katılan farklı dozlardaki kurkumin ve resveratrolun serum Ca seviyesi üzerine etkileri Şekil 1'de, serum P seviyesi üzerine etkileri Şekil 2'de ve serum Mg seviyesi üzerine etkileri ise Şekil 3'te verildi. Şekil 1 ve Şekil 3'e bakıldığında rasyona katılan resveratrol ve kurkumin katkılarının tüm dozlarının serum Ca ve Mg sevilerini etkilemediği tespit edildi ($P > 0.05$). Şekil 2'ye bakıldığında ise rasyona katılan 250 mg/kg kurkuminin serum P seviyesini istatistiksel olarak arttırdığı belirlendi ($P| < 0.01$).

Canlıların serumdaki biyokimyasal parametrelerin değerleri metabolik durum hakkında oldukça önemlidir. Hastalık durumu, çeşitli çevresel faktöre bağlı stresler ve beslenme bu parametreleri oldukça etkileyebilmektedir (Gumus ve Ozbilgin, 2022). Kalsiyum, vücutta en çok bulunan mineral olup vücut ağırlığının yaklaşık %1.5-2'sini, fosfor da, kalsiyumdan sonra, vücutta en fazla bulunan ikinci element olup toplam vücut ağırlığının yaklaşık % 0.8-1.2'sini oluşturur (Gropper ve ark., 2009). Vücutta Ca ve P mineralleri birçok biyolojik fonksiyonda birlikte görev aldığı için kanatlı hayvanların kanındaki değerleride önemlidir (Qian ve ark., 1997). Bu nedenle, broylerler için Ca gereksinimlerin belirlenmesinde P gereksinimleride dikkate alınmalıdır. Yine kemik dokusunun gelişimi üzerine Ca ve P minerallerinin büyük etkisi olduğu bildirilmiştir (Waldenstedt, 2006). Bir diğer önemli mineral olan Mg biyolojik sistemler için gerekli olup, biyokimyasal olarak çeşitli enzimatik ve metabolik işlemlerde yer alır (Fischer ve Giroux, 1991).



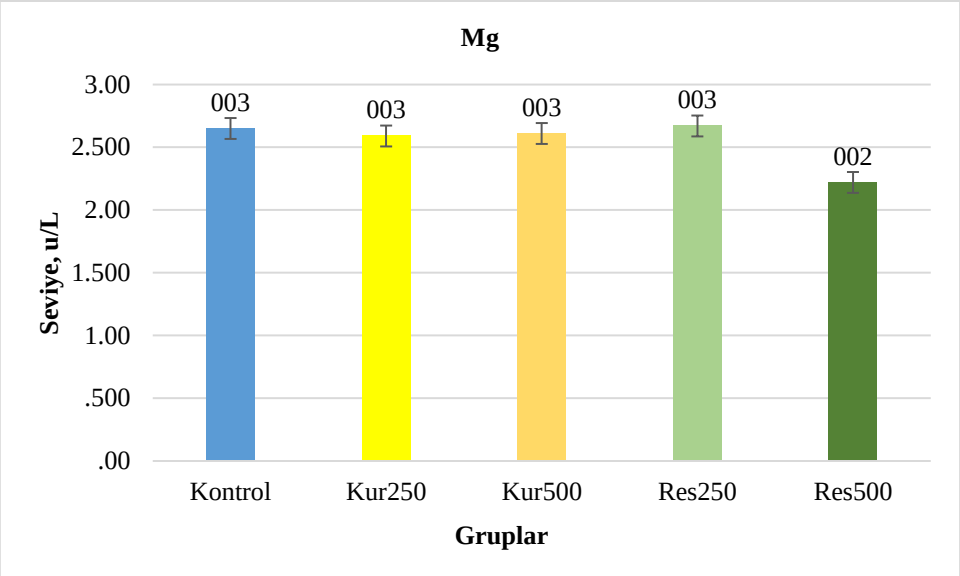
Şekil 1. Broyler rasyonuna katılan kurkumin ve resveratrolun serum Ca seviyeleri üzerine etkileri. (P > 0.05).



Şekil 2. Broyler rasyonuna katılan kurkumin ve resveratrolun serum P seviyeleri üzerine etkileri. (P < 0.01).

Bu çalışmada da elde edilen sonuçlar incelendiğinde kullanılan farklı dozlardaki kurkumin ve resveratrol katkılarının serum Ca ve Mg seviyerini etkilemediği görülürken, rasyonuna 250 mg/kg kurkuminin katılan grupta serum P seviyesinin önemli olarak arttığı belirlenmiştir. Broylerde yapılan bir çalışmada rasyona katılan resveratrol ve kurkumin katkılarının 42 günlük yaşta serum Ca ve P seviyelerini etkilemediği, serum Mg seviyesinin ise resveratrol katılan gruplarda arttığı belirtilmiştir (Gumus ve Ozbilgin, 2022). Yine benzer olarak sıçanlarda yapılan başka bir çalışmada içme suyuna 10 mg/kg dozunda resveratrol ilave edilen grubun serum Ca ve P seviyelerinin etkilenmediği, Mg seviyesinin ise arttığı bildirilmiştir (Arslangil ve Baltacı, 2015). Bıldırcınlarda yapılan bir çalışmada benzer etkilere sahip bitkisel bir katkı olan kekik uçucu yağının rasyona katılan 300 ve 450 mg/kg dozlarının serumda Mg seviyesini önemli oranda arttırdığı, serum Ca ve P seviyelerini ise etkilemediği bildirilmiştir (Gumus ve ark., 2017).

Sonuç olarak; yerleşim sıklığı uygulanan broylerlerin rasyonuna katılan resveratrol ve kurkumin katkılarının serum Ca ve Mg seviyelerini etkilemediği, serum P seviyesini ise 250 mg/kg kurkumin dozunun önemli oranda arttırdığı görüldü. Buna göre resveratrol ve kurkumin katkılarının serumda bakılan parametreler üzerine olumsuz etkilerinin olmaması ve içerdikleri diğer birçok olumlu özelliklerinden dolayıda broyler rasyonlarında kullanılmasının uygun olacağı düşünülmektedir.



Şekil 3. Broyler rasyonuna katılan kurkumin ve resveratrolun serum Mg seviyeleri üzerine etkileri. (P > 0.05).

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Effects of Different Organic Source Materials on Growth, Flowering, and Yield in Zinnia Plant

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Abstract

Zinnia (*Zinnia elegans*) is an ornamental plant of the Asteraceae family, originating from Central America and Mexico, which can also be used in landscape design, grown as potted or cut flowers with various colors. Organic fertilizers, on the other hand, are important plant food sources that increase the uptake of nutrients and minerals needed by the plant by the roots and have positive effects on growth, development, and yield. The study was carried out in a randomized plot design with three replications, with 4 pots in each replication and 3 plants in each pot. A total of 10 applications consisting of liquid compost (25%-50%), vermicompost (25%-50%), and humic acid (600-1200 ppm) and combining these applications were applied to Zinnia seedlings. The first application was applied as 400 mL per pot when the plants reached 20 cm in size. Applications were made 3 times with an interval of 7 days. When the plants are harvested, flower diameter (mm), stem thickness (mm), number of flowers (piece), stem length (cm), number of branches (pieces), the weight of branches (g), number of leaves (pieces), root length (cm), root fresh weight (g), root dry weight (g), vase life (days) parameters were examined. As a result of the study, the highest flower diameter (72.27 mm) and SPAD value (34.93) was 600 ppm humic acid application, the highest flower stem thickness (4.67) and flower stem length (45.56 cm) 25% liquid compost + 25% vermicompost application, the highest flower stem thickness (4.67). The number of flowers (6.17 pieces) and root wet weight (8.10 g) were found in 25% vermicompost application, the highest number of branches (7.25) in 1200 ppm humic acid application, the highest branch weight (30.76) in 50% vermicompost application. As a result, it was observed that in applications where 25% of vermicompost was used, it had positive effects on the number of leaves, flowering, and root parameters. In humic acid applications, it has been found to have a positive effect when used at low rates such as 600 ppm. It is stated in the results of the study that the doses used to give better results when applied at low rates.

Key Words: *Humic acid, Vermicompost, Compost, Cut flower, Sustainable Agriculture*

Farklı Organik Kaynaklı Materyallerin Zinnia Bitkisinde Büyüme, Çiçeklenme ve Verime Etkileri

Özet

Zinnia (Zinnia elegans), Asteraceae familyasına ait Orta Amerika ve Meksika kökenli olan, çeşitli renklere sahip olan saksılı veya kesme çiçek olarak yetiştirilen peyzaj tasarımında da kullanılabilen bir süs bitkisidir. Organik gübreler ise bitkinin ihtiyaç duyduğu besin elementlerinin ve minerallerin kökler tarafından alımını artıran büyüme, gelişme ve verim üzerinde olumlu etkiler yapan önemli bitki besin kaynaklarındandır. Çalışma tesadüf parselleri deneme desenine göre üç tekerrürlü, her tekerrürde 4 saksı ve her saksıda 3 er bitki olacak şekilde yürütülmüştür. Zinnia fidelerine sıvı kompost (%25-%50), vermikompost (%25-%50), hümik asit (600-1200 ppm) ve bu uygulamaların kombine edilmesiyle oluşan toplam 10 uygulama yapılmıştır. İlk uygulama, bitkiler 20 cm boyuta gelince saksı başına 400 mL olacak şekilde uygulanmıştır. Uygulamalar 7 gün ara ile 3 kez yapılmıştır. Bitkiler hasada geldiğinde çiçek çapı (mm), çiçek sap kalınlığı (mm), çiçek sayısı (adet), çiçek sap uzunluğu (cm), dal sayısı (adet), dal ağırlığı (g), yaprak sayısı (adet), kök uzunluğu (cm), kök yaş ağırlığı (g), kök kuru ağırlığı (g), vazo ömrü (gün) parametrelerine bakılmıştır. Çalışma sonucunda en yüksek çiçek çapı (72.27 mm) ve SPAD değeri (34.93) 600 ppm hümik asit uygulamasında, en yüksek çiçek sap kalınlığı (4.67) ve çiçek sap uzunluğu (45.56 cm) %25 sıvı kompost + %25 vermikompost uygulamasında, en yüksek çiçek sayısı (6.17 adet) ve kök yaş ağırlığı (8.10 g) %25 vermikompost uygulamasında, en yüksek dal sayısı (7,25) 1200 ppm hümik asit uygulamasında, en yüksek dal ağırlığı (30,76) %50 vermikompost uygulamasında bulunmuştur. Sonuç olarak, vermikompostun %25 oranında kullanıldığı uygulamalarda yaprak sayısı, çiçeklenme ve kök parametrelerine üzerine olumlu etkiler yaptığı gözlemlenmiştir. Hümik asit uygulamalarında ise 600 ppm gibi düşük oranlarda kullanıldığında olumlu etki yaptığı saptanmıştır. Kullanılan dozlar düşük oranlarda uygulandığında daha iyi sonuçlar verdiği çalışmanın sonuçlarında yer almaktadır.

Anahtar Kelimeler: *Humik asit, Vermikompost, Kompost, Kesme çiçek, Sürdürülebilir Tarım*

ID: 633

Artificial Neural Network Applications in Seafood

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Abstract
Seafood are perishable products and have limited shelf life due to their nutritional composition, pH value, water content, water activity and weak connective tissue. The quality of seafood could be determined by analyzing the microbiological, chemical and sensory changes during a particular storage time. Additionally, safety of seafood is another concern in terms of public health and also could be determined by the evaluation of microbiological and chemical indices. Conventional methods are used for analyzing the quality and safety of seafood. However, recently neural networks are gaining popularity in order to determine, categorize and prediction of the quality and safety of seafood. Artificial neural network (ANN) is one of the sub subjects of artificial intelligence. Additionally, ANN is one of the most effective approaches for deciding whether or not the product is suitable for the consumption or is used to categorize the product. Predictive models were developed for many food categories, particularly for perishable products such as seafood. In this context, ANN applications to determine the quality and safety of seafood were evaluated. Furthermore, critical statistical indices were emphasized for assessment of the developed model performance in this study.
Key Words: *Artificial neural network, mathematical modeling, seafood, quality, safety*

Yapay Sinir Ağlarının Su Ürünlerinde Uygulamaları

Özet
Su ürünleri çabuk bozulabilen gıdalardır ve besin içerikleri, pH değerleri, su içerikleri, su aktivitesi ve zayıf bağ dokusu nedeni ile sınırlı raf ömrüne sahiptirler. Su ürünlerinin kaliteleri belirli zaman aralığına sahip depolama koşullarında mikrobiyolojik, kimyasal ve duyusal değişimlerin analizleri ile belirlenebilir. Buna ek olarak, su ürünlerinde güvenlik halk sağlığı açısından diğer bir konudur ve mikrobiyolojik ve kimyasal indislerin değerlendirilmesi ile belirlenebilmektedir. Su ürünlerinde kalite ve güvenliğin belirlenmesinde konvensiyonel metotlar kullanılabilmektedir. Ancak, günümüzde sinir ağları su ürünlerinin kalite ve güvenliğinin belirlenmesinde, categorize edilmesinde ve tahmininde popülerlik kazanmaktadır. Yapay Sinir Ağları (YSA) yapay zekanın alt konularından biridir. Bununla birlikte, YSA ürünün tüketilip tüketilemeyceği veya ürünün kategorize edilmesinde oldukça etkili yaklaşımlardan biri olmaktadır. Tahmin modelleri özellikle su ürünlerinde olmak üzere birçok gıda ürününde geliştirilmiştir. Bu kapsamda, su ürünlerinde kalite ve güvenliğin belirlenmesinde YSA uygulamaları değerlendirilmiştir. Dahası, bu çalışmada geliştirilen modellerin performans değerlendirilmesinde kullanılan istatistiki indisler vurgulanmıştır.
Anahtar Kelimeler: *Yapay sinir ağları, matematiksel modelleme, su ürünleri, kalite, güvenlik*

Giriş
Su ürünleri diğer ülkelerde olduğu gibi ülkemizde de ekonomik açıdan olduğu kadar insan tüketimi açısından da önemli bir yere sahiptir. Ülkemizdeki su ürünleri istatistikleri incelendiğinde yetiştiricilik üretiminin 2020 yılında 421 411,0 tondan 2021 yılında 476 686,0 tona çıktığı, bununla birlikte avlanan deniz balıkları miktarının 2020 yılında 291 910,0 ton ve 2021 yılında 262 289,7 tona ve son olarak avlanan tatlısu ürünlerinin miktarının 2020 yılında 33 119 tondan 2021 yılında 33 140,0 tona ulaştığı bildirilmiştir (TUİK, 2022). Bu kapsamda değerlendirildiğinde su ürünleri ülkemizde de tüketimin önemli bir kısmını oluşturduğu düşünülmektedir. Insan diyetinin büyük bir kısmını oluşturmasının yanında kara hayvanlarında bulunmayan fonksiyonel bileşenleri içermesinden dolayı sağlıklı gıdalar arasında yer almaktadır. Su ürünlerinde bulunan fonksiyonel bileşenler bireyin ateroskleroz ve trombotik rahatsızlıklardan korunmasına yardımcı olan n-3-çoklu doymamış yağ asitlerini (eikosapentaenoik asit dokosahexsaenoik asit) içermektedir (Hosomi ve ark 2012). Su ürünlerinin sağlıklı gıda olarak tüketilmesinin yanında besin içerikleri, pH değerleri, yüksek nem içeriği gibi özelliklerinden kaynaklı olarak çabuk bozulabilen gıdalar arasında yer aldığı bilinmektedir ve korumasız ve yetersiz depolama ve işleme uygulandığında çok hızlı bir şekilde bozulabildiği bilinmektedir (Gram, 2009). Su ürünlerinde kalite fizikokimyasal, tekstürel, duyusal elektriksel metotlar ile belirlenebilmektedir ancak kullanılan bu metotlar zaman ve ekonomik açıdan değerlendirildiğinde oldukça maliyetli olmaktadırlar (Hassoun ve Karoui, 2017). Bu açıdan değerlendirildiğinde su ürünlerinde kalite ve güvenliğin belirlenmesinde matematiksel model tabanlı uygulamalar ön plana çıkmaktadır.

Yapay sinir ağları (YSA) biyolojik sinir ağlarına benzer olarak nöronlar ile birbirlerine bağlanan bir sistemi ifade eder ve bu sayede gelen verileri işleyerek eylem alınmasına olanak sağlar (Mishra ve Srivastava 2014). Dahası,

yapay sinir ağları biyolojik sinir sisteminden esinlenerek oluşturulmuş matematiksel model tabanlı bir bilgi işleme sistemidir (Maind ve Wankar 2014). Yapay sinir ağları nöron ismi verilen işleme birimlerinden oluşurlar. Nöronlar, girdi (input) ve çıktılardan (output) oluşurlar ve nöron fonksiyonu nöronu aktive eder ve bu sayede bilgi işlenerek çıktıya ulaşılır (Kukreja vd., 2016). Yapay sinir ağları bu sayede gerçek hayat problemlerinin çözümünde birçok alanda kullanılmaya başlanmıştır ve fonksiyon yaklaşımı veya regresyon analizi, sınıflandırma, veri işleme, filtreleme, kategorize etme gib birçok alanda uygulanmıştır (Shanmuganathan, 2016). Bu kapsamda değerlendirildiğinde su ürünleri insan tüketimine sunulmakta ve gıda kalite ve güvenliği açısından da değerlendirilmesi gerekmektedir. Bu çalışmada yapay sinir ağlarının su ürünleri uygulamaları incelenmiştir.

Yapay sinir ağlarının su ürünlerinde uygulamaları

Biyolojik faaliyetlerin kinetiklerin matematiksel modeler ile belirlenebilmektedir. Matematiksel modellerin birçok uygulama yöntemi olmakla birlikte YSA bu yöntemlerin uygulama alanlarından biri olarak sunulmaktadır. Genel olarak YSA'nın gıdalarda birçok uygulaması olmasına ragmen su ürünlerindeki uygulamaları göreceli olarak kısıtlıdır. Yapılan çalışmalarda optimizasyon ve tahmin modellerinin ağırlıklı olarak incelendiği görülmüştür. Bu kapsamda, Genç (2022) yapmış olduğu çalışmada su ürünlerinde depolama zamanının YSA tabanlı bir matemetiksel model ile tahmin edilebilirliğini araştırmıştır. Çalışmada karides, yayın, çipura, gökkuşağı alabalıkları, sazan, tilapiya, sarıağız balığı gibi farklı su ürünlerinde depolama zamanına bağlı olarak meydana gelen renk değişimleri giriş verisi olarak kullanılmıştır. İleri beslemeli geri yayılım algoritması Marquardt algoritması ile eğitilmiştir. Momentumlu kademeli azalma ve adaptif öğrenme oranlı geri yayılım fonksiyonu eğitim fonksiyonu olarak belirlenmiştir. Yapılan çalışmada su ürünlerinin depolama zamanının tahmin edilmesi için geliştirilen en uygun topolojinin 30 nöron içerdiği bildirilmiştir. Yapılan diğer bir çalışmada Kumar ve Kumar (2021) YSA tabanlı birleşik risk derecelendirme yaklaşımını incelemişlerdir. Araştırmacılar yapmış oldukları çalışmada Avrupa'da bulunan balık ve su ürünlerinde risk oluşturan kontaminantları süreklilik, biyoakümülasyon ve toksisite açısından değerlendirmişler ve herbir bileşik için YSA tabanlı kendi kendini düzenleyen harita yaklaşımını kullanarak bir tehlike indeksi oluşturmuşlardır. Araştırmacılar yapmış oldukları çalışma sonuçlarının öncelikli kontaminantları belirlediğini ve düzenleyici kararlarda, bilimsel panellerde ve güvenlik ölçümlerinde bu sonuçların kullanılabileceğini bildirmişlerdir. Lalabadi vd. (2020) yapmış oldukları çalışmada çok sınıflı yapay sinir ağları ve destek vektör makineri kullanarak balıklarda göz ve solungaç rengine dayalı tazelik kategorizasyonunu araştırmışlardır. YSA sınıflandırmasında çok katmanlı algılayıcı ve destek vektör makineleri (DVM) sınıflandırmasında ise radial tabanlı işlev çekirdeği kullanılmıştır. Araştırma sonuçlarına göre YSA sınıflandırmasının DVM'ye göre daha hassas sonuçlar verdiği bildirilmiştir. Moosavi-Nasab vd. (2021) balık filetolarında toplam uçucu bazik azot (TVBN) miktarının derin öğrenme sinir ağı ile birleştirilen hiperspektral görüntüleme ve meta analizi ile değerlendirmiştir. Araştırmada doğrusal derin sinir ağının (DDSA) balık filetolarında TVBN içeriğini Kabul edilebilir oranda tahmin edebildiği belirtilmiştir. Ancak en küçük kareler DVM algoritmasının diğer modellere göre daha hassas ve doğru sonuçlar verdiği araştırmacılar tarafından bildirilmiştir. Yapılan diğer bir çalışmada farklı balık türlerinin belirlenmesinde derin öğrenme tabanlı bilgisayarlı akıllı bir system geliştirilmesi amaçlanmıştır. Çalışmada derin öğrenme algoritması olarak evrişimli sinir ağı kullanılmıştır. Araştırma sonuçlarına göre ggeliştirilen modelin genel hassasiyetinin % 94 olduğu ve modelin F1-değerinin %98 olduğu barbun balığında güvenli olarak çalıştığı bildirilmiştir (Rasheed, 2021).

Sonuç

Su ürünlerinde YSA tabanlı geliştirilen modeler incelendiğinde risk değerlendirmede, sınıflandırmada, kategorizasyonda, optimizasyonda ve matematiksel tahmin gibi alanlarda kullanıldığı görülmektedir. Gelişen teknoloji de göz önünde bulundurulduğunda YSA tabanlı algoritmaların su ürünlerinde kalite vegüvenlik değerlendirilmesi amacı ile kullanılması hem zaman hem de maliyet açısından olumlu sonuçlar vereceği düşünülmektedir. Bununla birlikte su ürünlerinde YSA tabanlı uygulamaların geliştirilmesi yapılacak olan çalışmalarda da optimizasyon teknikleri ile birlikte hassas sonuçların elde edilmesine olanak sağlayacağı yapılan çalışmalar açıcından değerlendirildiğinde de açıkça görülmektedir. Dahası, YSA tabanlı tahmin modellerin tahribatsız ve hızlı olması bununla birlikte geliştirildikten sonra üçüncül modeler gibi kullanımının kolay olması gibi avantajlarından dolayı tercih edilebilirliğinin yüksek olduğu düşünülmekte ve su ürünlerinde kullanımının artması bu alanda yapılacak olan çalışmalarda zaman ve ekonomik açıdan avantaj sağlayabileceği düşünülmektedir.

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The relationship of antibacterial activity of *Origanum majorana* L. with its plant nutrient elements

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Abstract
The importance and popularity of medicinal aromatic plants are on the rise all over the world, especially due to economic problems and resistance of bacteria towards antibiotics. These kinds of plants have been used in traditional medicine for centuries. The reduction of productivity of agricultural lands due to unconscious agricultural applications such as excess fertilizers or pesticides have major impact on the plant nutrient element concentrations in agricultural soils all over the world. This change may indeed affect the elemental composition of cultivated plants and may alter the biological activities of the crops. In this study the antibacterial activity of the ethanol extract of *Origanum majorana* L. belonging to Lamiaceae family on Gram-positive and Gram-negative bacteria was evaluated together with the correlations of macro and micro nutrient elements of this plant. Ethanol extract of the harvested aerial parts of *Origanum majorana* L. grown in the lab conditions on soil obtained from the experimental field of Faculty of Agriculture was tested on *E. coli*, *P. aeruginosa*, *S. aureus* and *E. faecalis.* Moreover, some macro (P, K, Ca, Mg) and micro (Fe, Cu, Zn, Mn, B and Ni) nutrient elemental concentrations were determined using ICP-OES. The results showed the antibacterial activity of the extracts on these bacteria, in the order of *S. aureus*, *P. aeruginosa*, *E. faecalis*, *E. coli* and their significant positive correlation with copper and nickel micro nutrient elements ($\rho=1$, $p=0.010$, for each). This means that as these elements increase in the plant, its antibacterial activity will increase, most probably up to a certain level. Therefore, soil analyses prior to fertilizer or pesticide applications are vital for cultivation of medicinal aromatic plants which are frequently used in traditional medicine.
Key Words: *Origanum majorana L., macro and micro nutrient elements, antibacterial activity*

Origanum majorana L. bitkisinin bitki besin elementleri ile antibakteriyel aktivitesisnin ilişkisi

Özet
Tıbbi aromatik bitkilerin popülaritesi tüm dünyada özellikle antibiyotik direnci ve ekonomik problemlerden dolayı gitgide artmaktadır. Bu tür bitkilerin yüzyıllardır geleneksel tıpta kullanıldığı bilinmektedir. Tarım alanlarında fazla gübre ya da pestisit kullanımı gibi bilinçsiz uygulamalar nedeniyle tarım topraklarının verimliliği azalmakta ve bitki besin elementi içerikleri gün geçtikçe azalmaktadır. Bu değişiklikler de tarımı yapılan bitkilerin içeriklerini ve biyolojik etkilerini de değiştirebilmektedir. Bu çalışmada Lamiaceae familyasına ait *Origanum majorana* L. bitkisinin etanolle elde dilmiş özütü Gram pozitif ve Gram negatif bakteriler üzerinde etkileri bitkinin makro ve mikro besin element içeriği ile birlikte değerlendirilmiştir. Tekirdağ Namık Kemal Üniversitesi Ziraat Fakültesi deneme alanı toprağı kullanılarak laboratuvar ortamında yetiştirilen *Origanum majorana* L. bitkisinin toprak üstü aksamının etanol özütü *E. coli*, *P. aeruginosa*, *S. aureus* ve *E. faecalis* üzerinde denenmiştir. Ayrıca bazı makro (P, K, Ca, Mg) ve bazı mikro (Fe, Cu, Zn, Mn, B ve Ni) besin elementleri içerikleri ICP-OES kullanılarak belirlenmiştir. Sonuçlar bu özütün antibakteriyel etki sıralamasının *S. aureus*, *P. aeruginosa*, *E. faecalis*, *E. coli* şeklinde olduğunu göstermiştir. Antibakteriyel etkinin bakır ve nikel ile belirgin pozitif korelasyonu olduğu da gösterilmiştir (her biri için $\rho=1$, $p=0.010$). Bu sonuç, bu elementlerin bitkideki miktarının muhtemelen belli bir miktara kadar arttıkça antibakteriyel etkilerinin de artacağı anlamına gelmektedir. Bu nedenle, pestisit ya da gübre uygulanmasından önce toprak analizlerinin yapılması özellikle geleneksel tıpta kullanılan bitkilerin yetiştiriciliğinde büyük önem arz etmektedir.
Anahtar Kelimeler: *Origanum majorana L., makro ve mikro besin elemetleri, antibakteriyel aktivite*

Introduction

Origanum majorana L is a member of Lamiaceae family. The genus *Origanum* have around nine hundred species and many of them are used in food industry as well as cosmetics. The fragrance of marjoram is preferred for being a spicy odor. Besides such uses, the plant has been used in traditional medicine for centuries and consumed as food (Pimple et al., 2012). Therefore, marjoram is also a medicinal aromatic plant. It is rich is proteins, carbohydrates, and Vitamin C (Hussain et al., 2010). The essential oils of medicinal aromatic plants are rich in phytochemical compounds such as polyphenols. Such bioactive chemicals make the plants have certain biological activities such as antibacterial, anti-fungal, anti-carcinogenic, anti-inflammatory and antioxidant effects (Amor et al., 2019; Lombrea et al., 2020). Moreover, it was found to have immunomodulatory effects (Wang et al., 2021). Essential oil of marjoram is indeed rich in alpha-terpinene., gamma-terpinene, beta terpineol and sabinene (El-Khateeb et

al., 2020; Kimera et al., 2021). Therefore, it has many biological activities. In a recent study, the essential oil of O. Majorana was used to produce a paper to be used as a protectant agent in food industry and it was tested on meat spoilage and was shown to be used as protectant agent in food industry (Yasar et al., 2022).
Macro and micro nutrient elements are vital for plant health and cultivation. The macro elements are elements such as N, P, K, Ca, and Mg which are required in large amounts for the growth and development of plants. On the other hand, micro elements such as Fe, Cu, Zn, Mn B, and Ni, are required in relatively lower amounts than macro elements but they are very crucial for the healthy metabolism of plants. They are vital for enzyme activities since they have roles as enzyme cofactors in plants. Their concentration in plants give an idea of plant health and also soil health, since plants absorb these elements from the soil during development. Their concentration in plants also give an idea of the requirement of fertilizers in agriculture. They are also very important for the formations of molecules in essential oils. In this study, we aimed to determine the nutrient elements of *O. majorana* and their correlations with the antibacterial activity of the ethanol extract of the plant.

Materials and Methods
The soil used in this study was obtained from the trial field of Faculty of Agriculture, Namık Kemal University, Tekirdag. The soil was sifted out and the pots of 4 L were filled with this soil. The seeds of *Origanum majorana* L. was bought from a local seed provider. The seeds were sown to viols filled with peat. After germination and formation of the seedlings, the seedlings were transferred to the pots filled with the trial soil. The seedlings were watered regularly. The plants were kept for 3 months after which they were harvested. The fresh weight of plants was recorded. They were dried and grinded. The macro and micro nutrient element concentration of plant were measured with ICP-OES in the central lab (NABILTEM) of Tekirdag Namık Kemal University. The dried plant material was also used to obtain extract with ethanol as solvent. Maceration technique was adopted for extraction with a 1:20 m/v dry weight/ethanol ratio. The plant material was kept for 48 hours at dark. The extract was tested on 4 bacteria: 2 Gram positive (*S. aureus* and *E. faecalis*) and two Gram negative (*E. coli* and *P. aeruginosa*). The bacteria were obtained from Middle East Technical University, Ankara, Turkey. Well diffusion method was adopted for antibiogram of majorana extract. Mueller Hinton agar plates were prepared and bacteria adjusted to 0.5 McFarland were spread on the agar plates under aseptic conditions. Using sterile pipette tips, wells of 8 mm diameter were formed and 100 µL of extract was added into the well. The plates were kept at 37°C for 24 hours after which the inhibition of bacterial growth was measured by the clearance around the wells. The experiment was replicated three times. The correlation between the antibacterial activity of the extract and the nutrient elements in marjoram plant was determined using Pearson correlation using Minitab software.

Results and Discussion
Origanum majorana L. was grown on the soil obtained from a trial field of the university. The study was a pot study. After the harvest, the macro and micro nutrient elements of the plant were detected by ICP-OES. The contents of macro and micro elements of marjoram grown in this study are given in Table 1.

Table 1. Macro and micro nutrient elements in *O. majorana*

		Control
Macro Nutrient Elements	N (%)	3.61±0.09
	P (%)	0.45±0.03
	K (%)	3.20±0.08
	Ca (%)	2.20±0.25
	Mg (%)	0.51±0.03
Micro Nutrient Elements	Fe (ppm)	359.77±37.59
	Cu (ppm)	6.16±0.25
	Zn (ppm)	62.33±3.91
	Mn (ppm)	81.57±9.33
	B (ppm)	75.37±5.84

Marjoram grown in this study contains sufficient amount of macro nutrients P, Ca, K compared to the contents given by USDA Handbook (Murphy et al., 1978). The iron content of the plant was high when compared to *Ocimum basilicum* grown on a similar soil we used in one of our previous studies; the iron content was around 125 in that study. Similarly, Zn and B contents are higher in marjoram, but manganese content is lower in marjoram compared to sweet basil, which is another medicinal aromatic plant (Gürgan Eser & Adiloğlu, 2020).

Table 1. Antibacterial effects of *O. majorana* on different bacteria

Bacteria	Inhibition zone (mm)
E. coli	-
P. aeruginosa	14.33 ± 0.33
S. aureus	21.3 ± 0.33
E. faecalis	12.33 ± 0.33

The effect of the extract on *E. coli* could not be observed (Figure 1). The effect of the extract was the highest on *S. aureus* in terms of bacterial growth inhibition (Table 1). The activity on the other Gram-positive bacterium *E. faecalis* was also significant. This shows that the marjoram extract was more effective on inhibiting Gram-positive bacterial growth. *S. aureus* is a normal member of the human microbiota but it became an important source of nosocomial infections and many antibiotic resistant strains of this bacterium are known to cause serious health problems. Similar to this bacterium, other bacteria used in this study are normal flora members but some pathogenic strains of them appear and cause different health problems. Bacterial ability to exchange chromosomal particles making them advantageous gave rise to antibiotic resistance which is an alarming health issue all over the world. Testing different natural or synthesized chemicals against bacterial growth is therefore very important. Here, we can suggest that ethanol extract of *O. majorana* has significant inhibiting effect for Gram positive bacteria, especially *S. aureus*.

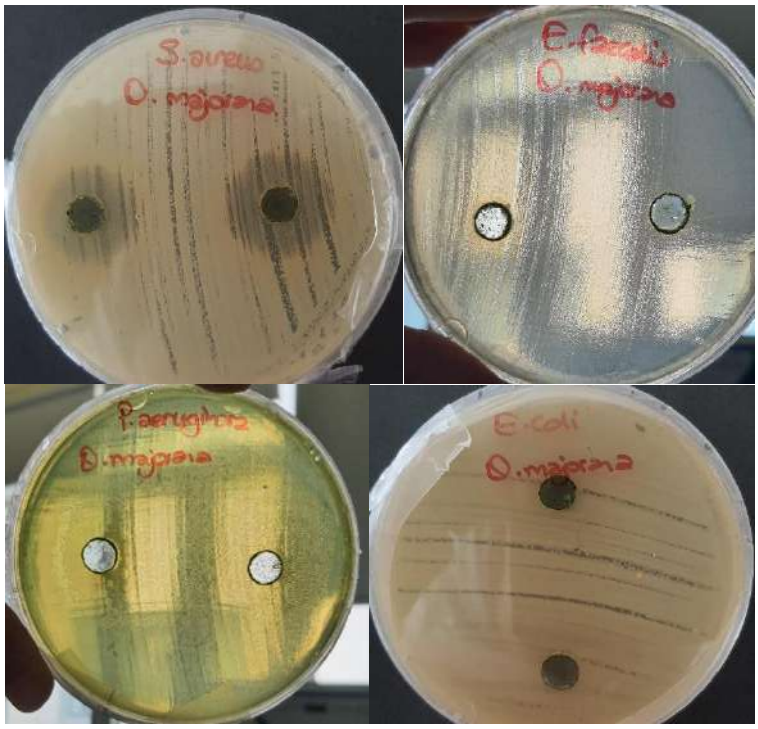

Figure 1. Antibiogram of *O. majorana* extracts tested with different bacteria

After the antibacterial effect, the correlations of the antibacterial effect with the nutrient elements in marjoram were determined in this study. This is important for the cultivation medicinal aromatic plants because the nutrient elements can change depending on the soil they are growing on. The agricultural soils are getting polluted more and more all around the world. The pollutions in soil affect the plants' ability to uptake nutrient elements from soil and thus change the nutrient element concentrations in the plants. This in turn affect the biological activities of the extracts (Gürgan Eser & Adiloğlu, 2020; Gürgan & Adiloğlu, 2021). The correlations of the antibacterial activity of marjoram extract and the nutrient elements in the plant are found to be significantly positive for some nutrient elements. One of them is magnesium. The correlation between Mg and antibacterial activity against *S. aureus* was found to be significantly positive (ρ=0.99, p=0.046). This means that as Mg in the plant increases, the antibacterial activity will increase. This is the result of bacterial cell wall structure which can bind cations and if too many cations bind to the cell wall it may lead to the distortion of cell wall and to kill the bacterial cell. Copper has a strong positive correlation with bacterial growth inhibition (ρ=1.00, p=0.01). This is an expected result as copper has an antibacterial effect (Arendsen et al., 2019). The similar thing is valid for the nickel metal and its correlation with antibacterial activity was significantly positive (ρ=0.99, p=0.024). Nickel has an antibacterial activity and its nanoparticles can be used as an antibacterial agent in several applications (Vahedi et al., 2017).

Conclusion

Origanum majorana is a medicinal aromatic plant which has been used as food and source of essential oil for centuries. The essential oil of this plant is rich in bioactive chemicals which make the plant earn many biological activities such as antibacterial, antioxidant, and anticancer activities. The ethanol extract of this plant, which is easier to obtain in a traditional medicine aspect, was tested on different bacteria and found to be effective on inhibiting especially Gram-positive bacteria. Moreover, the concentrations of macro and micro nutrient elements of this plant were detected and their correlation with the antibacterial activity was tested. Significant positive correlation with copper and nickel with bacterial growth inhibition was determined. Increasing copper and nickel content in plant- which is very possible since pesticides containing these metals are frequently used in agricultural practices- would increase the antibacterial effect of the extracts, most probably up to certain point, which should be determined in the future. Such information is crucial for sustainable and healthy agriculture and will lead farmers to maintain better agricultural applications.

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Can Spirulina cure diabetes patients?

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Abstract
Diabetes is a chronic glucose metabolism disease related with high premature mortality rates. More than 4 million people/year die from diabetes around the world and it is responsible from 11.3 % of all death causes. Changes is lifestyle and diet are the first recommendations to patients with diabetes, however, patients usually cannot stick with them and hence medications are prescribed to the patients in most cases. The side effects of the pharmaceuticals raise concerns among patients which lead them to search for alternative treatments. Functional foods are gaining attention at this point. Spirulina, a photosynthetic and edible algal microorganism living in water environments, is accepted as a functional food with its high nutritional content such as lipids, proteins, vitamins and minerals. Moreover, the bioactive chemicals such as phenolic compounds make them gain more attention in a medical view. The extracts of spirulina have antioxidant, antibacterial, anticarcinogenic and anti-inflammatory effects. Besides these health benefits, its utility for diabetic patients have been studied. For instance, the results of such a study revealed that administering spirulina to diabetes cases could lower blood glucose levels and also lipids in blood. This study aimed to summarize the researches on spirulina whose market continues to widen all over the world in a perspective to be used for diabetic patients.
Key Words: *Spirulina, Diabetes, Metabolism*

Spirulina diyabet hastalarını tedavi edebilir mi?

Özet
Diyabet yüksek erken ölüm oranıyla seyreden kronik bir glikoz metabolizması hastalığıdır. Her yıl dünyada 4 milyondan fazla insan diyabet ve ilişkili hastalıklardan yaşamını yitirmektedir ve bu tüm ölümlerin %11,3'ünü oluşturmaktadır. Diyabet hastalarına genellikle ilk olarak hayat tarzı değişikliği önerilmekte ancak hastalar buna uyamadığı için ilaç başlanmaktadır. Kullanılan ilaçların yan etkileri hastaları alternatif tedavi yöntemleri bulmaya yöneltmektedir. Fonksiyonel gıdalar bu noktada ilgi çekmektedir. Yenilebilir fotosentetik bir mikro alg türü olan Spirulina lipitler, proteinler, vitamin ve mineraller gibi yüksek besin içeriklerinden dolayı fonksiyonel bir gıda olarak Kabul edilmektedir. Bunun yanında, fenolik bileşikler gibi biyoaktif kimyasallar da tıbbi açıdan önem kazanmasına yol açmaktadır. Spirulina ekstraktları antioksidan, antibakteriyel, anti karsinojenik ve anti enflamatuvar etkilere sahiptir. Sağlığa faydalarını yanında Spirulina diyabet hastalarında da araştırılmıştır. Örneğin, çalışmalardan birinin sonuçları diyabet hastalarına verilen Spirulina'nın kan lipit ve glikoz seviyelerini düşürdüğünü göstermiştir. Bu derleme, dünya çapında Pazar payı her geçen gün artan Spirulina'nın diyabet hastaları için kullanımı için yapılan çalışmaları özetlemektedir.
Anahtar Kelimeler: *Spirulina, diyabet, fonksiyonel gıda*

Introduction

Diabetes is a glucose metabolism disorder that affects millions of people all over the world. It was reported that around 382 million people suffer from diabetes in 2013 and this number is supposed to increase to 592 million by 2035. It is related with insulin secretion and/or irregular actions of enzymes playing role in oxidative stress which is caused by insulin metabolism. Therefore, it is known that people with diabetes have lower superoxide dismutase, catalase activities, and lower glutathione contents in renal and hepatic tissues (Bitam & Aissaoui, 2020). Since this disease is known to affect people for very long time, people have tried many alternative therapies, but usually ended up using drugs. Therefore, a natural therapeutic which can be applied into a pharmaceutical can help. Spirulina can be handy in this concept.

Spirulina is a microscopic blue green alga (cyanobacterium) rich in carbohydrates, proteins, amino acids, and especially phytopigments. The principal pigment of Spirulina is phycocyanin. Spirulina is rich in polyphenols, flavonoids, phycobiliproteins, carotenoids and chlorophyll (Bitam & Aissaoui, 2020). Spirulina is also as an enriched sources of bioactive secondary metabolites such as carbanilic acid, oxazolidin, piperidin, benzophenone. Such bioactive chemicals give Spirulina some biological characteristics such as antibacterial activity (Alshuniaber et al., 2021). Several researchers studied the anti-diabetic properties of Spirulina. For example, Spirulina was reported to increase the activities of catalase and superoxide dismutase enzymes (Bitam & Aissaoui, 2020). This suggests that consuming Spirulina can help the antioxidative metabolism in diabetes patients. When Spirulina was given to diabetic patients as 2g/day for 2 months, the fasting blood glucose level and postprandial blood glucose

significantly reduces. Moreover, HbA_{1c} significantly reduced which suggested improving long term glucose regulation (Parikh et al., 2001). In another study, 8g/day Spirulina consumption by diabetes patients without any other functional foods significantly reduced plasma triglycerides, malondialdehyde levels and blood pressure, and increased plasma adiponectin levels in 12 weeks (Lee et al., 2008). Spirulina was also found to decrease total cholesterol, LDL, VDL and increase HDL in blood (Hatami et al., 2021). Moreover, Spirulina was reported to increase volatile fatty acid producing bacteria in gut microbiome and improve the stability of microbiome, which is very important for general human health (He et al., 2022). Taking into account of the anti-diabetic health effects of Spirulina, in this study, we aimed to grow Spirulina platensis in lab scale and determined the growth kinetics, harvest efficiency and cell number to be able to produce this microalgal species in large scale.

Materials and Methods

Apart from having a high protein content, Spirulina is a blue-green alga with carbohydrates, other essential nutrients such as vitamins (A, C, E) and minerals such as iron, calcium, chromium, copper, magnesium, manganese, phosphorus, potassium, sodium and zinc (Gogna et al., 2022). Thus, it can be a promising food product for many diseases, especially cancer, obesity, heart diseases and diabetes. In this compilation study, a small-scale production profile of spirulina culture obtained from a private enterprise was revealed under laboratory conditions. First of all, the obtained culture was examined under a microscope to see if it was contaminated (Figure 1). After this process, the nutrients required for the growth of spirulina were added to the 5 plastic drums at the rates shown in Table 1.

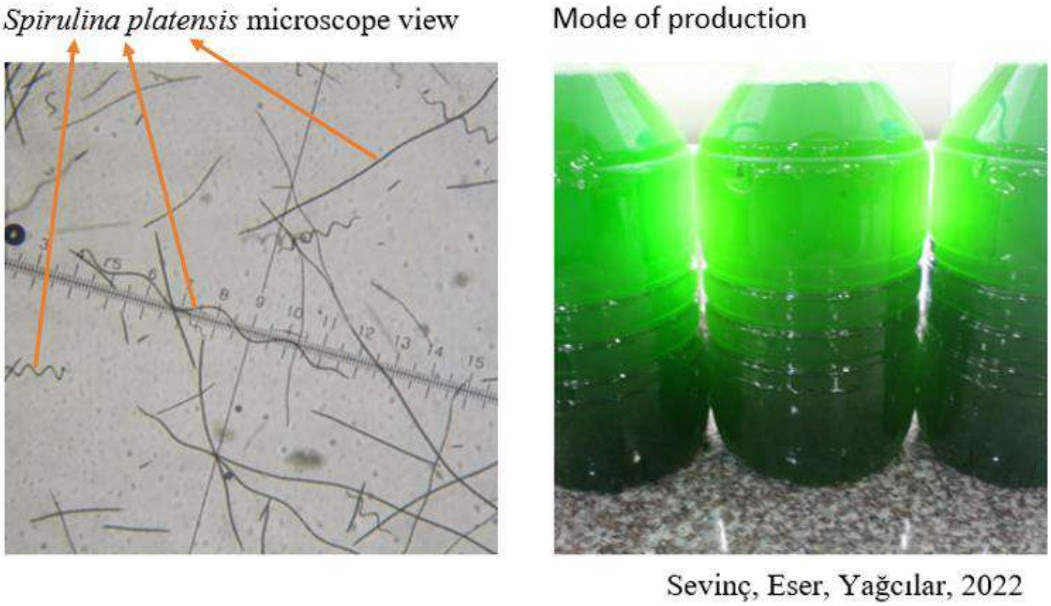


Figure 1. *Spirulina platensis* microscope view and mode of production.

Table 1. Composition of modified spirulina medium

Ingredient	To make 5 L of mix
Sodium Bicarbonate ($NaHCO_3$)	80 g
Potassium Nitrate (KNO_3)	10 g
Sea Salt (NaCl)	5 g
Ammonium Phosphate ($(NH_4)_3PO_4$)	0.5 g
Magnesium Sulfate ($MgSO_4$)	0.5 g
Potassium Sulfate (K_2SO_4)	2.5 g
Lime or Calcium Chloride ($CaCl_2$)	0.5 g

When the ideal growing conditions of Spirulina are examined in many studies, it has been reported that the temperature is 25-35 ℃ and the best growth is 30 ℃ (Soni et al., 2019). Since light is important for photosynthesis, light intensity has been investigated in different studies and it has been stated that the light value of 3000 lux and 5000 lux is ideal (Pandey et al., 2011). The growth in the applied laboratory conditions was also kept similar to these values (Table 2).

Table 2. Spirulina growth conditions

Spirulina platensis harvest characteristics	Value
Temperature	32.86 ℃
pH	10
TDS	15.85 ppm
Conductivity	19.94 ppm
Light Value	3967.66 lux
Ambient Temperature	32.33 ℃
Ambient humidity	39.66 %

Cell counts were made every four days with the fuchs-Rosenthal counting chamber (Figure 2) from sowing the initial culture until harvest time. The Fuchs-Rosenthal Counting Chamber consists of 16 chambers of one square millimeter areas orientated by triple lines. It is generally recommended to count these 16 areas, preferably 8 in each chamber. In our study, 16 chambers were counted.

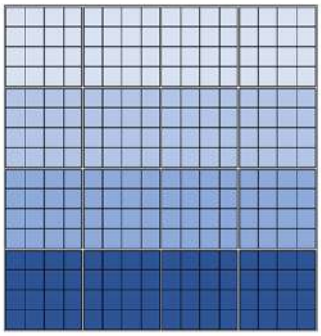
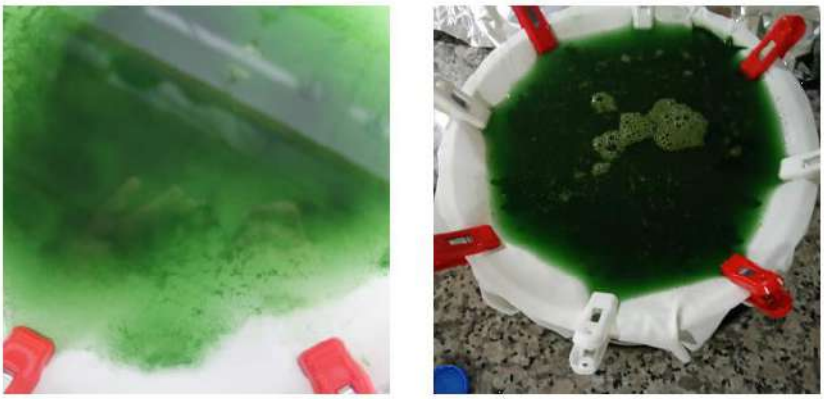


Figure 2. Fuchs-Rosenthal counting chamber

Harvest time was determined by observing the pH, cell number and color changes of the cell counted cultures (Figure 3A). Adult cells were collected in the gland with the help of a silk sieve cloth with a harvesting shape of 43 microns (Figure 3B). The wet product obtained was weighed and dried.

A. *Spirulina platensis* harvesting process

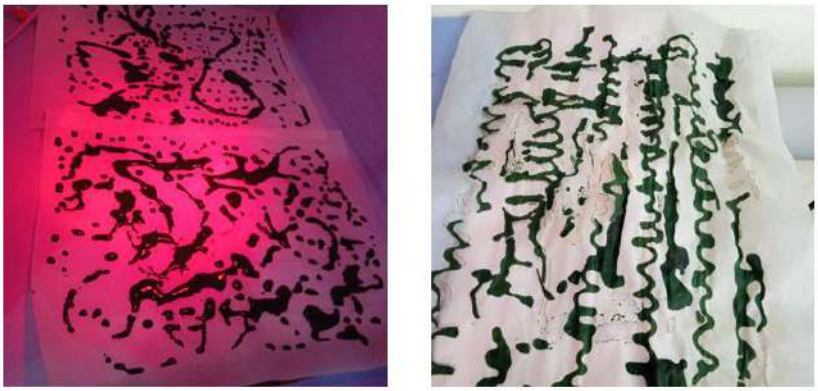
B. *Spirulina platensis* harvesting process



Sevinç, Eser, Yağcılar, 2022

Figure 3. Spirulina platensis harvesting process

A. *Spirulina platensis* drying process B. *Spirulina platensis* drying process



Sevinç, Eser, Yağcılar, 2022

Figure 4. Spirulina platensis drying process

Finally, the harvest efficiency with the wet and dry weight values given in Table 3 was calculated with the help of the following formula.
Harvest efficiency = 100* Sample dry weight (g) / Sample wet weight (g)

Tablo 3. Harvesting efficiency

	1.	2.	3.
Wet weight	35.2	34.6	36.8
Dry weight	3.23	3.32	3.41
Harvest Efficiency	% 9.17	% 9.59	% 9.26

Results and Discussion
The four-day cell growth numbers of spirulina grown and harvested under laboratory conditions at the 20-day harvest time are given in Table 4 and the growth curve is shown in the graphic below (Figure 5).

Table 4. Cell number of *Spirulina platensis* in ml water sample

Number of measurements / day	Total number of cells / ml
1.	2187
4.	3750
8.	7812
12.	11979
16.	18854
20.	23958

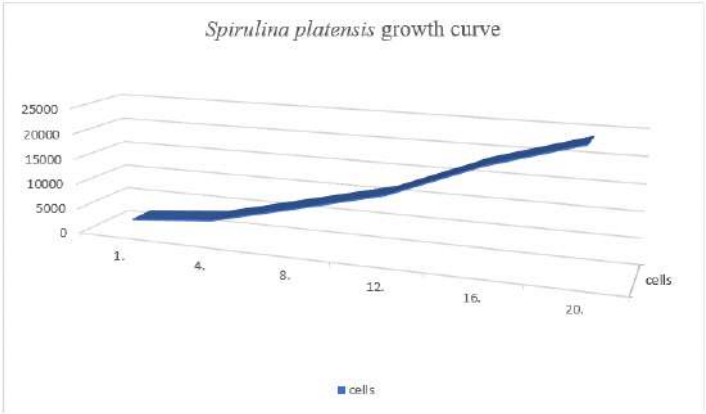


Figure 5. *Spirulina platensis* growth curve

Conclusion

In conclusion, there are studies in which *spirulina platensis* microalgae responds positively in diabetic patients and it is shown to be a promising agent as a functional food for diabetes. However, more studies are needed to increase the number of studies on this subject and to better understand the effects of spirulina.

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ID: 636

Evaluation of total antioxidant and oxidant status, oxidative stress index and DPPH free radical scavenging activities of pumpkin (*Cucurbita maxima*) seeds ethanolic extracts

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Abstract
Fruits and vegetables are basic crops of mass consumption for human population to meet their food requirements. Recent advances in medicinal studies have revealed that different parts of fruits and vegetables are loaded with phytochemicals responsible for eliminating the risks of different diseases. Pumpkin (*Cucurbita maxima*) is one of the abundantly grown and consumed vegetable all around the world. Seeds of this vegetables are named as nutritional power houses due to their excellent nutrient profiles. In present study total antioxidant status (TAS), total oxidant status (TOS), oxidative stress index (OSI) and DPPH free radical scavenging activity, of pumpkin seeds extracts were determined. Extraction of pumpkin seeds was carried out in a Soxhlet apparatus using ethanol as extraction solvent. TAS and TOS were determined through Rel Assay Kits and free radical scavenging activity was measured through DPPH assay. TAS was found 4.18±0.36 and TOS 14.68±0.42, whereas value of OSI was measured 0.35±0.10. DPPH free radical scavenging activity was observed increasing with increasing the concentration and maximum value 56.10±0.90% was observed at 2 mg/mL concentration. From these results it was concluded that pumpkin seeds could be utilized as natural antioxidant source with potential to reduce oxidative stress and minimizing the risks of certain diseases.
Key Words: Pumpkin; Seeds; Antioxidant; Extracts; Free radicals

Introduction

Fruits and vegetables parts (peels, flesh, seeds) have been found involved in reducing the risks of many diseases due to presence of phytochemicals, responsible for different health promoting activities in humans. Pumpkin seeds due to presence of phenolic compounds, minerals, vitamins, carotenoids and essential oils, possess strong antioxidant potential and reduce oxidative stress in human body (Hussain *et al.*, 2022). Extracts of different herbs, fruits and vegetables have been found loaded with biologically active components and are a well alternative source of drugs. Due to in sufficient health services in many developing and under develop countries the need of complimentary medicines has been increased (Mohammed *et al.*, 2020). Expectations of public are very high from food producers in terms of healthy and nutritious food products, which can play both functional and medicinal role in the body and most economic and extraordinary sources of functional ingredients are waste by products of fruits and vegetables (Hussain *et al.*, 2022). Plants are natural sources of antioxidant compounds and extracts of these plants and their parts have been traditionally used in curing different ailments due to their antioxidant, antimicrobial, antiviral, anti-inflammatory, antiallergic, antihypertensive and anticarcinogenic properties (Uysal *et al.*, 2021).

Pumpkins are the members of family *Cucurbitaceae* and genus *Cucurbita* and their usage as a traditional food treating diseases is very common since ancient times. The excellent pharmacological properties of pumpkins are due to their phytochemical composition, which includes phenols, flavonoids, carotenoids and tocopherols. Among pumpkin parts, seeds are the most suitable component with respect to their chemical composition and their usage in different food products in different forms has gained very importance in recent times (Hussain *et al.*, 2022). Production of pumpkins, squashes and gourds in 2019 was estimated above 23 million tons cultivated all over the world comprising an area of 1.54 million hectare and in Pakistan 2.7 lac tons on 26515-hectare area (FAO, 2019). Plants especially fruits and vegetables produce secondary metabolites due to different metabolic reaction in their parts and these non-nutritive components have been reported involved in a range of biological activities in human bodies, when consumed in fresh or processed forms. Specially the antioxidant properties of different plant species and their parts like leaves, peels and seeds, are edge in lowering disease factors (Kina *et al.*, 2021). Consumption of pumpkin seeds on a regular basis could be beneficial for both healthy and diseased persons, due to the excellent nutritional profiles of these seeds. Nutrients present in pumpkin seeds play mediating role in oxidation related reactions resulting in the protection of body cells. So many biologically active components have been reported in pumpkin seeds, which are capable of scavenging free radicals in the human body (Hussain *et al.*, 2021). Ingredients used in the development of so many drugs drive their source from plants, fungi and animals. A variety of natural ingredients from extracts of plants are used in complimentary medicines in different regions of the world.

Discovery of new plants, analysis of their different parts and extraction of active compounds is the need of time to overcome the need of modern drugs (Akgul *et al.*, 2022).

Oils extracted from raw pumpkin seeds due to its antioxidant potential, significantly reduced serum triglycerides, total cholesterols, LDL cholesterols, uric acid, creatinine, serum transaminases and urea in experimental animals, whereas serum HDL cholesterols were significantly increased, which was a clear indication of health promoting potential of pumpkin seeds (Nameni *et al.*, 2021). Investigations made by Majid *et al.* (2020) on humans by application of pumpkin seed oil, in controlled lifestyle, showed a significant reduction in endpoint LDL, significant increase in HDL cholesterol. Experiment results revealed pumpkin seed oil have potential of hypolipidemic and anti-hypertensive activity as it lowered LDL and increased HDL levels. Pumpkin seed oil extracts exhibited anti-oxidant, anti-bacterial and anti-inflammatory activities therefore, pumpkin seed oil could be a promising source of ingredients for pharmaceutical and food industries to develop pharma foods and supplements (Amin *et al.*, 2020). Experiments were conducted to check the antioxidant status of pumpkin seeds and results revealed that pumpkin seed oil retarded liver damage by inhibiting oxidative stress induced by sodium nitrate in adult rats (Rouag *et al.*, 2020). As pumpkin seeds are excellent source of nutrients that's why these are known as nutritional powerhouse. Pumpkin seeds have no side effects on human health so these can be consumed on regular basis to promote human health with minimum use of supplements (Maheshwari *et al.*, 2015).

In this context it is very important to investigate peels, flesh and seeds of different medicinal plants, especially fruits and vegetables for their health promoting activities. Antioxidant properties of different plant portions and the agents responsible for this are needed to be discovered for benefit of mankind. Present study was designed to investigate the extracts of pumpkin seeds for their total antioxidant status, total oxidant status, oxidative stress index and DPPH free radical scavenging activity in comparison with ascorbic acid.

Materials And Methods

Procurement and preparations of plant materials

Mature pumpkins were collected from the fields directly and specimen was submitted to Botanical research Centre for identification. Seeds were separated from pumpkins after cutting with knife. Seeds were cleaned from any adhering fibrous material. Seeds were dried in hot air microwave oven at 60°C till constant weight. Fine powder was obtained after grinding the dried seeds in common spice grinder.

Preparations of pumpkin seeds extracts

For preparation of pumpkin seeds extracts, 20 g of powder was taken in flask and 200 mL ethanol was added and extraction was carried out at 50°C for approximately 6 hours. The solvents of the prepared extracts were removed in the rotary evaporator.

Determination of total antioxidant status, oxidant status and oxidative stress index

Total antioxidant status (TAS) and total oxidant status (TOS) of pumpkin seeds ethanolic extracts were measured using Rel assay kits by following the guidelines provided by Erel (2005) with some modifications. Trolox was used as standard calibrator in determination of TAS, whereas hydrogen peroxide was used as standard calibrator in TOS analysis. Oxidative stress index (OSI) was calculated as proportion of TOS and TAS values as described by Sevindik (2019).

Determination of DPPH free radical scavenging activity

For determination of DPPH free radical scavenging activity of pumpkin seeds ethanolic extracts at different concentrations, stock solutions of extracts were prepared using dimethyl sulfoxide at 0.25, 0.5, 1 and 2 mg/mL concentrations. DPPH solution (0.039%) was taken 160 µL in a cuvette and 50 µL stock solution was added and mixture was incubated for 30 minutes before analysis and then absorbance was measured at 517 nm using spectrophotometer. Same process was repeatedly carried out for all selected concentrations of pumpkin seeds extracts by following the guidelines given by Shimada *et al.* (1992). Standard reference antioxidant in this study was used ascorbic acid.

Results And Discussion

Antioxidant status, oxidant status and oxidative stress index of pumpkin seeds extracts

Results of TAS, TOS and OSI have been presented in Table 1, from where it can be seen that TAS of pumpkin seeds ethanolic extracts was found 4.18±0.36 mmol/L and TOS was found 14.68±0.42 µmol/L, which means that pumpkin seeds possess more antioxidant potential. OSI was calculated as ratio between TAS and TOS and value was noted as 0.35±0.10.

Production of free radicals in human body by different enzymatic and non-enzymatic processes is very common, which is caused by different factors including environmental and internal body reactions. As a result of these free radicals, oxidative stress is produced in the body cells and this oxidative stress results in advancement and occurrence of so many diseases including cancer, brain and heart diseases (Sevindik *et al.*, 2021). Natural body defense system works to reduce oxidative stress caused by free radicals, but in many cases this natural defense system does not work sufficient to protect body cells. Supplementary antioxidant agents from different plant sources are then added to complimentary medicines and foods to support scavenging of free radicals (Mohammed

et al., 2021). Antioxidant and oxidant status of a medicinal plant *Echium italicum* was determined by Uysal *et al.* (2021), and supportive results were found in terms of antioxidant capacity of plants and their parts. Similarly, Mohammed *et al.* (2020) collected plants from different regions of Iraq and determined their antioxidant status, oxidant status and oxidative stress index, and it was concluded that ethanolic extracts of plants have high antioxidant and low oxidant potential so these plants and their parts in different forms can be used as natural antioxidant agents.

Total antioxidant status value is an indicator of the antioxidant compounds provided by the plant materials. Greater the value of total antioxidant status means higher are the antioxidant compounds in plant extracts (Mohammed *et al.,* 2021). Hussain *et al.* (2021) made a comparison of phytochemicals present in peel, flesh and seeds of pumpkin (*Cucurbita maxima*), and concluded that pumpkin seeds are excellent sources of total phenolic, flavonoid, carotenoid and mineral contents and due to present of these biologically active components antioxidant status of pumpkin seeds is high as compared to peel and flesh portion. Makni *et al.* (2011) studied the effect of pumpkin and flax seeds mixtures on alloxan induced diabetic rats and found that diet supplemented with pumpkin seeds exhibited antioxidant activity in rats to control lipid oxidation related diseases. Similar to our results, data was present in the study of Akgul *et al.* (2022), where ethanolic extracts of plants exhibited strong antioxidant and low oxidant potential, encouraging the use of plants as natural antioxidant agents.

Total oxidant status of any plant material indicates the whole oxidant compounds produced by plant material due to metabolic reactions occurred in plant cells with variable speed and concentrations due to different environmental and structural factors (Mohammed *et al.,* 2021). Oxidative stress index value is an indication of endogenous oxidant compounds suppressed by endogenous antioxidant agents provided by the plant materials (Dogan *et al.,* 2014).

Table 1. Total antioxidant status, total oxidant status and oxidative stress index of pumpkin seeds ethanolic extracts

TAS, TOS and OSI of pumpkin seeds extracts			
Sample	**TAS (mmol/L)**	**TOS (µmol/L)**	**OSI**
Pumpkin seeds extracts	4.18±0.36	14.68±0.42	0.35±0.10

Values are presented as means of triplicate results ± standard deviation

DPPH free radical scavenging activity

Data of free radical scavenging activity of pumpkin seeds ethanolic extracts and ascorbic acid at different concentrations have been presented in Table 2. From the findings it was evident that by increasing the concentration of extracts the DPPH free radical scavenging was found increased as at 0.25mg/mL value of DPPH free radical scavenging activity of pumpkin seeds ethanolic extracts was found 22.96±1.56 and was significantly increased to 56.10±0.90 at 2 mg/mL concentration, while DPPH free radical scavenging activity of ascorbic acid at 0.25 mg/mL was 65.46±0.95, which was increased to 92.70±0.30 at 2 mg/mL.

Use of traditional herbal remedies as preventive measures and to cure certain diseases are very common in developing and develop countries due to their lesser side effects with fewer complications. The antioxidant potential of a plant or its part depends upon the presence of biological active ingredients capable of suppressing free radicals and reactive oxygen species in living body. Recent advances in medicinal sciences have revealed that peels and seeds of plants have antioxidant potential (Pandey *et al.,* 2019). DPPH free radical scavenging activity of pumpkin seeds 80% methanolic extracts was found 16.56 mg AAE/100 g, in a study conducted by Hussain *et al.* (2021), in which a comparison of antioxidant and antimicrobial activities of pumpkin peel, flesh and seeds was made. Asif *et al.* (2017) made research to investigate antioxidant status of different parts of pumpkin, by DPPH free radical scavenging activity of different types of extracts and concluded that pumpkins are capable of promising antioxidant activities. Dissanayake *et al.* (2018) used DPPH free radical scavenging assay to check the antioxidant potential of pumpkin different fractions by using three different solvents and came on result that all types of solvents provided good results for DPPH free radical scavenging activity of different pumpkin parts. Supportive results were also found in the study of Singh *et al.* (2016), in which different fruits of *Cucurbitaceae* family were analyzed for their antioxidant potential by using different solvents using DPPH free radical scavenging analysis and both methanolic and ethanolic extracts exhibited prominent antioxidant activities.

Tyan *et al.* (2018) determined antioxidant activity of three different plants extracts of *Cucurbitaceae* family by using DPPH free radical scavenging method and concluded that by increasing the concentration of extracts dose the free radical scavenging activity was increased. They suggested that pumpkin seeds due to their antioxidant potential could reduce the risk of oxidation related diseases such as cardiovascular diseases and cancer. Hussain *et al.* (2021) made a comparison of phytochemicals present in peel, flesh and seeds of pumpkin (*Cucurbita maxima*), and concluded that pumpkin seeds are excellent sources of total phenolic, flavonoid, carotenoid and mineral contents and these bio-actives are capable of scavenging free radicals. Phenolic compounds such as flavonoids, alkaloids, saponins and steroids present in pumpkin seeds have been reported good antioxidant agents by scavenging the free radicals in living bodies (Mala and Kurian, 2016). Results supporting to our study were

found in the research work of Akgul *et al.* (2022), when DPPH free radical scavenging activity of medicinal plants was compared with ascorbic acid at different concentrations and data obtained revealed that plants ethanolic extracts have potential of scavenging free radicals.

Table 2. DPPH free radical scavenging activity of pumpkin seeds extracts in comparison with ascorbic acid at different concentrations

DPPH free radical scavenging activity of pumpkin seeds extracts		
Concentration mg/mL	Ascorbic acid (%)	EtOH (%)
0.25	65.46±0.95	22.96±1.56
0.5	86.90±0.80	36.60±1.10
1	89.18±0.45	43.58±1.40
2	92.70±0.30	56.10±0.90

Values are presented as means of triplicate results ± standard deviation

Conclusion

Pumpkin is one among the most nutritious vegetable also used as a medicinal food due to its pharmacological potential. Consumption of pumpkin and its seeds have a very long history since ancient times to cure different remedies. Pumpkin seeds extracts TAS was found 4.18±0.36 and TOS 14.68±0.42, whereas value of OSI was measured 0.35±0.10. DPPH free radical scavenging activity was observed increasing with increasing the concentration and maximum value 56.10±0.90% was observed at 2 mg/mL concentration. Pumpkin seeds are excellent source of phytochemicals responsible for strong antioxidant potential, a future prospect for pharma foods industry.

Recommendations

Pumpkin is a versatile vegetable known for its excellent nutritional profile loaded with phytochemicals promoting human health in different ways. Modern and innovative technologies could be implemented to utilize pumpkin in different ways to extract bioactives from pumpkin for development of nutraceuticals and functional foods. Waste streams of pumpkin like peels and seeds can be utilized in efficient ways to develop powders and extracts and their incorporation in bakery, beverages and pharma food industry.

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Conflict Of Interest

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ID: 639

Investigation of Some Antibacterial Effects of Some Plant Extracts

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Abstract

Medicinal aromatic plants are preferred as an alternative to medications all over the world. These plants have also beneficial industrial uses such as pharmaceutical, cosmetics, and food industry. Moreover, they can be used in agricultural applications as pesticides. The extracts of these plants are rich in phenolics because of which they are named as medicinal plants. The extraction method is crucial as different solvents dissolve make different compounds found in the plant materials. In this study, the antibacterial activities of the extracts of lavender (*Lavandula officinalis*), epicalyx (*Althaea officinalis*), St. John's wort (*Hypericum perforatum*), daphne (Laurus nobilis), green tea (*Camellia sinensis*), blackberry (*Rubus fruticosus*), olive leaf (Olea europaea) and parsley (*Petroselinum crispum*) obtained by different solvents were tested on *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and *Enterococcus faecalis*. The naturally dried plants were obtained from herbalist shops and their extracts were obtained using ethanol, distilled water, and hexane using Soxhlet extraction. Antibiogram technique was applied with agar well diffusion method in triplicates. Green tea, St. John's wort, daphne leaf, olive leaf and epicalyx extracts were determined to have inhibition effect on bacteria when compared with the reference antibiotic. The most effective solvent for green tea was distilled water and ethanol was the best for the other plants; while hexane was not an appropriate solvent for the Soxhlet extraction.

Key Words: *Antibacterial effect, Plant extracts, Soxhlet, Antibiogram*

Bazı Bitki Özütlerinin Antibakteriyel Etkilerinin Araştırılması

Özet

Günümüzde antibiyotik direnci ciddi bir sorun haline gelmiştir. Tıbbi aromatik bitkiler tüm dünyada ilaçlara laternatif olarak kullanılmaktadır. Bu bitkilerin aynı zamanda farmasötik, kozmetik ve gıda endüstrileri gibi farklı endüstrilerde de faydalı kullanım alanları vardır. Ayrıca, tarımda pestisitlere alternatif olarak da kullanılabilmektedirler. Tıbbi bitki ismini almalarını sağlayan şey bitkilerin fenoliklerce zengin ekstraktlarıdır. Bitkide bulunan farklı bileşiklerin çözülmesini sağlamak için kullanılan ekstraksşyon metodu çok önemlidir. Bu çalışmada, lavanta (*Lavandula officinalis*), hatmi (*Althaea officinalis*), kantaron (*Hypericum perforatum*), defne (Laurus nobilis), yeşil çay (*Camellia sinensis*), böğürtlen (*Rubus fruticosus*), zeytin yaprağı (Olea europaea) and maydanoz (*Petroselinum crispum*) bitkilerinin farklı çözücüler ile elde edilen ekstraktarı *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, ve *Enterococcus faecalis* bakteri üzerinde denenmiştir. Aktarlardan alınan ve doğal olarak kurutulan bitkilerin ekstraktları etanol, distile su ve hekzan kullanılarak elde edilmiştir. Antibiyogram tekniği agar kuyu metodu ile üç tekrarlı olacak şekilde denenmiştir. Yeşil çay, kantaron, defne, zeytin yaprağı, ve hatminin bakteriler üzeirnde antibakteriyel etkisi olduğu gösterilmiştir. Yeşil çay için en etkili çözücü distile su iken diğer bitkiler için etanol daha etkili olmuştur. Soxhlet ekstraksiyonunda bu bitkiler için hekzanın etkili bir çözücü olmadığı özlenmiştir.

Anahtar Kelimeler: *Antibakteriyel etki, bitki ekstraktları, Soxhlet, Antibiyogram*

ID: 640

Abamectin, hexythiazox and spiromesifen resistance in populations of *Tetranychus urticae* Koch (Acari:Tetranychidae) collected from cucumber greenhouses in central district of Tokat province*

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Abstract
The two-spotted spider mite, *Tetranychus urticae* Koch (Acari: Tetranychidae), which has rapidly developed high resistance to many classes of acaricides, is one of the most important pests in greenhouses. This study was carried out to determine the resistance levels of *T. urticae* populations collected on cucumber plants produced in the greenhouses of Gümenek village in the central district of Tokat province in the 2022 production season against abamectin, hexythiazox and spiromesifen. The LC_{50} values of the collected populations were determined by spray tower-leaf disc method. The resistance rates were found by dividing the LC_{50} values of the collected greenhouse populations to the LC_{50} value of the susceptible population. The resistance levels of *T. urticae* were determined as between 1.88-2.14-folds against abamectin, 1.67-1.84 folds against hexythiazox and 1.77-2.09 folds against spiromesifen. According to these results, a low rate of resistance development was observed against the studied acaricides in *T. urticae* populations.
Key Words: *T. urticae, Acaricide, Resistance, Cucumber, Greenhouse*

Tokat ili merkez ilçesindeki hıyar seralarından toplanan *Tetranychus urticae* Koch (Acari: Tetranychidae) popülasyonlarının abamectin, hexythiazox ve spiromesifen'e karşı direnç düzeylerinin belirlenmesi*

Özet
Birçok akarisit sınıfına hızla yüksek direnç geliştirmiş olan iki noktalı örümcek *Tetranychus urticae* Koch (Acari: Tetranychidae), seralardaki en önemli zararlılardan biridir. Bu çalışma, 2022 üretim sezonunda Tokat ili Merkez ilçesi Gümenek köyü seralarında üretilen hıyar bitkileri üzerinden toplanan *T. urticae* popülasyonlarının abamectin, hexythiazox ve spiromesifen'e karşı direnç düzeylerinin belirlenmesi için yapılmıştır. Toplanan popülasyonların LC_{50} değerleri ilaçlama kulesi kullanılarak yaprak disk metodu ile belirlenmiştir. Toplanan sera popülasyonlarının LC_{50} değerleri hassas popülasyonun LC_{50} değerine oranlanarak direnç oranları bulunmuştur. *T. urticae* popülasyonlarında abamectin'e karşı 1.88-2.14 kat; hexythiazox'a karşı 1.67-1.84 kat ve spiromesifen'e karşı 1.77- 2.09 kat arasında direnç oranı tespit edilmiştir. Bu sonuçlara göre *T. urticae* popülasyonlarında çalışılan akarisitlere karşı düşük oranda direnç gelişimi görülmüştür.
Anahtar Kelimeler: *T. urticae, Akarisit, Direnç, Hıyar, Sera*

ID: 641

The Effect of Plant Growth Promoting Rhizobacteria and Mycorrhiza Applications on The Plant Growth of *Zinnia elegans* L. and *Dahlia variabilis* L.

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Abstract

This study was carried out to determine the effects of plant growth promoting rhizobacteria and mycorrhiza applications on the plant growth of *Zinnia elegans* L. (Dirty Lady Flower) and *Dahlia variabilis* L. (Star Flower). In the study, Zesty variety purple dirty lady flower, Figari Violet variety star flower, 4 different rhizobacteria (*Enterobacter cloacae* (ZE-2), *Bacillus cereus* (ZE-7), *Pseudomonas putida* (ZE-12), *Acinetobacter calcoaceticus* (ZE-13)] and 'Endo Roots Soluble' (ERS) mycorrhizal fungi obtained from a private company were used. In the study, firstly a suspension was prepared from bacterial isolates developed for 24 hours at 26 °C. The prepared suspensions were adjusted to 0.3 absorbance (A 600: 0.3) at 600 nanometers in the spectrophotometer. Likewise, it was prepared at a concentration of 5000 ppm in mycorrhiza. Flower seedlings were dipped into the prepared suspensions and kept for 30 minutes. At the end of the period, flower seedlings were planted in pots with a mixture of peat and perlite. Seedlings without rhizobacteria and mycorrhiza treatments were used as the control group. The experiment was established with 3 replications and 10 plants per replication. In the evaluations made throughout the experiment, rhizobacteria and mycorrhiza applications increased plant height, number of leaves and flowers, branch thickness, and branch weight especially in *Z. elegans* compared to the control. Among the applications, ZE-12+ZE-13 combination application was the most effective. As a result, with this study, it has been revealed that rhizobacteria and mycorrhiza applications, which are of natural origin and do not harm the environment, have the potential to be used in ornamental plants cultivation, and that these applications should be expanded.
Key Words: *Plant Growth Promoting Rhizobacteria, Mycorrhiza, Zinnia elegans, Dahlia variabilis*

Bitki Gelişimini Teşvik Eden Rizobakteri ve Mikoriza Uygulamalarının *Zinnia elegans* L. ve *Dahlia variabilis* L.'in Bitki Gelişimine Etkisi

Özet

Bu çalışma, bitki gelişimini teşvik eden rizobakteri ve mikoriza uygulamalarının *Zinnia elegans* L. (Kirli Hanım Çiçeği) ve *Dahlia variabilis* L. (Yıldız Çiçeği)'in gelişimleri üzerindeki etkisini belirlemek amacıyla yapılmıştır. Çalışmada Zesty çeşidi mor renkli kirli hanım çiçeği, Figarı Violet çeşidi yıldız çiçeği, 4 farklı rizobakteri (*Enterobacter cloacae* (ZE-2), *Bacillus cereus* (ZE-7), *Pseudomonas putida* (ZE-12), *Acinetobacter calcoaceticus* (ZE-13)) ve özel bir firmadan temin edilen 'Endo Roots Soluble' (ERS) mikoriza mantarları kullanılmıştır. Çalışmada ilk olarak 26 °C'de 24 saat süre ile geliştirilen bakteri izolatlarından süspansiyon hazırlanmıştır. Hazırlanan süspansiyonlar spektrofotometrede 600 nanometrede 0.3 absorbans (A 600: 0.3) değerine ayarlanmıştır. Aynı şekilde mikorizada 5000 ppm'lik konsantrasyonda hazırlanmıştır. Hazırlanan süspansiyonlar içerisine çiçek fideleri daldırılarak 30 dk bekletilmiştir. Süre bitiminde çiçek fideleri torf ve perlit karışımı bulunan saksılara dikilmiştir. Kontrol grubu olarak rizobakteri ve mikoriza uygulaması yapılmamış fideler kullanılmıştır. Deneme 3 tekerrürlü ve tekerrür başına 10'ar bitki olacak şekilde kurulmuştur. Deneme boyunca yapılan değerlendirmelerde kontrole kıyasla rizobakteri ve mikoriza uygulamaları özellikle *Z. elegans*'ta bitki boyu, yaprak ve çiçek sayısı, dal kalınlığı, dal ağırlığında artış sağlamıştır. Uygulamalar içerisinde en etkili ZE-12+ZE-13 kombinasyon uygulaması olmuştur. Sonuç olarak, bu çalışma ile süs bitkileri yetiştiriciliğinde doğal kökenli olan ve çevreye zararı olmayan rizobakteri ve mikoriza uygulamalarının kullanılabilme potansiyeline sahip olduğu, ayrıca bu uygulamaların yaygınlaştırılması gerektiği ortaya konulmuştur.
Anahtar kelimeler: *Bitki Gelişimini Teşvik Eden Rizobakteri, Mikoriza, Zinnia elegans, Dahlia variabilis*

ID: 642

Antibacterial Effect of *Salvia bracteata* ve *Tagetes erecta* Plant Extracts Against Some Plant Pathogen Bacteria

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Abstract

In this study, *Salvia bracteata* Banks&Sol. (Sage) and *Tagetes erecta* L. (Marigold) plants, methanol extracts of *Pseudomonas syringe* pv. *tomato* (*Pst*; Tomato bacterial spot disease agent), *Clavibacter michiganensis* subsp. *michiganensis* (*Cmm*; Tomato bacterial cancer and wilt disease agent) and *Xanthomonas euvesicatoria* (*Xe*; Pepper bacterial spot disease agent) were determined. In the study, the leaf part of *S. bracteata* and the leaf and flower parts of *T. erecta* were used. In order to prepare methanol extract from ground plant materials, 100 grams of plant material was weighed and placed in an erlenmeyer flask and 2000 ml of methanol was added and shaken at 150 rpm for 48 hours. At the end of the period, the material was filtered with the help of cheesecloth and the methanol was removed at 40 °C, so the extraction process was carried out. In the study carried out as a Petri experiment, different doses of extracts prepared from plant materials were prepared and placed in autoclaved media. After the media solidified, 100 µl of suspensions prepared from bacterial cultures at a density of $1x10^6$ cells/ml were taken and inoculated into the extracted media and smeared with sterile glass rod. Bacteria were cultivated on the media where the extracts were not added and used as a positive control. Bacteria densities were measured in the spectrophotometer (600 nm) 2 days after inoculation in petri dishes left to incubation at 26 °C. As a result of the experiment, the highest effect on pathogens was seen in the extract obtained from the flowers of *T. erecta*. In parallel with the dose increase, the effect ratio also increased. While all doses of flower extract except 250 ppm were effective on *Pst*, all doses on *Cmm* were effective, while 2000 and 3000 ppm doses were effective (100%) on *Xe*. While 3000 ppm dose of *S. bracteata* extract was effective on *Pst*, it did not affect other pathogens. The extract obtained from the leaves of *T. erecta* was only effective on *Cmm*. In conclusion, with this study, it was revealed that especially *T. erecta* has an antibacterial effect on pathogens.

Key Words: *Salvia bracteata, Tagetes erecta, Pseudomonas syringe* pv. *tomato, Clavibacter michiganensis* subsp. *michiganensis, Antibacterial effect*

Salvia bracteata ve *Tagetes erecta* Bitki Ekstraktlarının Bazı Bitki Patojeni Bakterilere Karşı Antibakteriyel Etkisi

Özet

Bu çalışma ile *Salvia bracteata* Banks&Sol. (Adaçayı) ve *Tagetes erecta* L. (Kadife çiçeği) bitkilerinden elde edilen metanol ekstraktlarının *Pseudomonas syringe* pv. *tomato* (*Pst*; Domates bakteriyel benek hastalığı etmeni), *Clavibacter michiganensis* subsp. *michiganensis* (*Cmm*; Domates bakteriyel kanser ve solgunluk hastalığı etmeni) ve *Xanthomonas euvesicatoria* (*Xe*; Biber bakteriyel leke hastalığı etmeni)'ya karşı antibakteriyel etkileri belirlenmiştir. Çalışmada *S. bracteata*'nın yaprak kısmı, *T. erecta*'nın yaprak ve çiçek kısımları kullanılmıştır. Öğütülmüş bitki materyallerinden metanol ekstraktı hazırlamak için, 100'er gram bitki materyali tartılarak erlenmayer içerisine konulmuş ve üzerine 2000 ml metanol eklenerek 48 saat 150 rpm'de çalkanmıştır. Süre bitiminde tülbent yardımı ile materyal süzülerek 40 ◦C'de metanol uzaklaştırılmış, böylece ekstraksiyon işlemi gerçekleştirilmiştir. Petri denemesi şeklinde yürütülen çalışmada, bitki materyallerinden hazırlanan ekstraktlardan farklı dozlar hazırlanarak otoklav edilmiş besi yerlerine konulmuştur. Besi yerleri katılaştıktan sonra, bakteri kültürlerinden hazırlanan $1x10^6$ hücre/ml yoğunluğundaki süspansiyonlardan 100 µl alınarak ekstraktlı besi yerlerine inokule edilmiş ve steril cam çubuk ile yayma ekim yapılmıştır. Ekstraktların eklenmediği besi yerlerine bakteri ekimi yapılarak pozitif kontrol olarak kullanılmıştır. 26 °C'de inkübasyona bırakılan petrilerde inokulasyondan 2 gün sonra spektrofotometrede (600 nm) bakteri yoğunlukları ölçülmüştür. Deneme sonucunda patojenler üzerinde en yüksek etki *T. erecta*'nın çiçeklerinden elde edilen ektraktta görülmüştür. Doz artışına paralel olarak etki oranı da artmıştır. *Pst* üzerinde çiçek ekstraktının 250 ppm dışındaki tüm dozları, aynı şekilde *Cmm* üzerinde bütün dozları etkili olurken, *Xe* üzerinde 2000 ve 3000 ppm dozları etkili (%100) olmuştur. *S. bracteata* ekstraktının 3000 ppm dozu *Pst* üzerinde etkili olurken diğer patojenler üzerinde etki göstermemiştir. *T. erecta*'nın yapraklarından elde edilen ekstrakt sadece *Cmm* üzerinde etkili olmuştur. Sonuç olarak yapılan bu çalışma ile özellikle *T. erecta*'nın patojenler üzerinde antibakteriyel etkiye sahip olduğu ortaya konulmuştur.

Anahtar Kelimeler: *Salvia bracteata, Tagetes erecta, Pseudomonas syringe* pv. *tomato, Clavibacter michiganensis* subsp. *michiganensis, Antibakteriyel etki*

ID: 643

Comparison of Israeli carp meat, scales, visceral organs and bone structures in terms of nutritional content

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Abstract

Recycling and use of food wastes have started to be promoted especially in developed countries. By-products formed during the processing of foods are released in varying amounts after the processes applied by the food industry. Many food wastes are a valuable source of nutrients with their protein, carbohydrate, and lipid contents. The evaluation of the by-products obtained in the food industry and the development of new functional products attract great attention in terms of providing a significant economic return at the industrial level. In this study, the use of meat, scales, viscera, and bone structures of Israeli carp (*Carassius gibelio*), which is one of the non-economic fish species of the Black Sea, was investigated as a functional product to increase nutritional value as an alternative protein and lipid source for human consumption and as animal feed. Its use as an alternative product for the proportional amounts of these structures among themselves was 46% as internal organs, 27% meat, 16% scales, and 11% bony structures. The use of other parts (63%) as an alternative is essential because of the low total meat ratio of 27% in Israeli carp, which is an invasive and non-economic species. Although the highest crude protein ratio was observed in the scales (21.31%), the lowest percentage was detected in the internal organs (1.08%). Considering the lipid ratio, the highest rate was observed in the internal organs (22.38%) and the lowest in the muscle tissue (1.43%). In terms of moisture content, the ratio decreased from fish meat to flakes. The highest rate was observed in muscle (80.59%), followed by internal organs (77.62%), bony structures (71.83%), and scales (67.31%). Ash ratios were also from highest to lowest scale (9.07%), bony structures (7.20%), internal organs (3.25%), and muscle (1.27%).

Key Words: *Israeli carp, waste assessment, alternative source, nutritional content.*

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İsrail sazanı eti, pulu, iç organı ve kemiksi yapılarının besinsel içerikler açısından karşılaştırılması

Özet

Gıda atıklarının geri kazanımı ve kullanımı, özellikle gelişmiş ülkelerde teşvik edilmeye başlanmıştır. Gıdaların işlenmesi sırasında oluşan yan ürünler, gıda endüstrisi tarafından uygulanan işlemler sonrasında değişen miktarlarda açığa çıkmaktadır. Birçok gıda atığı, içermiş olduğu protein, karbonhidrat ve lipit içerikleri ile değerli bir besin kaynağı olarak karşımıza çıkmaktadır. Gıda endüstrisinde elde edilen yan ürünlerin değerlendirilmesi ve yeni fonksiyonel ürünlerin geliştirilmesi, endüstriyel boyutta önemli bir ekonomik getiri sağlaması açısından yoğun ilgi görmektedir. Bu çalışmada, Karadeniz'in ekonomik değere sahip olmayan balık türlerinden İsrail sazanı (*Carassius gibelio*)'nın et, pul, iç organ ve kemiksi yapılarının gerek insan tüketiminde alternatif protein ve lipid kaynağı olarak kullanımında gerekse hayvan yemi olarak besinsel değeri artırmada fonksiyonel ürün şeklinde kullanımı için alternatif ürün olarak kullanımı araştırılmıştır. Bu yapıların kendi aralarındaki oransal miktarları 46% ile iç organ, 27% et, 16% pul ve 11% kemiksi yapılar şeklinde olmuştur. İstilacı ve ekonomik olmayan bir tür olan İsrail sazanında total oransal açıdan 27% oranındaki etin düşük olması nedeniyle diğer kısımların (63%) alternatif olarak kullanımı önem arz etmektedir. En yüksek ham protein oranı pullarda (21.31%) görülmesine rağmen en düşük oran ise iç organlarda (1.08%) tespit edilmiştir. Lipid oranına bakıldığında ise en yüksek oran iç organlarda (22.38%) en düşük ise kas dokusunda (1.43%) gözlenmiştir. Nem içerikleri açısından oran balık etinden pullara doğru düşüş eğiliminde olmuştur. En yüksek oran kasta (80.59%) gözlenirken bunu iç organlar (77.62%), kemiksi yapılar (71.83%) ve pullar (67.31%) takip etmektedir. Kül oranları da en yüksekten en düşüğe doğru pul (9.07%), kemiksi yapılar (7.20%), iç organlar (3.25%) ve kas (1.27%) şeklinde olmuştur.

Anahtar Kelimeler: *İsrail sazanı, atık değerlendirmesi, alternatif kaynak, besinsel içerik.*

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The influence of sweet potato peel extract on biogenic amine accumulation in amino acid decarboxylase broth by food-borne pathogens

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Abstract

Biogenic amines produced by bacteria can be toxic to humans and animals and cause a variety of illnesses. When seafood is improperly stored and handled, bacteria can rapidly grow and they decarboxylated free amino acids to produce biogenic amines. The growth of the bacterial cells in foods as well as the prevention of toxin production is of great importance for food processing technology. It has been reported that sweet potato peel extracts have antibacterial properties on food spoilage bacteria and pathogens. However, there are not sufficient research regarding to the effect of sweet potato peel extracts on biogenic amines production. Therefore, in this study, the impact of sweet potato peel extracts used at different doses (0.5 and 1 mL/100 mL) on biogenic amine (BAs) and ammonia (AMN) production by *Staphylococcus aureus, Escherichia coli, Klebsiella pneumoniae, Enterococcus faecalis, Pseudomonas aeruginosa, Aeromonas hydrophila* and *Salmonella enterica* serovar Paratyphi A) was investigated in both histidine decarboxylase broth (HDB) and tyrosine decarboxylase broth (TDB) separately. The results obtained from the current study showed that all pathogens have ability to decarboxylase amino acid (histidine or tyrosine) to produce biogenic amines. Significant differences ($P < 0.05$) were found in the production of AMN and BAs between members of the gram negative and gram-positive pathogens in both amino acid decarboxylase broths. These differences were observed depending on the concentration of extracts and the pathogens studied. Sweet potato peel extracts used at different doses in TDB showed significant increase compare to HDB under the same conditions. This results also showed that extract has higher inhibitory effect on AMN and BAs formation by food-borne pathogens in HDB than TDB.

Key Words: *Sweet potato peel extracts, biogenic amines, bacterial growth, amino acid decarboxylase broth, foodborne pathogens*

Tatlı patates kabuğu ekstresinin amino asit dekarboksilaz sıvısında gıda kaynaklı patojenler tarafından üretilen biyojenik amin üretimi üzerine etkisi

Özet

Bakteriler tarafından üretilen biyojenik aminler, insanlar ve hayvanlar için toksik olabilir ve çeşitli hastalıklara neden olabilir. Su ürünleri uygun şekilde depolanmadığında veya işlendiğinde, bakteriler hızla gelişebilir ve biyojenik aminler üretmek için serbest amino asitleri dekarboksile ederler. Gıdalardaki bakteri hücrelerinin gelişimi ve toksin üretiminin önlenmesi gıda işleme teknolojisi için büyük önem taşımaktadır. Tatlı patates kabuğu ekstrelerinin gıda bozucu bakteri ve patojenler üzerinde antibakteriyel özelliklere sahip olduğu bildirilmiştir. Ancak tatlı patates kabuğu ekstraktlarının biyojenik amin üretimi üzerindeki etkisine ilişkin yeterli araştırma bulunmamaktadır. Bu nedenle bu çalışmada, farklı dozlarda (0,5 ve 1 mL/100 mL) kullanılan tatlı patates kabuğu ekstrelerinin *Staphylococcus aureus, Escherichia coli, Klebsiella pneumoniae, Enterococcus faecalis, Pseudomonas aeruginosa, Aeromonas hydrophila* ve *Salmonella enterica* serovar Paratyphi A) tarafından biyojenik amin (BA'lar) ve amonyak (AMN) üretimine etkisi hem histidin dekarboksilaz sıvısı (HDB) hem de tirozin dekarboksilaz sıvısı (TDB) içinde ayrı ayrı incelenmiştir. Mevcut çalışmadan elde edilen sonuçlar, tüm patojenlerin biyojenik aminler üretmek için kullanılan amino asitleri (histidin veya tirozin) dekarboksile etme yeteneğine sahip olduğunu göstermiştir. Her iki amino asit dekarboksilaz sıvısında gram negatif ve gram pozitif patojen üyeleri arasında AMN ve BA üretiminde önemli farklılıklar ($P < 0.05$) gözlenmiştir. Bu farklılıklar, ekstraktların konsantrasyonuna ve kullanılan mikroorganizma türüne bağlı olmuştur. TDB'de farklı dozlarda kullanılan tatlı patates kabuğu ekstreleri, aynı koşullar altında HDB'ye göre önemli artış göstermiştir. Bu sonuçlar ayrıca ekstraktın HDB'de gıda kaynaklı patojenler tarafından TDB'ye göre AMN ve BA oluşumu üzerinde daha yüksek inhibitör etkiye sahip olduğunu göstermiştir.

Anahtar Kelimeler: *Tatlı patates kabuğu ekstraktı, biyojenik aminler, bakteri gelişimi, amino asit dekarboksilaz sıvısı, gıda kaynaklı patojenler*

ID: 645

Metal levels of commercially important *Saurida lessepsianus* from North-Eastern Mediterranean: Health risk estimation

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Abstract

The metal levels of a commercially important fish species (*Saurida lessepsianus*) of economic value in the northeastern Mediterranean were investigated. *S. lessepsianus* used in the study was investigated in Mersin Bay using commercial fishing boats. Sampling was done over four seasons (winter, spring, summer and autumn) between December 2018 and September 2019. Mg, P, K, Fe, Cu, Zn, Mn, Se, Al, Cr, As, Cd and Pb levels (µg/g, w/w) in fish species were measured seasonally. Min-max metal levels found in the studied fish species were as follows (µg/g, ww); Mg (149.27-361.37), P (960.66-2387.33), K (4322.83-5404.13), Fe (7.92-16.64), Cu (0.36-0.84), Zn (3.70-9.81), Mn (0.24-0.70), Se (0.61-2.27), Al (2.58-7.62), Cr (0.36-0.65), As (3.13-10.00), Cd (0.07-0.12) and Pb (0.36-0.65). In addition, to predict possible risks regarding consumer health that might arise from the consumption of these species, risk estimates were calculated for adults and children for consumption frequencies of once, thrice and seven times a week. For this, the estimated weekly intake (EWI), the target hazard quotient (THQ) and the lifetime cancer risk (CR) for the consumption of *S. lessepsianus* of economic value in the Northeastern Mediterranean were calculated. EWI values were found to be lower than the PTWI values determined by the European Food Safety Authority and FAO/WHO. For most samples examined, it was found that THQ<1. For the samples examined, it was determined that the CR values for consumers is low, except for heavy consumption cases.

Key Words: *Seafood, risk assessment, estimated weekly intake, Target Hazard Quotient, lifetime cancer risk,*

Kuzey-Doğu Akdeniz'den ticari olarak önemli *Saurida lessepsianus*'un metal seviyeleri: Sağlık riski tahmini

Özet

Kuzeydoğu Akdeniz'de ekonomik değeri olan ticari açıdan önemli bir balık türünün (*Saurida lessepsianus*) metal düzeyleri araştırılmıştır. Çalışmada kullanılan *S. lessepsianus* örnekleri, Mersin Körfezi'nde ticari balıkçı tekneleri kullanılarak temin edilmiştir. Örnekleme Aralık 2018 ile Eylül 2019 arasında dört mevsim olarak (kış, ilkbahar, yaz ve sonbahar) yapılmıştır. Mg, P, K, Fe, Cu, Zn, Mn, Se, Al, Cr, As, Cd ve Pb seviyeleri (µg/g, w/w) mevsimsel olarak ölçülmüştür. İncelenen balık türünde bulunan min-max metal seviyeleri (µg/g, ww); Mg (149.27-361.37), P (960.66-2387.33), K (4322.83-5404.13), Fe (7.92-16.64), Cu (0.36-0.84), Zn (3.70-9.81), Mn (0.24-0.70), Se (0.61-2.27), Al (2.58-7.62), Cr (0.36-0.65), As (3.13-10.00), Cd (0.07-0.12) ve Pb (0.36-0.65) olarak belirlenmiştir. Ayrıca bu türün tüketiminden kaynaklanabilecek tüketici sağlığına ilişkin olası riskleri tahmin etmek için yetişkinler ve çocuklar için haftada bir, üç ve yedi kez tüketim sıklıkları için risk tahminleri hesaplanmıştır. Bunun için Kuzeydoğu Akdeniz'de ekonomik değeri olan *S. lessepsianus* tüketimi için tahmini haftalık alım miktarı (EWI), hedef tehlike katsayısı (THQ) ve yaşam boyu kanser riski (CR) hesaplanmıştır. EWI değerleri, Avrupa Gıda Güvenliği Otoritesi ve FAO/WHO tarafından belirlenen PTWI değerlerinden düşük bulunmuştur. İncelenen örneklerin çoğu için THQ<1 olduğu belirlenmiştir. İncelenen numuneler için yoğun tüketim durumları dışında tüketiciler için CR değerlerinin düşük olduğu tespit edilmiştir.

Anahtar Kelimeler: *Su ürünleri, risk değerlendirmesi, tahmini haftalık alım, Hedef Tehlike Katsayısı, yaşam boyu kanser riski,*

ID: 646

Express Determination Of Ecotoxicantic Volume Substances In Waste Water Formed In The Process Of Hydrogen Purification Of Petroleum Oils

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The hydrogen treatment plant for petroleum distillates and other oil distillates at the Heydar Aliyev Oil Refinery is considered to be more environmentally and economically efficient than the old classical technological plants.As it is known, so far the complete reduction of emissions has not been achieved during the technological processes of oil refining in the developed countries of the world oil industry

One of the main directions of our research is the initial assessment of the environmental impact of wastewater generated at the facility.The following analyzes were performed for this purpose.

Spectral analysis of volatile ecotoxicants in water samples taken from wastewater formed during the hydrogenation of Autol 8 and Autol 15 oil distillates as catalysts as the main raw material was carried out in the above-mentioned facility [1-3].

We use gas chromatography-mass spectrometry method for the analysis of aromatic hydrocarbons in polystyrene wastewater; optical emission spectrometry method for metals; spectrometry method for phenols, dyes and fluorine; nephelometry method for turbidity; gravimetry method for common suspended particles.

The results obtained during laboratory measurements by taking water samples from the general wastewater outlet of the facility in accordance with the known methods are shown below (Table 1).

Table 1. Results of analysis of industrial wastewater

Assigned indicator	**Amounts. mg/l**
Polycyclic aromatic hydrocarbons	
Naphthalene	9.8
Acenaftilen	0.06
Acenaften	0.06
Fluoren	0.17
Fenantren	0.27
Anthracene	0.18
Fluorant	0.23
Pyrenees	0.36
Benz (a) anthracene	0.34
Krizen	0.53
Benz (b + j + k) fluorescent	0.30
Benz (a) pyrene	0.18
Inden (1,2,3-cd) pyrene	0.08
Benz (ghi) perilen	0.09
Dibenz (ah) anthracene	0.09
∑ 16 Polycyclic aromatic hydrocarbons	12.7

As can be seen from the results obtained from the tables, the reasons for the formation of all volatile organic and inorganic substances with all ecotoxicant properties in the water sample taken from the plant of the refinery can be explained as follows:

- Chemical transformations of hydrogen gas with Autol 8 and Autol 15 distillates due to the presence of sulfur, nitrogen, oxygen, phosphorus organic compounds, various mixtures of hydrocarbons and metal salts and catalysts, pressure and temperature up to 280-310^{0}C. resulting in volatile ecotoxicants.
- Although the individual quantities of the refinery are less than normal, as can be seen from the table, their total amount is very high and toxic.

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ID: 647

Evaluation of total antioxidant and oxidant status, oxidative stress index and DPPH free radical scavenging activities of pumpkin (*Cucurbita maxima*) seeds ethanolic extracts

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Abstract

Fruits and vegetables are basic crops of mass consumption for human population to meat their food requirements. Recent advances in medicinal studies have revealed that different parts of fruits and vegetables are loaded with phytochemicals responsible for eliminating the risks of different diseases. Pumpkin (*Cucurbita maxima*) is one of the abundantly grown and consumed vegetable all around the world. Seeds of this vegetables are named as nutritional power houses due to their excellent nutrient profiles. In present study total antioxidant status (TAS), total oxidant status (TOS), oxidative stress index (OSI) and DPPH free radical scavenging activity, of pumpkin seeds extracts were determined. Extraction of pumpkin seeds was carried out in a Soxhlet apparatus using ethanol as extraction solvent. TAS and TOS were determined through Rel Assay Kits and free radical scavenging activity was measured through DPPH assay. TAS was found 4.18±0.36 and TOS 14.68±0.42, whereas value of OSI was measured 0.35±0.10. DPPH free radical scavenging activity was observed increasing with increasing the concentration and maximum value 56.10±0.90% was observed at 2 mg/mL concentration. From these results it was concluded that pumpkin seeds could be utilized as natural antioxidant source with potential to reduce oxidative stress and minimizing the risks of certain diseases.

ID: 648

Reactive Extraction of Lactic Acid Using Trioctylamine with Environmentally Friendly Solvents

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Abstract

Today, carboxylic acids are used very frequently in fields such as medicine, food and cosmetics. The production of carboxylic acids by fermentation has gained importance with the increasing interest in environmentally friendly production types. However, separation of carboxylic acids from the fermentation medium is difficult. Many methods have been developed for the separation of these acids from the fermentation medium. Among these methods, separation by reactive extraction has recently come to the fore as an innovative method. Lactic acid is a small molecule organic acid that is used extensively in industry as both raw material and additive. Although the production methods of lactic acid are developed, there is a need for studies on the separation of lactic acid from the fermentation medium. In this study, the separation of lactic acid from aqueous solutions using trioctylamine (TOA) reactant and environmentally friendly solvents such as sunflower and rice bran oil was investigated, and it was aimed to contribute to the separation of lactic acid by reactive extraction. It is aimed to determine the most suitable reactant / solvent ratios with reactive extraction analyzes. As a result of the studies, the highest efficiency (72.91%) was achieved with the TOA reactant. An increase in yield occurred as a result of using both sunflower oil and rice bran oil (1:1) together. When the physical and reactive extraction results were examined, it was observed that the addition of TOA to the organic phase greatly increased the extraction efficiency in the recovery of carboxylic acids from aqueous solutions. While the physical extraction yield was 11.85%, the yield increased up to 72.91% in reactive extraction. An increase in yield was observed about 7 times. In general, it was understood from the results that the dispersion coefficient (from 0.13 to 2.69) values increased with the increasing extractant concentration, and the loading factor (from 1.79 to 0.69) values decreased. Considering the organic phase mixtures formed with extractant and diluent combinations, it has been determined that the most positive results in terms of extraction efficiency can be obtained when 3.62M TOA is used for lactic acid.

Key Words: *Reactive extraction, Physical extraction, Trioctylamine, Sunflower oil, Rice bran oil*

Çevre Dostu Çözücüler ile Trioktil Amin Kullanılarak Laktik Asitin Reaktif Ekstraksiyonu

Özet

Günümüzde karboksilik asitler ilaç, gıda, kozmetik gibi alanlarda çok sık kullanılmaktadır. Çevre dostu üretim çeşitlerine olan ilginin artması ile karboksilik asitlerin fermantasyon ile üretilmeleri önem kazanmıştır. Fakat karboksilik asitlerin fermantasyon ortamından ayrılması zor olmaktadır. Bu asitlerin fermantasyon ortamından ayrılmasına yönelik birçok yöntem geliştirilmiştir. Bu yöntemler arasında reaktif ekstraksiyon ile ayırma yenilikçi bir yöntem olarak son zamanlarda öne çıkmıştır. Laktik asit gerek hammadde gerekse katkı maddesi olarak endüstride yoğun bir şekilde kullanılan küçük moleküllü organik asittir. Laktik asitin üretim metotları gelişmiş olmasına rağmen fermantasyon ortamından ayrılmasına yönelik çalışmalar yapılmasına ihtiyaç duyulmaktadır. Bu çalışmada, laktik asitin sulu çözeltilerinden trioktil amin (TOA) reaktanı ve ayçiçek ve pirinç kepek yağı gibi çevre dostu çözücüler kullanılarak ayrılması incelenmiş ve reaktif ekstraksiyon ile laktik asitin ayrılmasına katkı sağlayacağı amaçlanmıştır. Reaktif ekstraksiyon analizleri ile en uygun reaktant / çözücü oranlarını tespit etmek hedeflenmiştir. Çalışmalar sonucunda TOA reaktanı ile en yüksek verime (%72.91) ulaşılmıştır. Hem ayçiçek yağı hem de pirinç kepek yağının (1:1) birlikte kullanılması neticesinde verimde artış meydana gelmiştir. Yapılan fiziksel ve reaktif ekstraksiyon sonuçları incelendiğinde, karboksilik asitlerin sulu çözeltilerden geri kazanımında organik faza TOA eklemesinin ekstraksiyon etkinliğini büyük oranda arttırdığı görülmüştür. Fiziksel ekstraksiyonda verim %11.85 bulunurken, reaktif ekstraksiyonda verim %72,91'e kadar çıkmıştır. Yaklaşık 7 kat verimde artış gözlenmiştir. Genel itibariyle sonuçlardan artan ekstraktan konsantrasyonuyla birlikte dağılma katsayısı (0.13'dan 2.69'a) değerlenin de arttığı, yükleme faktörü (1.79'dan 0.69'a) değerlerinin azaldığı anlaşılmıştır. Ekstrakttan ve seyreltici kombinasyonlarıyla oluşturulan organik faz karışımları göz önüne alındığında ekstraksiyon verimliliği açısından en olumlu sonuçların laktik asit için 3.62M TOA kullanıldığında elde edilebildiği tespit edilmiştir.

Anahtar Kelimeler: *Reaktif ekstraksiyon, Fiziksel ekstraksiyon, trioktil amin, Ayçiçek yağı, Pirinç kepek yağı*

Giriş

Günümüzde endüstriyel gıda sektörünün hızlı bir şekilde gelişmesi ile birlikte ürünlerin optimum koşullarda ve minimum maliyet, enerji ve zamanla prosesleri yönetmeye yönelik çalışmalar giderek artış göstermektedir. Bu süreç içerisinde kimyasal ayırma işlemleri önemli bir role sahiptir. Bu çeşit endüstrilerin temel amacı var olan ayırma yöntemlerini yeni teknikler kullanarak geliştirmek veya kombine ederek uygulanabilir makul seviyelerde süreç yönetimini en iyi şekilde yapabilmektir (Wasewar, 2012).
Karboksilik asitler polar ve hidrojen bağı yapabilen, karboksil grubu (R-COOH) içeren ve birden fazla karboksil grubuna sahip olan bileşiklerdir. Ayrıca karboksilik asitlerin karboksil grubu polar özelliklere sahip olduğundan asitlerin fiziksel özellikleri bu grup tarafından şekillendirilir (Volhardt ve Schore, 2010). Karboksilik asitler gıda ve kimya endüstrilerinde sıkça kullanılan, özellikle hayvan yemi, plastik, ilaç ve deterjan gibi ürünlerin üretilmesinde baş rol oynayan organik bileşiklerdir. Ayrıca karboksilik asitler polimerler üretiminde girdi hammaddesi olarak da kullanılmaktadır (Djas ve Henczka, 2018; Hong ve ark., 2001).
Geleneksel olarak organik asitlerin üretimi fermantasyon yöntemi ile yapılmaktadır. Enerji maliyetlerindeki artış nedeniyle fermantasyona olan ilgi giderek artmaktadır. Fakat fermantasyon ürünlerinin geri kazanımları konusundaki çalışmalar sınırlı olmaktadır. Bu sebeple, geri kazanım yönündeki yenilikçi teknolojilere ihtiyaç duyulmaktadır (Kertes ve King, 1986).
Fermantasyon sıvısına kalsiyum hidroksit veya kalsiyum karbonat ilave edilmesi sonucunda ortaya çıkan kalsiyum tuzunun sülfürik asitle muamele edilmesi geleneksel ürün geri kazanma yöntemi olarak bilinmektedir. Bu işlemler sonucunda hem kalsiyum sülfat atığının ortaya çıkması hem de büyük miktarda bulamacın işlenmesi yöntemin dezavantajıdır (Hong ve ark., 2001; Kertes ve King, 1986).
Bir diğer geleneksel yöntem olan sıvı-sıvı ekstraksiyonda ise sulu ve su ile karışmayan organik faz arasına çözünen aktarılır. Fazların birbirinden ayrılmasından sonra çözünen organik fazdan alınır. Ekstraksiyon da kullanılan çözücüler (eter gibi) düşük aktivite katsayısına sahip olan sulu fazdaki asitin çözücüye transferini zorlaştırdığından, karboksilik asitlerin geri kazanımı için uygun bir yöntem değildir (Hong ve ark., 2001). Genel olarak karboksilik asitlerin sulu çözeltilerinden geri kazanılmasında birçok yöntem sıklıkla kullanılmaktadır. İyon değişimi, sıvı-sıvı ekstraksiyon, ultrafiltrasyon, ters osmoz, kimyasal çökeltme, adsorpsiyon ve reaktif ekstraksiyon bu yöntemleri oluşturmaktadır (Kurzrock ve Weuster-Botz, 2010; Pazouki ve Panda 1998). Tüm bu ayırma yöntemleri arasında reaktif ekstraksiyon karboksilik asitlerin sulu çözeltilerinden geri kazanılması konusunda başarılı bulunmuştur. Bu yöntemin diğer ayırma proseslerine alternatif olacağı düşünülmüştür (Kumar ve Babu, 2008).
Laktik asit hem kimyasal sentez hem de laktik asit fermantasyonu ile biyoteknolojik olarak üretilmektedir. Bilinen en yaygın kimyasal sentez laktonitrilin hidrolize edilmesidir. Fakat bu yöntemde kullanılan petrokimyasal hammaddelerin sınırlı olması ve doğaya verilen zararlar nedeniyle sınırlamalar ortaya çıkmaktadır (Wee ve ark., 2006). Günümüzde laktik asitin çok büyük bir kısmı mikrobiyal fermantasyon yolu ile üretilmektedir. Endüstriyel olarak biyodönüşümlerin ilerlemesiyle mikroorganizma tarafından laktik asit üretimi tercih edilmeye başlanmıştır (Fazzino ve ark., 2021).
Laktik asit gıda, ilaç, kozmetik ve kimya endüstrilerinde yaygın olarak kullanılmasından ötürü laktik asit üretimine olan ilgi artmaktadır (Wee ve ark., 2006). Laktik asitin artan üretimiyle beraber hem fermantasyon ortamından hem de atık sulardan ve yan ürünlerden verimli bir şekilde ayrılması ve saflaştırılması önem kazanmıştır.
Reaktif ekstraksiyon, reaktant ve seyrelticinin birlikte kullanılması sonucunda reaktant ve ekstrakte edilen ürün arasında oluşan reaksiyon ile meydana gelir. Ortaya çıkan kompleks bileşenler daha sonra organik fazda çözünerek ayırma işlemi meydana gelir (Hong ve Hong, 2000). Reaktif ekstraksiyonu fiziksel ekstraksiyondan ayıran temel özellik, reaktif ekstraksiyon yönteminde bir reaktantın ortamda bulunması ve bu reaktantın karboksilli asitlerle kompleks oluşturarak ayırma işlemini gerçekleştirmesine dayanmaktadır. Bu yöntem diğer yöntemlere kıyasla basit, verimli ve temiz bir işlem olma özelliği bakımından ön plana çıkmaktadır.
Bu çalışmada bir karboksilik asit olan laktik asitin sulu çözeltilerden reaktif ekstraksiyon ile geri kazanılmasının incelenmesi amaçlanmıştır. Çevre dostu olarak ayçiçek ve pirinç kepek yağı çözücüleri ve reaktant olarak trioktil amin (TOA) kullanımlarıyla çalışma gerçekleştirilmiştir. Çalışmanın temel amacı ayçiçek ve pirinç kepek yağının 1:1 oranda kullanarak reaktant ile reaksiyonu sonucunda elde edilen sonuçların, dağılma katsayısı, yükleme faktörü ve ekstraksiyon verimine olan etkisi incelenmiştir.

Materyal ve Yöntem

Yüksek saflıkta kimyasallar laktik asit, amin (trioktil amin), ve çevre dostu bitkisel çözücüler (ayçiçek yağı, pirinç kepek yağı) ticari bir firmadan satın alınmıştır.
Denemelerde kullanılan laktik asitin fermantasyon sonucu oluşabilecek en yüksek miktarının hacimce %8'lik sulu çözeltisi hazırlanmıştır. Ana stok asit çözeltisinin karıştırılması ile asitin suda homojen dağılımı sağlanmıştır. Laktik asit ana stok çözeltisinden 10 mL alınarak 50 mL'lik erlenin içerisine yerleştirilmiştir. Böylece sulu faz hazırlanmıştır. Organik fazı oluşturmak üzere fiziksel ekstraksiyonda ekstraktan kullanılmadan 10 mL çözücü (ayçiçek yağı ve pirinç kepek yağı 1:1 oranda) eklenmiştir. Reaktif ekstraksiyonda organik fazı oluşturmak üzere

ekstraktan ve çözücüden toplam 20 mL olacak şekilde erlene ilave edilmiştir. Reaktif ekstraksiyonda organik fazın sulu faza hacimsel oranı 1:1 (10mL/10mL) olacak şekilde ekstraktan konsantrasyonu organik faz içerisinde artırılmıştır. Ekstraktan olarak kullanılan aminin çevre dostu bitkisel çözücüler (ÇDBÇ) (ayçiçek yağı ve pirinç kepek yağı 1:1 oranda) içerisinde ve 10 farklı konsantrasyonda karışımları hazırlanmıştır. Hazırlanan karışımlar çalkalayıcı (Wisecube WIS 30, Almanya) içerisinde 6 saat karıştırılmaya tabi tutulmuştur.
Literatürde bir maddenin denge dağılımını elde etmek için iki fazın karıştırılması ve ayrılmasında kullanılmak üzere birçok yöntem verilmiştir. Daha önce yapılan çalışmalar bir veya daha fazla saat çalkalama süresi önermişlerdir. Bu çalışmada denge derişimini elde etmek için gerekli süre ön denemeler sonucunda belirlenmiştir. Karıştırma işleminden sonra örneklerin fazları tamamen birbirinden ayrılması için yine ön denemeler sonucunda bekletilmiş ve süre tespit edilmiştir ve fazlar ayrılarak sulu fazdaki asit miktarları literatürde önerildiği şekilde 0.1 N NaOH ile fenolftalein indikatöründe titre edilerek analiz edilmiştir. Titrasyon hesaplamaları deneysel hatayı minimumda tutmak için 3 kez tekrarlanmış, ortalamaları alınmıştır. Organik fazdaki asit miktarları kütle denkliğinden bulunarak hesaplanmıştır. Denge hesaplamaları ile asitin dağılma katsayısına, yükleme faktörüne ve ekstraksiyon verimine ulaşılmıştır.

Hesaplanan Dağılma katsayısı (K_D), Yükleme faktörü (Z) ve Ekstraksiyon verimliliği (E) değerleri aşağıdaki formüllere göre hesaplanmıştır.

$$K_D = \frac{C_{LA(org)}}{C_{LA(su)}}$$

$$Z = \frac{C_{LA(org)}}{C_{Amin}}$$

$$E = (1 - \frac{C_{LA(su)}}{C^0_{LA(su)}}) \times 100$$

$C_{LA(org)}$: Ekstraksiyondan sonraki organik fazdaki laktik asit konsantrasyonu (mol/L)
$C_{LA(su)}$: Ekstraksiyondan sonraki su fazındaki laktik asit konsantrasyonu (mol/L)
C_{Amin} : Organik fazdaki amin konsantrasyonu (mol/L)
$C^0_{LA(su)}$: Su fazındaki başlangıç laktik asit konsantrasyonu (mol/L)
E : % ekstraksiyon verimi

Bulgular ve Tartışma

Reaktif Ekstraksiyon Bulguları

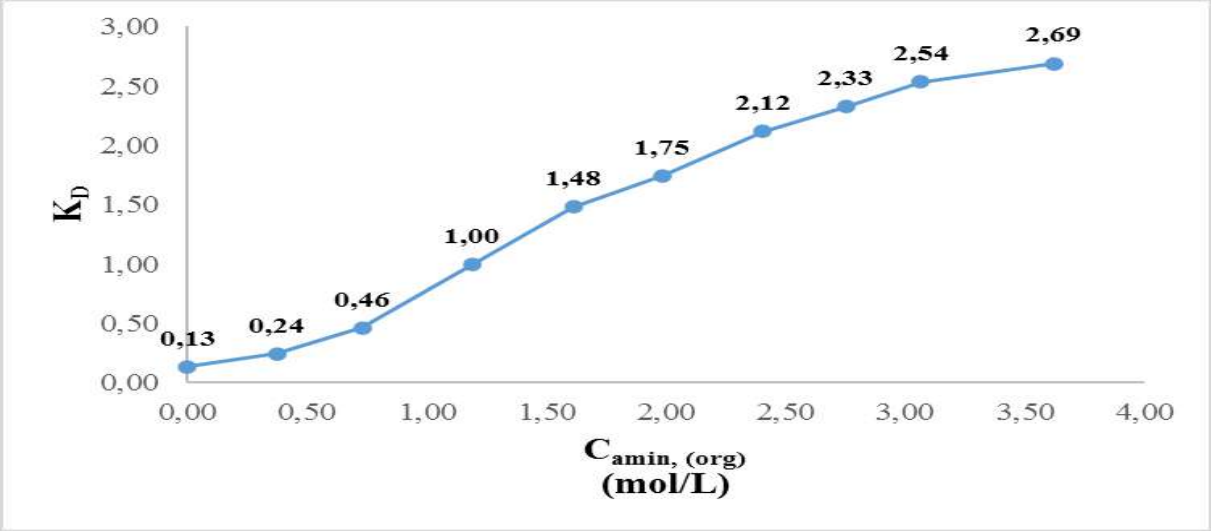
Elde edilen bulgular kapsamında TOA konsantrasyonundaki değişime göre dağılma katsayısı, yükleme faktörü, ekstraksiyon verimi ve K_{D1}/K_{D0} değerlerini gösteren grafikler sırasıyla Şekil 1, Şekil 2, Şekil 3 ve Şekil 4'te sunulmuştur.

Tablo 1. Laktik asitin TOA ve çözücü sistemiyle ekstraksiyon sonuçları

Çözücü	$C_{amin,\ (org)}$ (mol/L)	$C_{LA(raf)}$ (mol/L)	$C_{LA(org)}$ (mol/L)	K_D	Ort. K_D	Z	% E	Ort. %E	K_{D1}/K_{D0}
Ayçiçek Yağı ve Pirinç Kepek Yağı (1:1)	0.00	3.02	0.41	0.13	1.47		11.85	51.86	1.00
	0.37	2.76	0.67	0.24		1.79	19.53		1.81
	0.73	2.34	1.08	0.46		1.48	31.62		3.44
	1.19	1.72	1.71	1.00		1.44	49.88		7.40
	1.61	1.38	2.05	1.48		1.27	59.67		11.00
	1.99	1.25	2.18	1.75		1.10	63.57		12.98
	2.41	1.10	2.33	2.12		0.97	67.90		15.73
	2.75	1.03	2.40	2.33		0.87	69.94		17.30
	3.07	0.97	2.46	2.54		0.80	71.72		18.86
	3.62	0.93	2.50	2.69		0.69	72.91		20.01

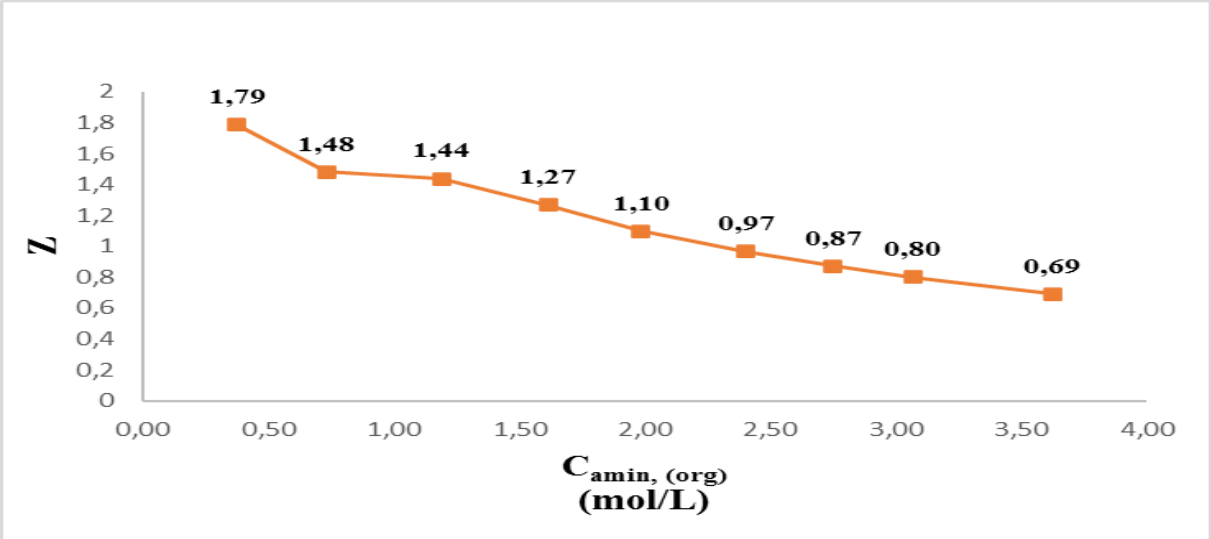
Dağılma katsayısı, gerçekleştirilen ekstraksiyon işleminin değerlendirilmesinde ve kıyaslanmasında kullanılan bir kavramdır. Birbirine karışmayan iki faz arasında dağılıma uğramış bir madde için, denge halinde her iki fazdaki konsantrasyonları oranıyla elde edilen bir değerdir. Yapılan birçok çalışmaya göre yüksek kaynama noktasına

sahip, orta molekül ağırlıkta ve suya karışmayan polar çözücüler yüksek dağılma katsayısı ve seçicilik göstermiştir (Wasewar ve Yoo, 2012).
Deneysel sonuçlara göre, fazlar arasında dağılıma uğrayan madde laktik asittir ve başlangıç dağılma katsayısı 0.13 iken amin konsantrasyonun artması ile birlikte 2.69'a kadar artış meydana geldiği görülmektedir. Daha önce yapılan çalışmalarda inert çözücülerin asitin çözücü fazına çok düşük bir dağılım verdiği bildirilmiştir (İnci ve Uslu, 2005; Tamada ve King, 1990; Uslu ve ark., 2009; Thakre ve ark., 2016; Keshav ve ark., 2012; Tamada ve ark., 1990).



Şekil 1. TOA konsantrasyonuna bağlı olarak laktik asitin dağılma katsayısındaki değişim

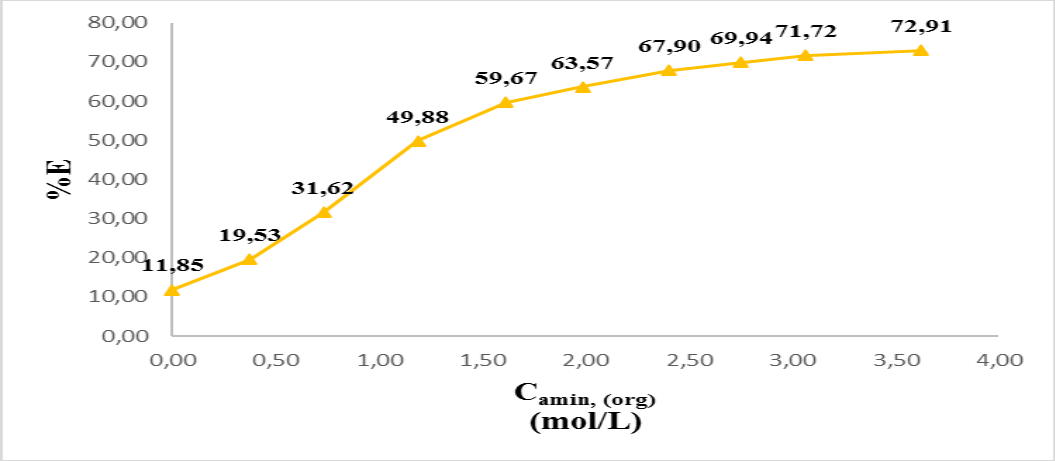
Sonuçlar incelendiğinde amin miktarındaki artışa bağlı olarak yükleme değerinin azaldığı görülmektedir. Deneysel verilere bakılacak olursa, amin miktarındaki artışla ekstrakte edilen laktik asit miktarının da artığı görülmektedir. Fakat aynı artışla yükleme faktöründeki azalışı birim amin tarafından ekstrakte edilen laktik asitin azaldığı anlamına gelmektedir. Yükleme faktörünün birden büyük olduğu durumlarda aşırı yükleme ortaya çıkmaktadır. Sonuçlara göre 5 farklı amin konsantrasyonunda yükleme faktörünün 1'den büyük diğer 4 farklı amin konsantrasyonunda ise yükleme faktörünün 1'den küçük olduğu anlaşılmaktadır.



Şekil 2. TOA konsantrasyonuna bağlı olarak laktik asitin yükleme faktöründeki değişim

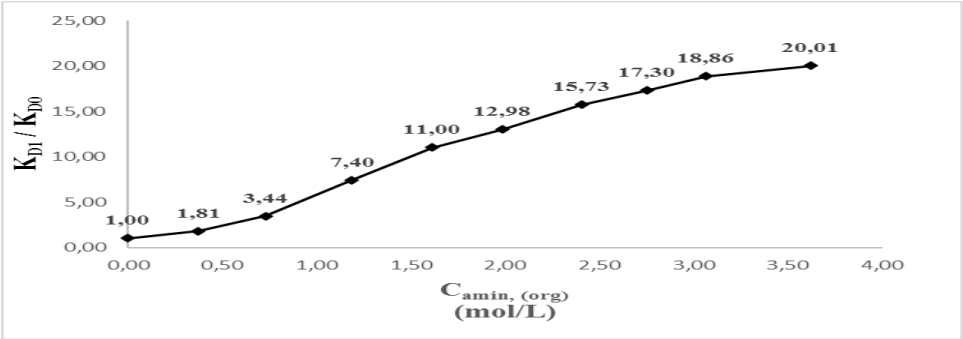
Şekil 3'te görüldüğü üzere TOA miktarının organik fazda artması ile birlikte reaktif ekstraksiyon verimi artmaktadır. Çalışma sonucunda 0.37 mol/L-3.62 mol/L aralığında TOA kullanarak gerçekleştirilen ekstraksiyonların verimlilikleri %19.53-%72.91 aralığında değişmiştir. En yüksek ekstraksiyon verimi 3.62 mol/L TOA ile %72.91 elde edilmiştir. Elde edilen sonuçlar incelendiği zaman, karboksilik asitlerin geri kazanımında reaktif ekstraksiyonda reaktan olarak kullanılan aminlerin oldukça iyi bir ekstraktan olabileceği düşüncesini doğrulamaktadır. Çözücü seçimi reaktif ekstraksiyonda önemli bir parametre olarak karşımıza çıkmaktadır.

Deneysel çalışmalarda kullanılan ÇDBÇ ayçiçek ve pirinç kepek yağlarının aynı oranda çözücü olarak kullanılması sonucunda ortaya çıkan verilerin literatüre kazandırılması hedeflenmiştir. TOA reaktanı ile hazırlanan deneylerde en yüksek dağılma katsayısı 2.69, en düşük yükleme faktörü 0.69 ve en yüksek ekstraksiyon verimi %72.91 sonuçları elde edilmiştir.



Şekil 3. TOA konsantrasyonuna bağlı olarak laktik asitin ekstraksiyon verimindeki değişim

Laktik asitin başlangıç dağılma katsayısındaki değişimi incelendiğinde, TOA miktarındaki artışa bağlı olarak maksimum 20.01 kat artış meydana geldiği görülmektedir. Bu da organik faza transfer olan laktik asitin sulu fazdaki laktik asite oranının reaktan miktarının artması ile doğru orantıda artış meydana getirdiği anlaşılmaktadır.



Şekil 4. TOA konsantrasyonuna bağlı olarak laktik asitin başlangıç dağılma katsayısındaki değişim

Fiziksel Ekstraksiyon Bulguları

Bu çalışmada laktik asitin sulu çözeltilerinden ÇDBÇ ile ayrılmaları incelenmiştir. Ayırma işlemi sıvı-sıvı ekstraksiyon ve reaktif ekstraksiyon yöntemleri kullanılarak gerçekleştirilmiştir. Reaktif ekstraksiyon yöntemi için amin içeren kompleksleştirme ajanı kullanılmıştır. Ayrıca her iki proses için de farklı çözücüler kullanılarak, çözücülerin aynı oranda birlikte kullanılmalarının ayırma verimliliği üzerine etkisi incelenmiştir.

Tablo 2. Laktik asit-çözücü sistemine ait sıvı-sıvı ekstraksiyon verileri

Çözücü	$C_{A,(aq)}$ (mol/L)	$C_{A,(org)}$ (mol/L)	K_D	% E
Ayçiçek Yağı ve Pirinç Kepek Yağı (1:1)	3.02	0.41	0.13	11.85

Sıvı-sıvı ekstraksiyon sonuçlarına göre ayırma verimliliğinin %11.85 ve dağılma katsayısının 0.13 olduğu tespit edilmiştir. Bu veriler, elde edilen en yüksek ayırma verimliliğinin yüksek molekül ağırlığındaki aside ait olduğunu göstermektedir. Ayırma verimliliğinin %15'in altında olduğu ve yapılan ekstraksiyonun istenilen oranda sonuçlar ortaya koymadığı görülmektedir. Analiz sonuçlarına göre fiziksel ekstraksiyon, reaktif ekstraksiyon ile kıyaslandığı zaman, organik faza TOA eklenmesiyle elde edilen dağılma katsayısındaki ve verimdeki büyük artış karboksilik asitlerin sulu çözeltilerden geri kazanılmasında reaktif ekstraksiyonun etkili bir ayırma metodu olduğu anlaşılmaktadır.

Daha önce yapılan bir çalışmada, laktik asitin sulu çözeltisinden geri kazanılmasında TOA ve Aliquat336 reaktanları ve ayçiçek yağı ve butan-2-ol çözgenleri kullanarak optimizasyon çalışmaları neticesinde ayçiçek yağı kullanıldığında dağıma katsayısını %24.8, ekstraksiyon verimliliğini ise %95.6 olarak bulmuşlardır (Kumar ve Thakur, 2019). Sonuçların bizim değerlerimizden farklı olmasının sebebi çalışmamızda optimizasyon yapmamış olmamızdan kaynaklanmaktadır.

Sonuç olarak, karboksilik asitlerin sulu çözeltilerden geri kazanılması açısından reaktif ekstraksiyon yönteminin ayırma etkinliğinin, sıvı-sıvı ekstraksiyona kıyasla çok daha yüksek olduğu, amin miktarının artmasıyla ayırma verimliliğin arttığı ve ÇDBÇ olarak kullanılan ayçiçek ve pirinç kepek yağlarının aynı oranda çözücü olarak kullanılması karboksilik asitlerin reaktif ekstraksiyon ile ayrılmasında başarılı sonuçlar elde edildiği görülmüştür.

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Connection Of Fisheries Management And Ballast Water Management Contract (Bwm Convention, 2004)

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Abstract

Although land-based pollution is expressed as the most important pollution factor in the pollution of the seas (80%), the rate of pollution originating from ships (approximately 20%) is not to be underestimated. The fact that marine pollution is caused almost exclusively by ships requires investigation of the measures to be taken against marine pollution from ships and their applicability. As a matter of fact, the most important cause of pollution caused by ships is ballast water, and it has been determined that over 7,000 marine organisms are transported between ports with ballast waters on a global scale every day.

Ballast water is used to maintain the balance of the ship on the water when the ships are not loaded. Considering that 90% of international trade is still provided by ships and 3-5 billion tons of ballast water is transported by approximately 85,000 ships every year with world maritime trade, the importance of pollution caused by ballast water becomes apparent. While ballast water is one of the elements that cause the transport of exotic marine and freshwater organisms between all seas of the world and cause pollution, the pollution in question is very effective especially in the aquaculture sector. Therefore, in this article, the connection of ballast water with fisheries management has been examined and solutions have been sought for the problems.

Key Words: *Fisheries Management, Balast Water, Pollution*

Balikçilik Yönetimi İle Balast Suyu Yönetimi Sözleşmesi Bağlantisi (Bwm Convention, 2004)

Özet

Denizlerin kirlenmesinde kara kaynaklı kirlilik en önemli kirlilik unsuru olarak ifade edilse de (%80), gemilerden kaynaklanan kirliliğin oranı da (yaklaşık %20) azımsanmayacak orandadır. Deniz kaynaklı kirliliğe neredeyse sadece gemilerin neden olmasıysa gemi kaynaklı deniz kirliliğine karşı alınması gereken önlemlerin ve uygulanabilirliğinin araştırılmasını gerektirmektedir. Nitekim gemilerden kaynaklanan en önemli kirlilik nedeni balast suları olup, yapılan çalışmalarda küresel ölçekte her gün 7.000'in üzerinde deniz organizmasının balast suları ile birlikte limanlar arasında taşındığı tespit edilmiştir.

Balast suyu, gemilerin yükü olmadığı zamanlarda geminin su üzerinde dengesini sağlamak amacıyla kullanılmaktadır. Halen Uluslararası ticaretin %90'ının gemilerle sağlandığı ve dünya deniz ticareti ile her yıl yaklaşık 85.000 gemi tarafından 3-5 milyar ton balast suyunun taşınımının gerçekleştiği dikkate alındığında balast suyundan kaynaklanan kirliliğin önemi ortaya çıkmaktadır. Balast suyu, egzotik deniz ve tatlı su organizmalarının tüm dünya denizleri arasında taşınımını sağlayan ve kirliliğe neden olan unsurlardan biri iken, söz konusu kirlilik özellikle su ürünleri sektöründe oldukça etkili olmaktadır. Bu nedenle bu makalede balast suyunun balıkçılık yönetimi ile bağlantısı irdelenmiş, sorunlara çözüm aranmaya çalışılmıştır.

Anahtar Kelimeler: *Balıkçılık Yönetimi, Balast Suyu, Kirlilik*

ID: 650

The Coenzyme Q10 (CoQ10) in Fish

Semra Küçük

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Abstract
Total fisheries and aquaculture production has been increasing on the World and it has reached to almost 214 million in 2020. Global fishery consumption will be increased from 20 kg to 22 kg per capita. Foods with protein are very important for a human being healthy and fit. Aquatic products contains many essansial elements in their biochemical structures. The enzymes are the proteins that act to accelerate biochemical reactions as a catalyser and catalyze more than 5.000 reactions. The enzymes react with substrates and the reactions convert to products. Enzymes are classified in two groups (amino acid sequences, enzymatic reactions) such as lactase, DNA polymerase, and alcohol dehydrogenase. But some enzymes need organic or inorganic cofactors. Enzymes with cofactors structure ares called holoenzymes. On the other hands, cofactors from enzyme act in transportation of some chemical groups (NADHP, ATP, FMN, FAD, TPP, THF) to another enzyme. Coenzyme Q10 (CoQ10) is a cofactor and found a high amount in the mitochondria of cells in order to produce energy by oxidative phosphorylation. This activity is common in the some tissues (heart, brain, liver and kindey). Cofactor has a role on the electron transport chain. In this study, it is going to be given more detail information about the definition, mechanism, functions and indicating the previous studies being done on the coenzyme Q10 in fish.
Key Words: *Aquatic products, Coenzyme Q10, Aquaculture*

Balıklarda Coenzim Q10

Özet
Toplam balıkçılık ve su ürünleri üretimi dünya da yükselmektedir ve 2020 yılında 214 milyon ton ulaşmıştır. Golbal su ürünleri tüketimi kişi başına 20 kg dan 22 kg'a yükselmiştir. Sağlıklı ve formda bir insan için proteinli gıdalar çok önemlidir. Akuatik ürünler biyokimyasal yapılarında birçok esansiyel elementi içerirler. Enzimler, biyokimyasal reaksiyonlarda bir katalizatör olarak hızlanmasında görev yapan proteinlerdir ve 5,000 den fazla reaksiyonu katalize eder. Enzimler substratlar ile reaksiyona girerler ve reaksiyonlar ürünlere dönüşür. Enzimler iki grupta (aminoasit dizisi ve enzimatik reaksiyon) sınıflandırılır, örneğin laktaz, DNA polimeraz ve alkol dehidrogenaz. Fakat bazı enzimler organik veya inorganik kofaktörleri ihtiyaç duyarlar. Kofaktörle enzimin oluşturduğu yapı holoenzim olarak isimlendirilir. Diğer taraftan, kofaktörlerin bir enzimden diğer enzime bazı kimyasal grupları (NADHP, ATP, FMN, FAD, TPP, THF) transport edilmesinde görev yaparlar. Koenzim Q10 (koQ10) bir kofaktördür ve hücrelerin mitokondrilerinde oksidatif fosforilasyon ile enerji üretmek için yüksek miktarda bulunur. Bu aktivite bazı dokularda yaygındır (kalp, beyin, karaciğer ve böbrek). Kofaktör elektron transport zincirinde görev yapar. Bu çalışmada, kofaktörlerin tanımı, mekanizması ve fonksiyonları ve balıklar için kofaktörler hakkında şimdiye kadar yapılmış çalışmalar üzerine detaylı bilgiler verilecektir.
Anahtar Kelimeler: *Akuatik ürünler, Koenzim Q10, Akuakültür*

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New Trends in Functional Beverages Nowadays

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Abstract
The word functional food is the name given to the foods that are produced by adding bioactive substances obtained from natural foods to the foods we consume in daily life and that do not have synthetic properties. The difficulty in accessing healthy foods financially and physically is the basis of the increasing difficulty of quality and healthy nutrition. Although the healthy food market continues to spread today, ready-to-eat foods continue to be foods that are easily accessible to everyone and continue to be at the forefront of our society's consumption preferences. The most important point that distinguishes healthy foods from ready-made foods is that apart from the basic food components (carbohydrate, protein, fat, minerals) that provide our daily nutritional needs, there are components that have positive effects on human health. The awareness of healthy nutrition, which has become increasingly widespread in societies in recent years, and the decrease in consumption and health expenses due to the positive effects they have on health, although the production costs of these products are higher than those of normal food products, the interest of manufacturers in functional foods is increasing day by day. The beverage market also plays an important role in functional foods. However, studies have examined the positive effects of functional fruit and vegetable juice on health. Fruits and vegetables are considered as functional foods due to their positive effects on health due to the antioxidant and phenolic compounds they naturally contain, due to their antioxidant and antimicrobial effects. In this study, studies on functional fruit and vegetable juices were examined. The functional beverage market in our country is advancing and reaching more consumers. In addition, different techniques are used in probiotic products to keep cell viability at the maximum level, and cell growth can be supported by enriching product formulations with various components. Thanks to future studies, it will be possible to increase product diversity by using probiotics in different product groups.
Key Words: *Functional food, functional fruit juice, Healthy Food, Nutrition, New Foods, Probiotic bacteria, Probiotic juice*

Günümüzde Fonksiyonel İçeceklerde Yeni Eğilimleri

Özet
Fonsiyonel gıda kelimesi, doğal besinlerden elde edilen biyoaktif özellikteki maddelerin, günlük yaşamda tükettiğimiz gıdalara eklenmesi ile ortaya çıkan ve sentetik özellik taşımayan gıdalara verilen isimdir. Kaliteli ve sağlıklı beslenmenin giderek zorlaşmasının temelinde sağlıklı gıdalara maddi ve fiziki anlamda ulaşmanın güçlüğü bulunmaktadır. Günümüzde sağlıklı gıda pazarı yaygınlaşmayı sürdürse de, hazır gıdalar herkesin rahatlıkla ulaşabileceği besinler olmaya ve toplumumuzun tüketim tercihlerinin başında gelmeye devam etmektedir. Sağlıklı gıdalar ile hazır gıdaları birbirinden ayıran en önemli nokta günlük besin ihtiyacımızı sağlayan temel gıda bileşenleri (karbonhidrat, protein, yağ, mineraller) dışında insan sağlığına olumlu etkileri olan bileşenler olduğuna dikkat çekmektedir. Toplumların son yıllarda giderek yaygınlaşan sağlıklı beslenme bilinci, bu ürünlerin üretim maliyetlerinin normal gıda ürünlerininkinden yüksek olmasına rağmen, sağlığa yaptıkları olumlu etkileri nedeniyle tüketim ve sağlık giderlerinin azalması, üretici firmaların fonksiyonel gıdalara olan ilgisini gün geçtikçe arttırmaktadır. Fonksiyonel gıdalarda içecek pazarı da önemli rol almaktadır. Bununla birlikte yapılan çalışmalarda fonksiyonel meyve ve sebze suyunun sağlık üzerindeki olumlu etkileri incelenmiştir. Meyve ve sebzeler, doğal olarak içerdikleri antioksidan ve fenolik bileşiklerin, antioksidatif ve antimikrobiyel etkilerine bağlı olarak sağlık üzerine olumlu etkilerinden dolayı fonksiyonel gıda olarak değerlendirilmektedir. Bu çalışmada fonksiyonel meyve ve sebze sularıyla ilgili yapılan araştırmalar incelenmiştir. Ülkemizde fonksiyonel içecek pazarı ilerlemektedir ve daha çok tüketiciye ulaşmaktadır. Ayrıca probiyotik ürünlerde hücre canlılığını maksimum seviyede tutmak adına farklı tekniklerden yararlanılmakta, ayrıca ürün formülasyonları çeşitli bileşenlerle zenginleştirilerek hücre gelişimi desteklenebilmektedir. İleride yapılacak çalışmalar sayesinde probiyotiklerin farklı ürün gruplarında kullanımı ile ürün çeşitliliğinin arttırılması mümkün olabilecektir.
Anahtar Kelimeler: *Fonksiyonel gıda, fonksiyonel meyve suyu, Sağlıklı Gıda, Beslenme, Yeni Gıdalar ,Probiyotik bakteriler,Probiyotik meyve suyu*

1. Giriş

1.1 Fonksiyonel Gıda

Fonksiyonel gıdalar besleyici değerlerine ek olarak fiziksel performansta, zihinsel aktivitede, hastalıkların tedavisinde ve kontrolünde rol oynayan, fizyolojik fonksiyonları düzeltilmiş gıda ve gıda bileşenleridir (Farr, 1997; Belem, 1999; Hardy, 2000; Roberfroid, 2000). Başka bir tanım ise normal bir diyetin parçası olarak tüketilmesi amaçlanan, ancak basit besin gereksinimlerinin sağlanmasının ötesinde fizyolojik rollere hizmet edecek şekilde modifiye edilmiş ve temel beslenmenin ötesinde sağlık yararları sağlayabilen geleneksel gıdalara benzer görünüşte gıdalar olarak tanımlanabilir (Bech-Larsen ve Grunert,2003; Labrecque ve ark. 2006).

Fonksiyonel gıda ürünleri, her zamankinden daha fazla sağlık bilincine sahip tüketicilerin beklentilerini karşılamak için yaratılmış, katma değeri olan yeni bir ürün kategorisini temsil etmektedir. Fonksiyonel gıdaların çoğunda belirtilen fonksiyonellik, kalp / damar sistemi, sinir sistemi ve sanayileşmiş ülkelerde yaygın olarak görülen bazı kanser türleri gibi hastalıkların önlenmesine yardımcı olmaktır (Labrecque et al., 2006).

Fonksiyonel gıda bilimi, beslenme biliminde yeni araştırma alanları bulmak ve yeni fonksiyonel gıdalar geliştirmek için bu alanları kullanmak anlamına gelir. Fonksiyonel gıda geliştirme bilimsel bir sorundur ve bilimsel bilgiye dayanmalıdır. Hedef, fonksiyonlara ve bunların gıda bileşenleri tarafından olası iyileştirmelerine odaklanır. Fonksiyonel gıda biliminin amaçları şunlardır;

- Bir gıda içindeki fonksiyonel bileşen ile vücuttaki hedef fonksiyonlar arasındaki faydalı etkileşimleri belirlemek
- Bu işlevlerle ilgili belirteçleri ve bunların gıda bileşenleri tarafından modülasyonlarını tanımlamak ve onaylamak
- Fonksiyonellik için ihtiyaç duyulan yiyecek miktarının veya bileşenlerinin güvenliğini değerlendirmek
- Belirtilen gıda bileşenlerinin ilgili alımını kanıtlamak için insan müdahalesi denemelerinde test edilecek hipotezleri formüle etmek, bir veya daha fazla hedef fonksiyonla ilişkilidir (Diplock, 1999).

2. Fonksiyonel Gıdanın Tarihçesi

Fonksiyonel gıdalarla ilgili ilk çalışmalar Japonya'da 1984 yılında başlamış olup, 1986 yılında yine Japonya'da fonksiyonel gıdalar yoluyla halk sağlığının korunması amacıyla altı uzmandan oluşan "fonksiyonel gıda forumu" kurulmuştur. Söz konusu komitenin raporu doğrultusunda Japonya Sağlık Bakanlığı "sağlık kullanımı için spesifik gıda" teriminin (FOSHU-Food for Spesific Health Use) kullanılmasının uygun olacağı sonucuna varmıştır (Farr, 1997).

Lifli gıdalar (dietary fibres) piyasaya sürülen ilk ticari fonksiyonel gıda bileşenleridir. 1980'lerin sonlarında lif içeriği yüksek içeceklere olan ilginin artması, hem Japonya ve hem de tüm dünyada fonksiyonel gıda pazarının oluşmasına katkıda bulunmuştur. 1988'de Japonya'da Fibre-mini olarak adlandırılan ve yumuşak bir içecek olan ilk fonksiyonel gıda üretilmiştir. Bu içecekte suda çözünebilen polidekstroz kullanılmış ve mide-bağırsak düzenleyicisi olarak satışa sunulmuştur (Sheey ve Morrisey, 1998).

3. Fonksiyonel Gıda Çeşitleri Ve Bileşenlerinin Sağlığa Etkileri

Herhangi bir gıdanın fonksiyonel gıda olarak tanımlanması için taşıması gereken özellikler aşağıda sıralanmaktadır (Farr, 1997; Hardy, 2000; Roberfroid, 2000; Colmenero ve ark., 2001).

- Söz konusu gıda sağlığın devamını sağlayıcı veya iyileştirici olmalı; aynı zamanda diyetin gelişmesine de katkıda bulunmalıdır.
- Gıda veya bileşenlerinin yararları nutrisyonel veya medikal temellere dayanmalıdır.
- Gıda veya bileşenlerinin tüketilen miktarları nutrisyonel veya medikal bilgilerle tespit edilebilmelidir.
- Gıda veya bileşenleri güvenli olmalıdır.
- Gıda bileşenlerinin fiziko-kimyasal özellikleri iyi tanımlanmalı, bu bileşenler kalitatif ve kantitatif metodlarla tespit edilebilmelidir.
- Benzer gıdalarla karşılaştırıldığında bu gıdaların kompozisyonunun zararlı bir etkisi gözlenmemelidir.
- Bu gıdalar sıradan diyetlerde bulunabilmelidir.
- Bu ürünler sıradan gıdaların bileşiminde bulunmalıdır.
- Bu gıdalar veya bileşenleri ilaç olarak kullanılmamalıdır.

Tablo 1. Ülkemizde yapılan akademik çalışmalar da fonksiyonel gıda çeşitleri ve bileşenleri bu şekildedir; Raghuveer C. (2009)

FONKSİYONEL GIDA ÇEŞİTLERİ	
Takviyelenmiş Gıdalar	Aynı Türden İlave Besin Bileşenleriyle Takviyelenmiş Gıdalar-E Vitamini Katkılı Yiyecekler
Zenginleştirilmiş Gıdalar	Gıda İçinde Bulunmayan Bir Besin Maddesinin Eklenmesiyle Oluşan Gıdalar
Değiştirilmiş Gıdalar	İstenmeyen Zararlı Bazı Besin Bileşenlerinin Çıkarılıp Ya da Azaltılıp, Faydalı Özellikleri Bulunan Bir Bileşenlerle Değiştirilen Gıdalar
Değiştirilmemiş Gıdalar	Normal Kendi Besin İçeriğinde Herhangi Bir Farklılık Olmayan Gıdalar
Geliştirilmiş Gıdalar	Genetik Modifikasyonla Besin İçeriği Değiştirilmiş Veya Zenginleştirilmiş Gıdalar

Gıdalardaki Fonksiyonel Bileşenler	**Sağlığa Etkileri**
✓ Beta-Karotenler ✓ Şeker Alkolleri ✓ Vitamin Ve Mineraller ✓ Diyet Lifleri ✓ Oligosakkaritler ✓ Antioksidanlar ✓ Fenoller ✓ Laktobakteriler ✓ Doymamış Yağ Asitleri ✓ Antioksidanlar ✓ Glikosidler, İsoprenoidler ✓ Peptidler Ve Proteinler ✓ Prebiyotik Ve Probiyotikler ✓ Konjuge Linoleik Asitler	✓ Kalp ve damar sağlığının iyileştirilmesi ✓ Onkolojik risklerin azaltılması ✓ Diyabet ve tansiyon riskinin azaltılması ✓ Duyusal özelliklerin gelişmesi ✓ Obezite ve kilo alamama gibi sorunlara iyi gelmesi ✓ Ürolojik ve gastrolojik rahatsızlıkların giderilmesi ✓ Kemik ve kan rahatsızlıklarında destekleyici olması ✓ Mikrobiyolojik etkilerden vücudu koruması

4. Fonksiyonel Gıdaların Ülkemizdeki Kullanım Amaçları Ve Çeşitleri

Son on yılda; küreselleşme, ticarileşme, nüfus artışı ve kentleşme gibi nedenlerle değişen üretim ve tüketim motifleri sonucu tüketicilerin gıda ürünlerine yönelik taleplerinde dikkate değer değişimler meydana gelmiştir. Ülkemizde fonksiyonel gıdalar daha çok şu amaçlarla kullanılmaktadır:

- İlaç tedavisine alternatif olarak tedaviyi destekleyici ürün olarak kullanmak
- Besin yetersizliğini gidermek ve gıdayı besinsel olarak daha zengin hale getirmek
- Çölyak hastaları gibi bazı hastalıklar için gıda kullanımı
- Lif içeriği arttırılmış ürünlerin diyet ürünü olarak kullanılması
- Sporcular için beslenmeyi ve sağlığı iyileştirmek
- Bazı maddelere karşı duyarlı kişilere uygun ürün olarak kullanmak
- Özelikle bayanlarda fonksiyonel gıdaların vücut bakım ürünü olarak kullanımı
- Sağlığı korumak veya daha iyi hale getirmek (Raghuveer, 2009).

5. Fonksiyonel Gıdaların Ülkemizdeki Durumu

Diyabetik ve Fonksiyonel gıda derneğinin açıklamasına göre, ülkemizde diyet ve fonksiyonel gıda pazarının büyüklüğü yaklaşık 420 milyon TL ye ulaşmıştır. Beslenmeden kaynaklı rahatsızlıkların artması sebebiyle fonksiyonel gıda pazarına artan ilgi günden güne artmaktadır. Bu pazar ürünlerinin kullanım sebeplerine baktığımızda ise, herhangi bir katkı içermemeleri, tansiyon, diyabet, kolesterol gibi rahatsızlıkların tedavisine yardımcı rol oynamaktadır. Ülkemiz insanlarının bilinç ve ekonomik durumunun iyileşmesiyle fonksiyonel gıdalar gibi sağlığa yardımcı ürünlere olan ilgileri artmıştır. Ülkemizde 330 milyon TL lik bu pazarın hane başına tüketim oranına baktığımızda %43 tür. Tüketilen bu ürünlerin dağılımı ise şöyledir; %39.1 ile maden suları birinci ,%15.5 le margarin üçüncü,%12.6 le çay, %6.4 le bisküvi,%6.2 meyve suyu ve bu şekilde ürünler devam etmektedir. Bu pazarın 90.7 milyon TL lik kısmını diyet ürünler oluşturmaktadır.
Ülkemizde fonksiyonel gıda pazarı yerli ve yabancı şirketlerin her geçen gün ilgisini çekmektedir. Bu ilginin sebebine baktığımızda ülkemizin tarımsal açıdan zengin olması, fonksiyonel gıdalara olan ilginin yüksek olması, genç ve yetişmiş insan gücüyle büyük bir potansiyel barındırması yatırım yapmış ya da yapacak olan firmaları cezbetmiştir. Ve bu gibi yeni ürünleri benimsemekte zorlamayıp hızlı bir şekilde kabullenmesi yatırım yapacak olan firmalar için büyük bir pazar olarak görülmektedir (Ekşi, 2005).
Günümüzde fonksiyonel gıda piyasasının dünyada ulaştığı pazarın büyüklüğü yaklaşık 80 milyar USD, global ölçekli fonksiyonel gıda pazarının bir önceki yıla göre büyüme oranı ise %10-15 olarak belirlenmiştir. Bu büyüme oranın altında yatan sebeplere baktığımızda sağlığa olan harcamamaların azaltılması, sağlığın korunmasına yardımcı olunması ve doğal ürünlere olan ilginin yüksek olması temel sebeplerdendir. Küresel ölçekte fonksiyonel gıda pazarının %38.1 süt ,%22.7 tahıl ve tahıl ürünleri, %12.5 içecekler, %8.1 katı ve sıvı yağlar,%7.4 et, balık ve yumurta ,%5.8 soya ürünleri ve %5,7 ise diğer fonksiyonel gıdalar olmak üzere bu oranlarda bulunmaktadır (Krystallis, A., Maglaras, G. And Mamalis, S., 2008).

Tablo 2. Türkiye'de fonksiyonel gıda sağlığı beyanı örnekler

MARKA	ÜRÜN	SAĞLIK ETKİSİ
Yovita	Prebiyotik yoğurt	"Sindirim sisteminin düzenlenmesine ve prebiyotik lifli bağışıklık sisteminin desteklenmesine yardımcı olur"
Becel Pro-aktiv	Margarin	Bitki stenolü kolesterol seviyesini düşürmeye yardımcı olur" "Kötü kolesterolü 2-3 hafta içinde düşürdüğünü kanıtladı"
Keskinoğlu	Omega 3 Yumurta	Fiziksel ve zihinsel gelişime yardımcı olur
Dimes Life	Ayva Suyu	Yüksek lif içerir. Lif, sindirim sisteminin düzgün çalışmasına yardımcı olur"

Türkiye 80 milyon nüfusu ile Avrupa'daki en kalabalık ülkelerden biridir. Önde gelen ülkelerle kıyaslandığında fonksiyonel gıda tüketimi oldukça düşüktür. Türkiye'de 2012 - 2017 yılları arasında fonksiyonel gıda büyüme hızı %52 olarak ölçülmüştür Bu oran diğer ülkelerden daha yüksektir. Türkiye'de artan büyüme hızı tüketicilerin tutumlarında pozitif anlamda bir değişim olduğunu göstermektedir. Ancak Amerika, Japonya ve Avrupa ülkeleri ile karşılaştırıldığında Türkiye'de fonksiyonel gıda pazarı hala az gelişim göstermektedir ve desteğe ihtiyaç duyulmaktadır.

Türkiye'de fonksiyonel gıda çeşitliliği oldukça azdır. Süt ürünleri sunulan tüm çeşitleriyle en çok tüketilen ürünlerdir. Türkiye'de süt ürünleri, kahvaltıdan akşam yemeğine kadar ve aynı zamanda bazı yemeklerin ana maddesi olarak da kullanılan ürünlerdir. Dünya Pazar araştırması prebiyotiklerin fonksiyonel gıdalar arasında en fazla gelişim gösteren sektör olduğunu göstermektedir (Gök ve Ulu, 2018). Toplumun genel tüketim alışkanlıklarına yakın olmaları süt ürünleri ile üretilen fonksiyonel gıdalar olan prebiyotiklerin diğer fonksiyonel ürünlere göre daha çabuk benimsenmesine ve tüketiminin yüksek olmasına sebep olmuştur. En çok tüketilen süt ürünleri yoğurt, ayran, peynir ve kefirdir ve bunlar probiyotik kaynağıdır.

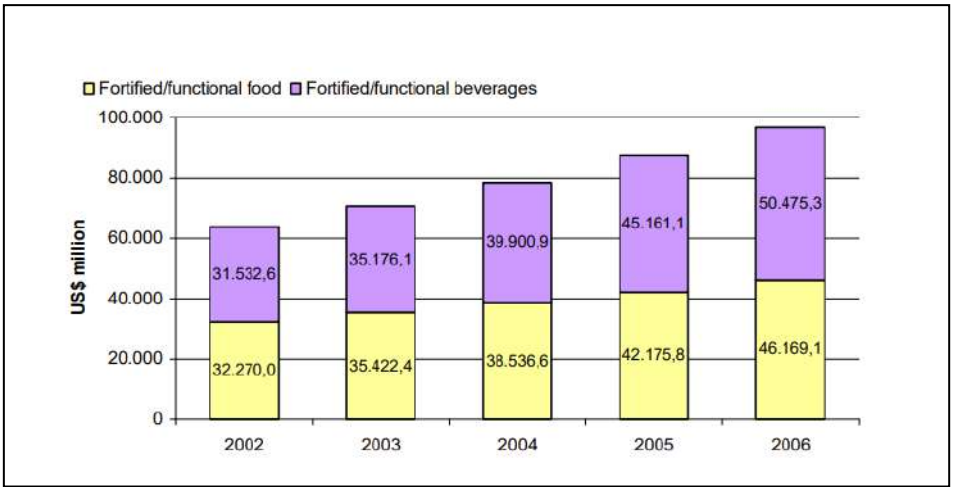
6. Fonksiyonel Gidalarda İçeçek Pazari

Son on yılda, yaşam koşullarının değişmesiyle fonksiyonel gıda tüketim eğilimi yüksek bir büyüme oranı göstermiştir (Verbeke, 2005). Euromonitor International'a (2007) göre küresel fonksiyonel/zenginleştirilmiş yiyecek ve içecek pazar büyüklüğü 152,2 milyar ABD doları, meyve/sebze suyu pazarı ise 11 milyar ABD doları olmuştur (Tablo 3). Güçlendirilmiş/fonksiyonel meyve/sebze suyu küresel pazar büyüklüğünün büyümesi 2004 yılında %8,1, 2007 yılında ise %8,3 oranında artmıştır. Küresel fonksiyonel pazarın sürekli arttığı aşikardır.

Tablo 3. Güçlendirilmiş/fonksiyonel yiyecek ve içeceklerin küresel pazar büyüklüğü (milyon ABD doları) (Euromonitor International, 2007)

	2004	2005	2006	2007
Güçlendirilmiş/fonksiyonel yiyecek ve içecekler	118.687,00	128.760,00	137.934,90	152.152,50
Güçlendirilmiş/fonksiyonel içecekler	39.752,40	45.137,20	50.311,40	56.214,70
Güçlendirilmiş/fonksiyonel meyve/sebze suyu	8.823,50	9.538,90	10.321,40	11.178,50

Öte yandan, Resim 2'de verildiği gibi, her tür fonksiyonel gıdanın pazar büyüklüğü de sürekli artmaktadır (Euromonitor International, 2007). Ayrıca içecek pazar büyüklüğünün toplam kuvvetlendirilmiş/fonksiyonel yiyecek ve içeceklerden biraz daha büyük olduğu görülmektedir.



Şekil 1. Fonksiyonel/güçlendirilmiş yiyecek ve içeceklerin (içecekler hariç) küresel pazar büyüklüğü (Euromonitor International, 2007)

Tablo 4'te verildiği gibi, Birleşik Krallık, Avrupa ülkelerinin fonksiyonel içecek pazar büyüklüğünde 2,82 milyar ABD doları büyüklüğü ile ilk sırada yer almaktadır. Fransa 340,6 milyon ABD doları ile 7. sırada yer alırken, Türkiye 156,6 milyon ABD doları pazar büyüklüğüne sahip ve 14. sırada yer alıyor. Türkiye'nin kişi başına düşen fonksiyonel içecek tüketiminin Fransa'dan daha düşük olduğu açıktır (Euromonitor International, 2008). Türkiye'de fonksiyonel yiyecek ve içecek tüketimi hala düşüktür. 2011 yılı sonuna kadar fonksiyonel gıda pazar büyüklüğünün yaklaşık 130 milyar ABD doları olacağı tahmin edilmektedir (Euromonitor International, 2008).

Tablo 4. 2007 yılında Avrupa'da ülkelere göre fonksiyonel içecekler piyasa değeri (milyon ABD doları) (Euromonitor International, 2008)

Europe	**8.686,5**
United Kingdom	2.816,8
Germany	1.327,3
Italy	636,1
Spain	618,2
Austria	455,0
Netherlands	432,4
France	340,6
Russia	290,5
Belgium	289,4
Ireland	263,0
Sweden	204,0
Switzerland	169,1
Finland	158,2
Turkey	156,6

7. Fonksiyonel Meyve Suyu Pazarındaki Yeni Eğilimler

Global meyve suyu pazarı, son yıllarda tüketicilerin giderek artan sağlık bilinci ve endişeleri ile gelişmekte olan ülkelerde harcanabilir kişisel gelir oranının artması gibi faktörlerden büyük oranda etkilenmektedir. Günümüzde tüketiciler, gazlı içecekler yerine, ilave şeker ve yapay tatlandırıcı ile koruyucu içermeyen organik içecekleri tercih etmektedirler. Yakın geçmişte, ilave şeker içerikleri nedeni ile tercih edilmeyen meyve suyu ürünleri, son yıllarda, fonksiyonel özellikleri ile öne çıkan yeni ürünlerin geliştirilmesi ve yeni üretim tekniklerinin uygulanması gibi olumlu gelişmeler sayesinde tekrar tüketicilerin dietlerinde yer almaya başlamıştır (Global Fruit Juice Market Outlook 2024, 2017).
Meyve suyu pazarına son on yıllarda giriş yapmış olan taze sıkılmış ve "direkt (konsantreden üretilmeyen; NFC (not from concentrate))" meyve suyu ürünleri önemli bir gelişme kaydetmişlerdir (Ashurst, 2009). Yeni geliştirilen meyve suyu ürünleri, "0", "doğal", "organik", "vitamin ve minerallerce zenginleştirilmiş", "ilave şeker ve koruyucu içermez" gibi özellikleri vurgulanarak fonksiyonel içecekler arasında yerlerini almıştır (Abate, 2005).
Birçoğu sağlık üzerine olumlu antioksidan etkileri ile iyi bilinen vitaminler, mineraller ve fenolik bileşenler için önemli birer kaynak olan meyve suları (Granato ve diğ., 2010a), her yaş grubu için hoşa giden lezzet özellikleri ile birlikte sağlıklı ürünler kategorisinde konumlandırılmaktadır. Meyve-bazlı içecekler, global gıda endüstrisinde en hızlı büyüyen alanlardan biri olarak gösterilmekte olup, meyve suyu tüketim oranının yetişkinlerde %60 oranlarında olduğu rapor edilmiştir (Hughes, 2001).

8. Meyve Suyu-Bazlı Fonksiyonel Yeni İçecek Grupları

- **Taze Meyve Suları**

Taze meyve suyu grubu, taze sıkılmış meyve suları ile direkt (veya konsantreden üretilmeyen; NFC (not from concentrate)) meyve sularından oluşmaktadır. Taze sıkılmış meyve suları, son tüketiciye en yakın noktada, kabuk ve diğer atıkları uzaklaştırılarak, üretilen ve tek kişilik porsiyonlar halinde paketlenerek 2-3°C'ye soğutulan ve başka bir prosesten geçirilmeyen ürünlerdir (Ashurst, 2009). Minimal düzeyde ısıl işlemden geçirildikten sonra soğuk zincir ile taşınarak soğukta saklanan direkt (NFC) meyve suyu ürünlerinin, tüketime hazır yüksek kaliteli meyve suları olarak, popülaritesi her geçen gün artmaktadır. Turunçgil meyve suları, tropikal meyve suyu ve nar suyu karışımları bu tür ürünler arasında yer almaktadır.

- **Yoğun Kıvamlı Meyve Suyu-Bazlı İçecekler – "Smoothie"ler**

Smoothie içecekleri, saf içecek kategorisine dahil olup, bu gruptaki ürünler, bilinen meyve suyu veya meyve suyu karışımlarına oranla daha yoğun kıvama sahip ürünlerdir. Smoothie üretiminde, meyve ve/veya sebzeler, meyve/sebze suyu, posa ve püre eldesi için proses edilmekte ve karıştırılmaktadır (Morales-de la Pena ve diğ., 2016). Örnegin; yüksek C vitamini içeriğine sahip portakal suyu ile β-karotence zengin havuç suyunu karıştırarak antioksidanca zengin bir içecek (Torregrosa ve diğ. 2006), kaju elması suyu ile hindistan cevizi suyunun karıştırılmasıyla yüksek C vitamini ve sodyum, potasyum, fosfor, klorür ve magnezyum içeriği olan içecek (De Carvalho ve diğ., 2007) ve kaju elması, papaya, guava, acerola meyvesi (Barbados kirazı) ve çarkıfelek meyvesi karışımyla mikrobiyal bozulmaya dayanıklı, C vitamini açısından zengin ve istenen duyusal özelliklere sahip ürün (De Sousa ve diğ., 2010) literatürde yer almaktadır.

- **Meyve Suyu-Süt ve Meyve Suyu-Soya Sütü Karışımları**

Fonksiyonel içecek sektöründe öne çıkan yeni ürünler arasında, meyve suyuna süt veya soya sütü ilavesiyle elde edilen, farklı duyusal özelliklere ve biyoaktif bileşen içeriğine sahip karışımlar gösterilmektedir (Morales-de la Pena ve diğ., 2016). Bu tür karışımlarda, soya sütünün acı ve kekremsi tadı, meyve suyu ile maskelenebilmektedir (Zulueta ve diğ., 2007). Kalsiyum ve konjuge linoleik asitin temel kaynağı olan süt, protein ve yağda çözünen vitaminler açısından da zengin bir gıda ürünüdür (Morales-de la Pena ve diğ., 2016).
Yaban mersini suyu ile soya protein izolatının (%2,8) karıştırılmasıyla, stabil yapıda ve önemli miktarda antosiyanin içeren bir içecek geliştirilmiştir (Potter ve diğ., 2007). Benzer bir çalışmada, portakal, kivi ve ananas suyundan oluşan karışıma (%50) pastörize soya sütü (%42,5) ilavesiyle elde edilen içeceğin C vitamini, fenolik bileşenler ve izoflavonlar açısından zengin bir kaynak olduğu ve yüksek antioksidan aktivite gösterdiği belirlenmiştir (Morales-de la Pena ve diğ., 2010a ve b).

- **Probiyotik ve Prebiyotiklerle Zenginleştirilmiş Meyve Suları**

Süt ürünleri-bazlı olmayan probiyotik içeceklerin geliştirilmesinde, meyve suları ideal bir substrat olarak önerilmektedir. Meyve suları, sağlık için faydalı bileşenlerinin yanı sıra, probiyotik mikroorganizmaların gelişimi ve canlılığını koruması için de birçok avantaj sağlamaktadır (Granato ve diğ., 2010; Kandylis ve diğ., 2016). Bu avantajlar arasında; probiyotiklerin gelişimi için gerekli olan şeker ve diğer besin bileşenlerinin meyve sularında yüksek oranlarda bulunması, meyve suyunun, midenin asidik ortamından hızlı geçişi sayesinde probiyotiklerin yüksek oranda canlılığını koruyabilmesi sayılabilmektedir (Vijaya ve diğ., 2015). Bunların yanı sıra, meyve

suyunun, lezzet özellikleri ile, her yaş grubundan tüketicilere hitap etmesi de meyve suyu-bazlı probiyotik içeceklerin geliştirilmesi konusunda araştırmacıların ilgisini çekmektedir (Kandylis ve diğ., 2016).
Renuka ve diğ. (2009), ananas, mango ve portakal sularını fruktooligosakkaritler ile zenginleştirmiş ve zenginleştirilmiş meyve sularının fizikokimyasal ve duyusal özellikleri açısından oda sıcaklığında 4 ay, buzdolabı sıcaklığında ise 6 ay stabilitelerini koruduklarını belirlemiştir. Bir başka çalışmada, elma suyuna %20 oranında β-glukan içeren yulaf unu ilavesinin buzdolabı sıcaklığında depolama sırasında Lactobacillus rhamnosus probiyotik bakterisi üzerinde koruyucu etki gösterdiği tespit edilmiştir (Saarela ve diğ., 2006).

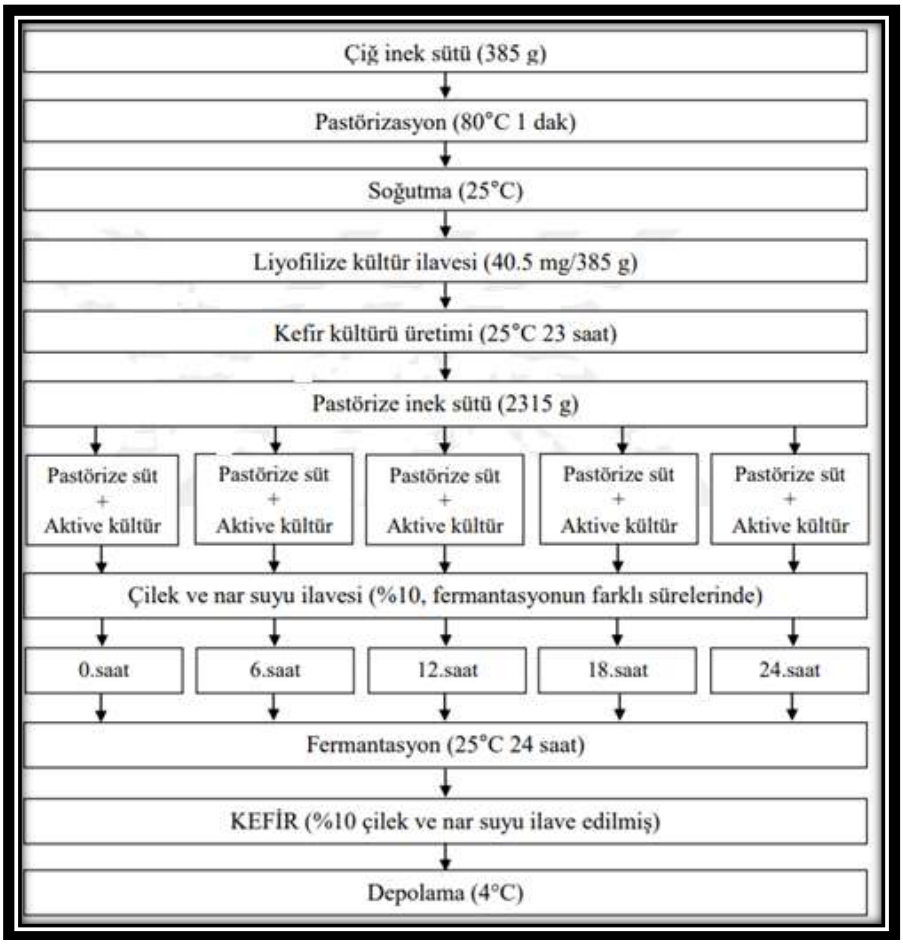
9. Gıdalarda Fonksiyonel Meyve Ve Sebze Suları Üzerine Yapılan Çalışmalar

- **Elma Sirkesinden Yapılan İçeceklerin Fizikokimyasal Ve Duyusal Özelliklerin Araştırılması**

Bu çalışmada, farklı baharat ekstraktları, elma sirkesi ve çeşitli tatlandırıcıların kullanımı ile -kakule, tarçın, karanfil ve karabiber baharatları ile elma sirkesi materyal olarak kullanılarak farklı formlarda sirke içeceği üretimi yapılmıştır. Sirke içeceği üretiminde sakkaroz, stevia ve aspartam ile asesülfam-K ilave edilerek üç farklı uygulama yapılmıştır. Çeşitli baharatların farklı formlarıyla elde edilen sirke içeceği, baharatların soğuk çay formatı dışında kullanılmasına da olanak sağlamaktadır. Sirke içeceği, sirke tüketimine yeni bir bakış açısı getirerek günlük alınması gereken sirke miktarının içecek şeklinde sunulmasıya alternatif bir tüketim şekli ortaya koymuştur. Bununla birlikte, farklı tatlandırıcılar kullanılarak şeker oranının düşürülmesi ile tüketiciye sakkaroz içeren ürünlere kıyasla daha düşük kalorili ürünler sunulmuştur. Bu çalışma ile diyabet hastaları için alternatif ürünler oluşturulmuştur (Terakye,2019).

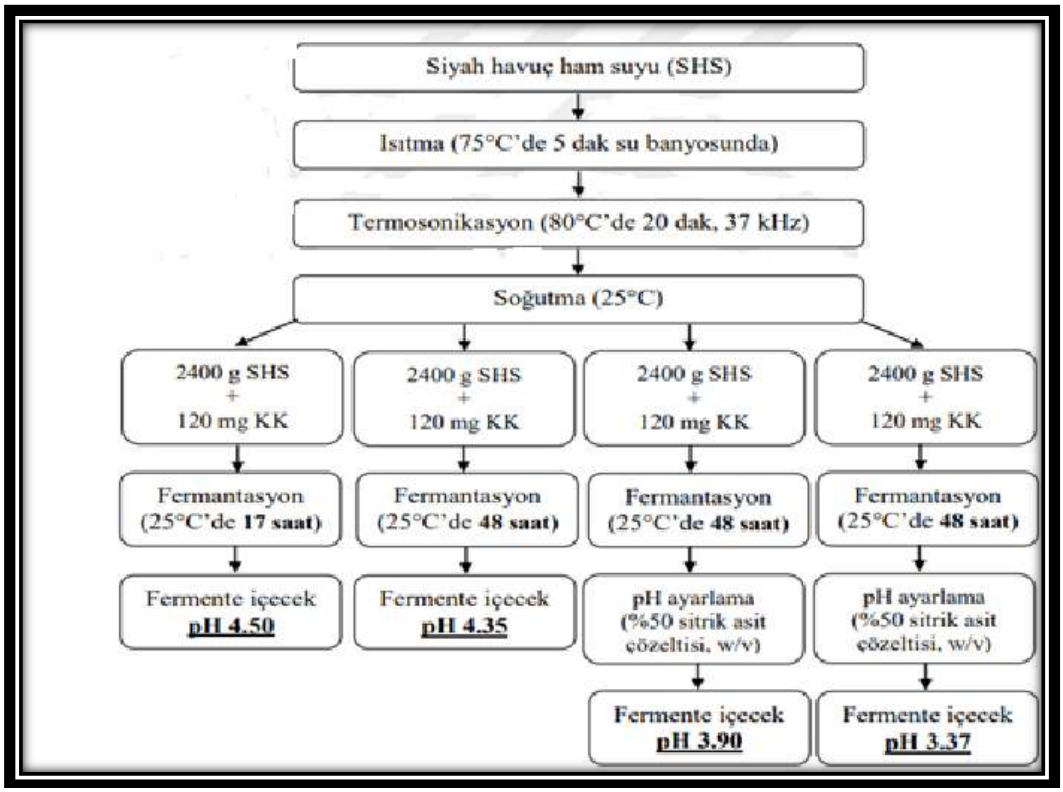
- **Antosiyaninlerce Zengin Meyve Ve Sebze Suyu Eklenmiş Kefirlerin Kalite Özelliklerinin Belirlenmesi Ve Kefir Kültürü ile Siyah Havuç Suyundan Fermente İçeçek Üretimi**

Daha lezzetli kefir üretimi için, sade kefire (SK) çilek (ÇS), karadut (KDS), nar (NS) ve siyah havuç (SHS) suyu %10 ve 25 (w/w) konsantrasyonunda ilave edilmiştir.



Şekil 2. %10 oranında çilek ve nar suyu içeren kefir üretimi akış şeması (Kabakcı,2019).
Yapılan bu araştırmada şu sonuçlara ulaşılmıştır;

- En yüksek antosiyanin stabilitesinin, sırasıyla, karadut, nar, çilek ve siyah havuç suyu ilaveli kefirlerde olduğu bulunmuştur.
- Gerek kefirin tadını iyileştirerek kefirin tüketimini kolaylaştırması, gerekse de yüksek antioksidan aktiviteye sahip olması nedeniyle, %25 çilek ve karadut suyu ilavesi önerilmektedir.
- %25 konsantrasyonunda nar suyu ilavesinin kefirin raf ömrünü azaltması (5 hafta) ve %10 nar suyu ilaveli kefirlerin mikrobiyel olarak daha stabil olması (8–11 hafta) nedeniyle, kefire %10 nar suyu ilavesi önerilmektedir.
- 7) Kefir kültürü ile fermantasyonla hem siyah havuç suyunun pH'sı düşürülerek tadı iyileştirilmiş, hem de probiyotik mikroorganizmalarca ve antosiyanince zengin yeni fermente içecekler elde edilmiştir (Kabakcı,2019).



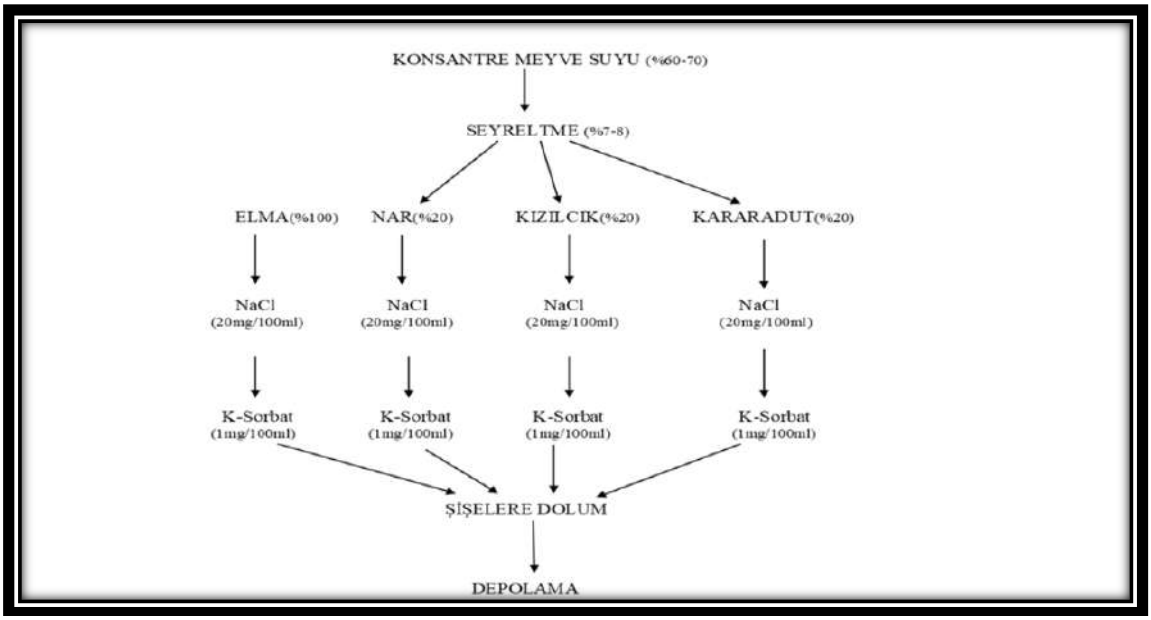
Şekil 3. Siyah havuç ham suyundan fermente içecek üretimi (Kabakcı,2019).

- **Yeni Bir İzotonik İçecek Olarak; Nar, Kızılcık Ve Karadut Suları İle Zenginleştirilmiş Elma Suyu Üretim Olanakları**

Bu çalışmada ülkemizde yaygın olarak kullanılan nar, kızılcık ve karadut gibi yüksek oranda fenolik ve antioksidan madde içeren meyvelerin suları elma suyuna katılarak besin değeri arttırılmış yeni bir izotonik içecek elde edilmiş ve elde edilen ürünün bazı özellikleri incelenmiştir. Toplam fenolik değeri en yüksek nar-elma içeceğinde 50.49-101.10 mg gallik asit/g aralığında belirlenmiştir. Yapılan analizler ve duyusal değerlendirmeler sonucunda içeceklerin oda sıcaklığında kolaylıkla depolanabileceği ve böyle bir ürünün tüketiciler tarafından talep göreceği belirlenmiştir(Toğrul ve Hayoğlu,2020).

Tablo 5. İzotonik içeceklerinde bulunan temel bileşenler ve oranları (Toğrul ve Hayoğlu,2020).

1.Örnek *Sample 1*	2. Örnek *Sample 2*	3. Örnek *Sample 3*	4. Örnek *Sample 4*
Elma suyu (%100)	Elma suyu (%80)	Elma suyu (%80)	Elma suyu (%80)
.....	Nar suyu (%20)	Kızılcık suyu (%20)	Karadut suyu (%20)
NaCl 20 mg/100mL	NaCl 20 mg/100mL	NaCl 20 mg/100mL	NaCl 20 mg/100mL
K-Sorbate 1.0mg/100mL	K-Sorbate 1.0mg/100mL	K-Sorbate 1.0mg/100mL	K-Sorbate 1.0mg/100mL



Şekil 4. Farklı oranlarda hazırlanan izotonik içeceklerin üretim akış şeması (Toğrul ve Hayoğlu,2020).

Çalışma sonucunda;

- Elma suyuna diğer meyve sularının özellikle nar ve kızılcık sularının eklenmesiyle fenolik ve antioksidan aktivite bakımından önemli derecede artış olduğu görülmüştür. İzotonik içeceklerin toplam fenolik madde içeriği ile antioksidan kapasitesi arasında doğrusal ve pozitif korelasyonun olduğu görülmüştür.
- Kırmızı meyvelerle zenginleştirilmiş elma suyunun, sağlık üzerinde besleyici bir işlevi olan yeni içeceklerin tasarımında potansiyel olarak ilgi çekici olabileceğini göstermiştir. İzotonik içecekler, görünüş, tat, koku ve genel kabul edilebilirlik gibi özellikler bakımından değerlendirildiklerinde elma suyunun panelistler tarafından çoğunlukla daha çok beğenildiği anlaşılmıştır.
- Diğer meyve suları ile zenginleştirilmiş izotonik elma sularının tüketiciler tarafından tercih edilebileceği, özellikle antreman esnasında susuzluğu gidermek, kaybolan elektrolitleri geri kazanmak ve açlık hissini engellemek için kullanılabileceği, yapısında fenolik ve antioksidan maddelerce zengin olduğu; doğal bir ürün olan böyle bir içeceğin gıda sanayisinde rahatlıkla kullanılabileceği tahmin edilmektedir.

➢ **Echinacea Purpurea (Ekinezya) Ekstraktı Kullanımı İle Fonksiyonel Meyve Suyu Ve Nektarlarının Geliştirilmesi**

Bu çalışmada, süperkritik akışkan ekstraksiyonu ile farklı ekstraksiyon parametreleri (basınç (100, 200 ve 300 bar), sıcaklık (40, 50 ve 60°C) ve co-solvent oranı (%0, %5 MeOH ve %10 MeOH)) kullanılarak Echinacea purpurea ekstraktları elde edilmiş ve uygun ekstrakt parametreleri belirlenerek fonksiyonel nitelikte meyve suyu ve nektarları geliştirilmiştir. Kurutulmuş Echinacea purpurea bitkisinin topraküstü kısımları öğütüldükten sonra, süperkritik akışkan ekstraksiyonu ve konvansiyonel ekstraksiyon olmak üzere iki farklı ekstraksiyon işlemine tabi tutulmuş, elde edilen ekstraktlar bileşenleri bakımından LC/MS/MS de incelenmiş ve antioksidan aktiviteleri belirlenmiştir. Buradan elde edilen sonuçlara bakılarak en uygun ekstraksiyon parametresi belirlenmiş ve fonksiyonel meyve suları üretilmiş, bileşenleri ve antioksidan aktivite bakımından incelenmiştir. Fonksiyonel nitelikli elma suyunun duyusal özelliklerinin ortanın üzerinde, fonksiyonel nitelikli kayısı nektarının tat değeri kötü-orta arasında, diğer duyusal özelliklerinin ise ortanın üzerinde olduğu belirlenmiştir.

Yapılan kromatografik analiz sonucu elma suyunda belirlenmesi planlanan 6 adet biyoaktif bileşikten 5 tanesi (caftaric acid, cichoric acid, cholorogenic acid, cynarin ve rutin) belirlenebilmiştir. Fonksiyonel nitelikteki elma suyundaki biyoaktif bileşiklerin, klasik elma suyuna göre daha fazla olduğu belirlenmiştir. Klasik elma suyundaki belirlenen biyoaktif bileşik toplamı 2.38 ± 0.05 ppm iken, fonksiyonel elma suyundaki belirlenen biyoaktif bileşik toplamı 11.01 ± 0.15 ppm'dir. Elde edilen bu sonuca göre; elma suyuna bitki ekstraktı eklenerek elde edilen fonksiyonel elma suyunun biyoaktif bileşikçe zenginleştirildiği söylenebilir.

Klasik kayısı nektarındaki belirlenen biyoaktif bileşik toplamı 1.35 ± 0.20 ppm iken, fonksiyonel kayısı nektarındaki belirlenen biyoaktif bileşik toplamı 4.48 ± 0.65 ppm'dir. Elde edilen bu sonuca göre; kayısı nektarına bitki ekstraktı eklenerek elde edilen fonksiyonel kayısı nektarının biyoaktif bileşikçe zenginleştirildiği söylenebilir (Dalabasmaz,2013).

Tablo 6. LC/MS/MS kullanılarak meyve sularında belirlenen biyoaktif bileşiklerin miktarları (Dalabasmaz, 2013).

Bileşen adı	Klasik elma suyu (ppm)	Fonksiyonel elma suyu (ppm)	Klasik kayısı nektarı (ppm)	Fonksiyonel kayısı nektarı (ppm)
Caftaric acid	0.054 ± 0.001	0.31 ± 0.02	N.P	0.016
Cichoric acid	0.52 ± 0.02	0.73 ± 0.02	0.08 ± 0.004	0.14 ± 0.03
Chlorogenic acid	1.76 ± 0.05	9.89 ± 0.15	1.03 ± 0.18	3.86 ± 0.6
Cynarin	0.04 ± 0.01	0.06 ± 0.01	N.P	N.P
Rutin	0.015 ± 0.002	0.021 ± 0.02	0.23 ± 0.01	0.47 ± 0.02
Toplam	2.38 ± 0.05	11.01 ± 0.15	1.35 ± 0.20	4.48 ± 0.65

(N.P: Pik gözlenmemiştir; no peak)

Yapılan antioksidan aktivite tayininde klasik elma suyunda EC50 değeri 127.32 ± 1.47 µL, fonksiyonel nitelikteki elma suyunda ise 114.33 ± 0.88 µL olarak belirlenmiştir. EC50 değerindeki bu düşüş antioksidan aktivitede %11.35 oranında bir artış olarak hesaplanmıştır. Klasik kayısı nektarında EC50 değeri 336.77 ± 1.81 µL, fonksiyonel nitelikteki klasik kayısı nektarında ise 228.34 ± 2.50 µL olarak belirlenmiştir. EC50 değerindeki bu düşüş antioksidan aktivitede %47.48 oranında bir artış olarak hesaplanmıştır.

Tablo 7. Meyve suyu ve nektarlarından elde edilen EC50 değerleri (Dalabasmaz,2013).

Örnek	EC_{50} değeri (µL)
Klasik elma suyu	127.32 ± 1.47
Fonksiyonel elma suyu	114.33 ± 0.88
Klasik kayısı nektarı	336.77 ± 1.81
Fonksiyonel kayısı nektarı	228.34 ± 2.50

Tüm bu sonuçlar toparlandığında; E.purpurea bitkisinin biyoaktif bileşiklerce zengin olduğu ve antioksidan aktivite gösterdiği sonucuna, literatürdeki diğer çalışmalarda olduğu gibi, ulaşılmıştır. Bu çalışmada, süperkritik akışkan ekstraksiyonla elde edilmiş ekinezya ekstraktlarının fonksiyonel meyve suyu ve nektarı üretiminde kullanılmasıyla, meyve sularına ve fonksiyonel ürünlere yeni bir bakış açısı kazandıracağına inanılmaktadır. Ayrıca, süperkritik akışkan ekstraksiyonunun çevre ile dost olarak nitelendirilmiş bir teknoloji olması ve soxhlet gibi klasik ekstraksiyon yöntemlerinin tersine kimyasal çözgen kullanılmadan, bitki ekstraktının elde edilmesi nedeniyle doğal bir ürün elde edilmiştir. Bu da tüketici algısını etkileyecek önemli etmenlerden biridir.

- **Fonksiyonel Bir Ürün: Peyniraltı Suyu İlave Edilerek Üretilen Nar Suyu İçeceği**

Bu çalışmada farklı oranlarda (%20, 30, 40 ve 50) peyniraltı suyu ilavesi ile üretilen Nar suyu içeceklerinin bazı fizikokimyasal ve duyusal özellikleri araştırılmıştır. Bu şekilde üretilen içecekler su banyosunda 65 °C'de 30 dakika süreyle pastörize edilmiştir. Pastörizasyon sonrası nar suyu içecekleri, +4 °C'de muhafaza edilmiştir.

Tablo 8. Nar suyu içeceğinin bazı duyusal parametrelerine ait ortalama değerler (Çelik vd.,2018).

Parametre	Deneme Örnekleri					
	Kontrol (Nar suyu)	%20 PAS'lı içecek	%30 PAS'lı içecek	%40 PAS'lı içecek	%50 PAS'lı içecek	Standart hata
Renk	2.902 ^{a}	2.724 ^{b}	2.577 ^{c}	2.406 ^{d}	2.165 ^{e}	0.210
Bulanıklık	2.859 ^{a}	2.715 ^{ab}	2.592 ^{bc}	2.397 ^{c}	2.106 ^{d}	0.385
PAS kokusu	2.776 ^{a}	2.417 ^{ab}	2.257 ^{bc}	2.131 ^{bc}	1.867 ^{c}	0.606
PAS tadı	2.882 ^{a}	2.557 ^{b}	2.348 ^{b}	2.000 ^{c}	1.676 ^{d}	0.344
Burukluk	2.784 ^{a}	2.368 ^{b}	2.160 ^{bc}	1.926 ^{c}	1.647 ^{d}	0.360
Ekşilik	2.150	2.226	2.218	2.393	2.365	0.515
Tatlılık	1.971	2.088	2.269	2.318	2.360	0.551
Aroma	2.693 ^{a}	2.433 ^{ab}	2.222 ^{b}	1.915 ^{c}	1.701 ^{c}	0.406
Ağızda Bıraktığı Tat	2.741 ^{a}	2.471 ^{b}	2.312 ^{b}	1.999 ^{c}	1.758 ^{d}	0.310
Genel Kabul Edilebilirlik	2.759 ^{a}	2.493 ^{b}	2.318 ^{bc}	2.093 ^{c}	1.677 ^{d}	0.375

*Farklı harfler ile gösterilen ortalamalar arasındaki fark istatistiksel olarak P<0.05 düzeyinde önemlidir.

Yapılan değerlendirmeler sonucunda, PAS (peyniraltı suyu) ilave oranının artışına paralel olarak nar suyu içeceklerinin KM ve çözünür KM oranlarının düştüğü, renk değerlerinin ise nar suyuna oranla, rakamsal olarak arttığı tespit edilmiştir. PAS katkılı nar suyu içeceğinin protein, laktoz ve mineral maddeler açısından zengin bir içecek olacağı; %20 peyniraltı suyu ilave edilen nar suyu içeceğinin tüketiciler tarafından daha fazla beğenileceği ve tüketilebileceği sonucuna varılmıştır (Çelik vd.,2018).

- **Mikro Yeşil Ve Meyve Bazlı Fonksiyonel İçecek İçin Bir Prosesin Optimizasyonu**

Bu çalışmada Fenugreek (çemen otu) (*Trigonella foenum-graecum*), kinnow mandarin (*Citrus reticulate*) ve aloe vera (*Aloe brobadensis) içeren mikrogreen* bazlı fonksiyonel meyve suyu karışımları incelenmiştir. Bu fonksiyonel içecek yüksek protein, mineraller (sodyum ve potasyum) ve vitamin (C vitamini) içeriğinin yanı sıra iyi kaynak beta-karoten, fenoller ve antioksidanlara sahiptir. Antioksidan, oksidatif stresi azaltarak ve reaktif oksijen türlerine karşı koruyucu etkilerinden dolayı diyabetik komplikasyonların azaltılmasına yardımcı olmuştur (Sharma vd., 2020).
Mikro yeşil bitkiler canlı renklere, dokuya ve yoğun tatlara sahiptir ve bu nedenle yenilebilir bir garnitür olarak kullanılır. Bitkisel besinlerin konsantrasyonu olgun yapraklardan daha yüksektir. Böylece mikrogreenler "fonksiyonel gıdalar" olarak sınıflandırılabilir. Bununla birlikte, ortam koşullarında depolandıklarında 1-2 günlük kısa bir ömüre sahiptirler **(**Xiao ve ark. 2012, 2014). Yüksek besleyici değeri, sağlığı teşvik etmesi ve hastalıkları önleyen özellikleri nedeniyle "fonksiyonel bir gıda" olarak kabul edilir.
Fenugreek (*Trigonella foenum graecum*), yaygın olarak çemen otu olarak bilinir. Fabaceae ailesine ait yıllık bir üründür ve güçlü baharatlı lezzeti nedeniyle bir mutfak baharatı olarak Kuzey Hindistan'a özgüdür **(**Olaiya & Soetan 2014**).** Fenugreek, kan şekeri seviyesini düşürmeye yardımcı olan 4 Hidroksisoleucin ve trigonellin gibi anti-diyabetik bileşikler içerir **(**Dutta ve ark. 2014**).**
Aloe vera özellikle kan şekeri seviyesini düşürmeye yardımcı olur (Rajasekaran vd. 2005**).** Biyoaktif bileşikleri anti-diyabetik, anti-ülser, antiseptik, anti-bakteriyel, antienflamatuar, anti-oksidan ve antikanser ajanlar olarak kullanılmaktadır. Bu çalışmada fenugreek mikrogren ve meyve tabanı kullanarak içmeye hazır bir içecek hazırlamak ve fenugreek mikrogreninin diyette kabul edilebilirliğini artırmak için hedeflenmektedir.

- **Kuşburnu Meyvesinin Geleneksel Yöntemle Meyve Suyuna İşlenmesi Aşamalarında Antioksidan Kapasite Değişiminin İncelenmesi**

Antioksidanlarca zengin olan kuşburnunun ürünlere işlenmesi sırasında doğal antioksidan bileşikler ve antioksidan aktivitede değişim olduğu bilinmektedir. Bu çalışma son yıllarda kullanımı artmakta olan kuşburnu meyvesinin geleneksel olarak meyve suyuna işlenmesi sırasında antioksian kapasitesindeki değişimi incelemeyi amaçlamıştır. Analizler sonucu askorbik asit, fenolik madde ve antioksidan özelliklerin değişimi istatistiksel olarak önemli bulunmuştur (Altan,2014).
Kuşburnu meyvesi yıkama işlemini takiben sap, çöp ve bozuk olan meyvelerinden arındırılmıştır. Kuşburnu meyvesi 1 kısım ürüne 2 kısım su eklenerek 70-80°C'de 4 dakika ön ısıl işlem uygulanmıştır. Ön ısıl işlem uygulanan meyveler palperden geçirilerek pulp elde edilmiş, 1 'e 3 oranında su ilave edilerek meyve suyu elde edilmiştir. 100 °C 'de 15 dakika pastörizasyon işlemi uygulanmıştır. Pastörize edilen meyve suyu sıcak dolum yöntemiyle kavanozlara doldurularak 30 °C 'ye kadar soğutulmuştur.

Tablo 9. Hammadde, ön ısıl işlem, pulp ve meyve suyuna işlem aşamalarında TFMM değerleri (Altan,2014).

İŞLEM AŞAMALARI	**TFMM(mg/kg)**
Hammadde	6147,5
Ön Isıl İşlem	7598,3
Pulp	9772
Meyve Suyu	15290
Min:	***6147,5***
Max:	***15290***
Ort:	***9701,95***

Kuşburnu meyve suyuna işlenirken işlem basamaklarında toplam fenolik madde miktarına artış meydana gelmiştir. II. aşamadaki artışın hem ısıl işlem uygulamasından hem de çekirdekten fenolik madde geçişinden kaynaklanma olduğu düşünülmüştür. Kuşburnunun kendine has buruk bir tadı olduğundan dolayı şekersiz meyve suyu tüketime uygun değildir. En ideal meyve suyunun %20-%30 şeker konsantrasyonu arasında üretilebileceği düşünülmektedir (Altan,2014).

- **Hint İnciri (*Opuntıa Fıcus-Indıca*) Meyvesinden Meyve Suyu Eldesi Kimyasal Ve Antioksidan Özelliklerinin İncelenmesi**

Bu çalışma, hint incirinin meyve suyu olarak kullanılma potansiyelini değerlendirmek amacıyla tasarlanmış ve depolanan meyvelerden taze olarak sıkılmış meyve suyu ile -18°C'de meyve suyu halinde bir ürün olarak 4 hafta boyunca depolanan meyve suyunun, depolama periyodu boyunca bazı fiziksel ve kimyasal özellikleri ile antioksidan kapasitesindeki değişimleri incelemeyi amaçlamıştır. Ayrıca çalışma ülkemizde yetişmekte olan, ticari ürün olarak kullanılmayan, besleyici değeri bir hayli yüksek bu meyvenin meyve suyu gibi bir çok ürüne işlenerek kullanılabileceğini göstermesi ve bu konu ile ilgilenecekler için kaynak ve gıda endüstrisi için yol gösterici olması açısından önem taşımaktadır. 1309 gram tartılan meyveden, 670 ml meyve suyu elde edilmiştir. Yüzde verim(%v/w) %51.18 olarak tespit edilmiştir. Hint inciri meyve suyunun *E.coli, S.aureus* ve *Candida* spp. üzerindeki antimikrobiyal etkisi araştırılmış ve yapılan analizler sonucunda zone oluşumuna dolayısıyla antimikrobiyal etkiye rastlanmamıştır (Dengiz, 2016).



Şekil 5. 18° C'deki meyve suyu Şekil 2: Taze olarak sıkılmış meyve suyu (Dengiz, 2016).

Hint inciri meyve suyuna soğuk sıkım tekniği kullanılarak vitamin, mineral gibi besin içerikleri korunarak tüketiciye kaliteli bir ürün sunulmasına yardımcı olunabilir. Hint inciri meyvesinin Akdeniz bölgesinde fazla miktarda yetişmesi ve besin içeriği zengin olan bu meyvenin ülkemizde ticari bir ürüne işlenmemesi nedeniyle bu meyve ilgi ilgili araştırmaların detaylı olarak yapılması önem taşımaktadır.

- **Bazı Sebzelerden Fermente Sebze Suyu Üretimi Ve Fermentasyonun Sebze Sularının Antioksidan Aktivitesi Üzerine Etkisi**

Bu çalışmada *L. plantarum* kültürü inoküle edilerek havuç, siyah havuç, kırmızı lahana ve pancar sularının laktik asit fermentasyonu gerçekleştirilmiş olup, elde edilen fermente sebze sularının 4 °C' de 5 haftalık depolanması boyunca fiziksel, kimyasal, mikrobiyolojik ve duyusal özelliklerindeki değişimler incelenmiştir.

Bu çalışmada, havuç, siyah havuç, kırmızı lahana ve pancar sebzelerinden elde edilen sebze sularına L. plantarum kültürü inoküle edilerek laktik asit fermentasyonu gerçekleştirilmiş, fermente edilen sebze suları 4 °C' de 5 hafta depolanmıştır. Depolama boyunca yedi günlük periyotta pH, toplam asitlik, indirgen şeker, toplam fenolik madde, toplam monomerik antosiyanin, toplam antioksidan kapasite ve duyusal özellik gibi kalite parametreleri belirlenmiştir. Depolama başı ve sonunda da laktik asit, toplam aerobik mezofilik canlı bakteri ve maya-küf sayımları yapılarak fermente sebze sularındaki değişimleri belirlenmiştir.



Şekil 6. *L. plantarum* kültürü inoküle edilerek havuç, siyah havuç, kırmızı lahana ve pancar suyu (Türker,2019).

- ✓ Fermente sebze sularından havuç suyunda en düşük düzeyde, siyah havuç suyunda en yüksek düzeyde toplam fenolik madde saptanmıştır. Toplam monomerik antosiyanin miktarı fermente siyah havuç suyunda 395,76 mg/L, kırmızı lahana suyunda 350,70 mg/L' dir. Troloks eşdeğer antioksidan kapasite değeri fermente siyah havuç suyunda en yüksek, fermente havuç suyunda en düşüktür. Depolama sonunda tüm fermente sebze sularının toplam fenolik madde içeriğinde azalma, monomerik antosiyanin ve antioksidan aktivite değerlerinde ise artış olmuştur.
- ✓ Fermente sebze sularından havuç suyunun en düşük düzeyde (119,18 mg gallik asit/L), siyah havuç suyunun ise en yüksek düzeyde (1235,70 mg gallik asit/L) toplam fenolik madde içerdiği saptanmıştır.
- ✓ Troloks eşdeğer antioksidan kapasite değeri (TEAC) en yüksek fermente sebze suyu siyah havuç olup (16,69 µmol troloks /mL), en düşük olan fermente sebze suyu havuç olarak belirlenmiştir (1,30 µmol troloks /mL).
- ✓ *L. plantarum* ile fermente edilen havuç ve siyah havuç suyunda 4 °C' de 5 haftalık depolama süresince küf-maya sayısı artarken, kırmızı lahana ve pancar sularında depolama başı ve sonunda tespit edilmemiştir.
- ✓ *L. plantarum* kültürü, laktik asit fermentasyonu sonucunda sebze sularının asitliğini düşürerek sebze sularına içilebilir bir lezzet vermiştir. Fermente sebze sularının duyusal özellikleri ve tüketici beğeni testi değerlendirmelerinden de anlaşılacağı gibi, fermente sebze sularının, özellikle siyah havuç ve kırmızı pancar sularının raf ömrü üzerine detaylı çalışmalar yapıldıktan sonra piyasaya yeni bir ürün olarak kazandırabileceği düşünülmektedir (Türker,2019).

- ➢ **Bazı Probiyotik Bakterilerin Mikroenkapsülasyonu Ve Meyve Suyunda Kullanımının Araştırılması**

Bu çalışmada bazı probiyotik mikroorganizmaların mikroenkapsülasyonu gerçekleştirilmiş olup, elde edilen mikrokapsüllerin %100 portakal suyu ve %100 elma şeftali suyunda kullanımı araştırılmıştır.Bu aşamanın sonucunda elde edilen veriler ve meyve sularının özellikleri göz önünde bulundurularak, meyve suyuna eklenmek için en uygun mikrokapsüller seçilmiştir. Probiyotik mikrokapsülleri meyve suyuna eklenmiş ve örnekler 35 gün boyunca 4 °C'de depolanmıştır. Depolama süresince meyve suyu örneklerinde bulunan probiyotik canlılıklarındaki değişim belirlenmiştir. Ayrıca, elde edilen probiyotik meyve suyu örneklerinin kalite analizleri ve duyusal analizleri gerçekleştirilmiştir.

Bu çalışmada ki amaç, insan bağırsağındaki mikrobiyal dengeleri iyileştirebilir nitelikte probiyotik bakteriler kullanarak meyve suyu üretimi için mikroenkapsülasyon yönteminin etkisinin araştırılmasıdır. Bu amaçla, öncelikle probiyotiklerin asit toleransı yüksek polimerler kullanılarak mikroenkapsülasyonunu gerçekleştirmek; sindirim sistemi simülasyonunda ve meyve suyunda depolama süresince probiyotik canlılığının etkin bir şekilde korunmasını sağlamak, ayrıca elde edilen meyve suyu örneklerinin tüketim bakımından kabul edilebilirliğini ortaya koymak hedeflenmektedir. Enkapsülasyon işleminin probiyotiklerin sindirim sistemi simülasyonunda canlı kalma yüzdelerini artırdığı belirlenmiştir.

Meyve sularının probiyotik gıda olarak adlandırılabilmesi için canlı probiyotik bakteri sayısının 106 kob/g olması gerekmektedir. *Lacticaseibacillus rhamnosus* içeren tüm meyve suyu örneklerinde canlı mikroorganizma sayısının 35 günlük depolama süresi boyunca bu değerin üzerinde olduğu belirlenmiştir. EcN (*Escherichia coli* Nissle) içeren örneklerde ise 35. günde 106 kob/mL değerinin altına düştüğü gözlenmiştir. EcN içeren ticari meyve suyu üretimi yapılması durumunda depolama süresi 14 gün olarak belirlenmelidir.

- ➢ **Probiyotiklerin Meyve ve Sebze Bazlı İçeceklerde Kullanımı**

Modern, sağlık bilincine sahip tüketiciler, refahı iyileştirebilecek ve hastalık riskini azaltabilecek gıdalar için artan bir istek gösterdiğinden, küresel fonksiyonel içecek pazarı gıda endüstrisinin büyüyen bir sektörüdür. Fonksiyonel gıda pazarının en hızlı büyüyen sektör olduğu ve 2008'de gıda endüstrisi için %2 ila %3'lük beklenen yıllık büyüme ile karşılaştırıldığında %10'luk bir büyüme olduğu bildirildi (Corbo vd., 2014). Bu ürünler, laktoz intoleransının daha yaygın olması ve düşük kolesterol ürünlerinin tercih edilmesi bağlamında önemli hale geldi ve tüketicilerin süt içeceklerinden kaçınmasına neden olmaktadır (Marsh vd., 2013). Ayrıca, meyvenin laktik fermentasyon için substratlar olarak uygulanması, tüketiciler tarafından takdir edilen, farklı duyusal ve fizikokimyasal özelliklere sahip ürünlerle sonuçlanan, her meyve tipine özgü tatlar ve besinlerin dahil edilmesi avantajına sahiptir. Peynir altı suyu eklenmiş veya eklenmemiş, farklı fermente Brezilya meyvelerinden yapılan içecek formülasyonlarının karşılaştırılması, süt bileşenlerinin eklenmesinin istenmediğini ve tüketicilerin tercihinin laktoz içermeyen fermente meyve suları olduğunu göstermektedir (Maldonado vd.,2017). Laktik asitle fermente edilmiş meyve veya sebze sularının geliştirilmesine yönelik son araştırmalar, özellikle LAB büyümesine ve sağlıkla ilgili özellikler üzerindeki etkisine odaklanmıştır (Tablo 10).

Tablo 10. Laktik asitle fermente edilmiş meyve veya sebze suları (Maldonado vd.,2017).

Hammadde	Ön Fermantatif Arıtma	Mikroorganizma	Beslenme Etkisi
Nar	Isıl işlem 80 C 5 dk	L. plantarum, L. acidophilus, L. paracasei, L. delbrueckii	DPPH radikal süpürme aktivitesinde artış; azalma antosiyanin içeriği; antioksidan aktivitede daha fazla artış L. plantarum'dan ziyade L. acidophilus ile işaretlenmiştir
Nar	Filtrasyon 0,22 µ m	L. plantarum	Toplam fenolik bileşik konsantrasyonu ve serbest radikal süpürme aktivitesi fermente edilmiş ürünlerde daha iyi korunmuştur. kontrolden daha meyve suyu, fermente edilmiş meyve suyu modüle edilmiş Bağışıklık aracılarının periferik kanda sentezi mononükleer hücreler
Nar	-	L. acidophilus, L. plantarum, B. longum subsp. infantis, B. bifidum	Fermente ürünlerde kateşin ve α-punikalagin tanımlanması meyve suları; antioksidan aktivite ve konsantrasyonda artış simüle edilmiş gastrointestinal sırasında fenolik türevlerin fermente meyve sularının sindirimi; fermantasyon arttı fenolik bileşiklerin biyoerişilebilirliği
Nar	Isıl işlem 70 C 5 dk	L. plantarum, L. acidophilus, L. delbrüeckii	Daha yüksek antioksidan aktivite ve toplam fenolik bileşikler kıyasla L. plantarum ile fermente edilmiş meyve sularında fermente edilmemiş
noni	Isıl işlem 121 C 15 dk	L. casei subsp. casei, B. longum, L. plantarum	B. longum ile fermente edilmiş meyve suyunun antioksidan aktivitesi diğer türlere göre daha iyi korunmuştur ve ilk fermente edilmemiş meyve suyuna benzer kaldı
Kiraz, domates, böğürtlen, kuru erik, beyaz üzüm meyve suyu ve aloe vera Kivi, rezene, ıspanak, papaya, beyaz üzüm meyve suyu ve aloe vera	Isıl işlem 80 C 10 dk	L. plantarum, L. pentosus, Lactobacillus sp.	Radikal süpürücü aktivitenin ve toplamın daha iyi korunması başlatılmış meyve sularında fenolik bileşik konsantrasyonu
Armut	-	asidofilus	Çoğu için α-glukozidaz inhibisyonunda önemli artış fermente meyve suyu örnekleri
Vişne suyu ve brokoli püresi	Vişne suyu ısıl işlem görmüş 121 C 10 dakika	L. plantarum	Fermente vişne suyu ve brokoli püresi zenginleştirildi yüksek insan biyoyararlanımına sahip fenolik türevde ve biyolojik aktivite
Hindistan cevizi suyu	-	L. plantarum, B. Animalis subsp. lactis	-

LAB, organik asitlerin üretiminin yanı sıra, fermantasyon yoluyla birçok önemli biyoaktif bileşiğin üretimine de katkıda bulunma yeteneğine sahiptir . Meyve ve sebze suları, güçlü bir sağlık çekiciliğine paralel olarak LAB için uygun bir büyüme substratı sağlayan vitaminler, mineraller ve antioksidan moleküller açısından değerli kaynaklardır . LAB'nin çeşitli suşları ile içecek fermantasyonunun, bazen toplam fenol ve flavonoid içeriğinde bir artışla birlikte antioksidan aktiviteyi büyük ölçüde arttırdığı rapor edilmiştir (Garcia vd.,2020). Meyve ve sebze suları, laktik asit fermantasyonu için uygun substratlar veya probiyotik bakteriler için vektörler olarak uygundur. Aktif LAB'nin meyve ve sebze özellikleri ile kombinasyonu sunarsayısız beslenme avantajı. Ayrıca, LAB metabolizmasından kaynaklanan sinerjik etkiler beklenebilir . Kombinasyonun avantajları laktozsuz içecekler, spesifik tat, EPS üretimi, şeker içeriğinde azalma ve biyoaktif bileşiklerin üretimini kapsar. LAB tüketimi, bağırsak sistemi sağlığını iyileştirebilir, bağışıklık sistemini güçlendirebilir, besinlerin biyoyararlanımını sentezleyebilir ve geliştirebilir ve belirli kanser ve kardiyovasküler hastalık riskini azaltabilir. LAB fermente meyve ve sebze içecekleri, metabolik hastalık yönetimi için yeni bir varlık sağlayabilir.

Probiyotik taşıyıcıları olarak meyve ve sebzelerin kullanılması ile fonksiyonel özellikleri arttırılmış daha sağlıklı ürünler elde edilebilmektedir. Farklı tekniklerle üretilen meyve ve sebze bazlı probiyotik içeceklerin geliştirilmesi amacıyla hammadde olarak sıklıkla elma, portakal, ananas, havuç ve pancar, probiyotik kültür olarak ise genellikle *Lactobacillus acidophilus, L. casei, L. plantarum, L. rhamnosus, Leuconostoc mesenteroides ve Bifidobacterium lactis* kullanılmaktadır. Bu çalışmada, probiyotik meyve ve sebze bazlı içeceklerin geliştirildiği güncel çalışmalar derlenmiştir.

Tablo 11. Ticari olarak üretilen çeşitli meyve ve sebze bazlı probiyotik içecekler (Corbo vd., 2014).

Ürün İçeriği	Probiyotik Suş	Marka	Uretici / Ulke
Portakal	*L. reuteri*	"R"	Ingman/İsveç
Portakal ve Mango	*L. rhamnosus* GG	Biola	Tine BA/Norveç
Şeftali ve Muz	*B. lactis*	It's Alive	Birleşik Krallık
Ananas, Havuç, β-karoten ve Kalsiyum	*L. rhamnosus* GG	Gefilus/Gfilac	Valio, İsveç/Finlandiya
Ahududu, Siyah Frenk Üzümü ve Üzüm	*L. plantarum* 299v	SHOT	Skanemejerier/İsveç
Portakal, Şeftali, Prebiyotik ve C vitamini	*L. rhamnosus* GG	Gefilus/Gfilac	Valio, İsveç/Finlandiya
Havuç, Zencefil ve Şeker Kamışı	*L. plantarum* 299v	GoodBelly	ABD
Zencefil, Frenk Üzümü, Yaban Mersini ve 19 Farklı Aromatik Bitki Ekstraktı	*L. acidophilus, L. rhamnosus, L. casei, L. lactis, L. salivarus, B. lactis, B. longum,*	Vita Biosa	Danimarka
Çilek, Siyah Frenk Üzümü, Mango, Muz ve Oligosakkarit	*B. lactis*	Tropicana	ABD
Erik, Üzüm ve Portakal	*L. paracasei*	Malee Enterprise Company	Tayland

Bu kapsamda fonksiyonel gıdaların büyük bölümünü oluşturan probiyotik ürünlere yönelik talep oldukça fazladır. Süt bazlı probiyotik gıdalar dünya genelinde en yaygın üretilen probiyotik ürünler olmasına rağmen laktoz intolerans, vejetaryen beslenme ve süt proteini alerjisi gibi çeşitli sınırlayıcı faktörler nedeniyle yeni gıda matrislerinin araştırılması hız kazanmıştır. Meyve ve sebzelerin içerdiği sağlığa faydalı bileşenlerin yanı sıra üretim, depolama ve tüketim gibi birçok aşama açısından probiyotik taşıyıcıları olarak kullanımları dikkat çekmektedir. Buna ek olarak, geleneksel fermente içeceklerden elde edilen potansiyel probiyotik suşlar ve farklı tekniklerle üretilen meyve ve sebze bazlı probiyotik içeceklere yönelik çalışmalar her geçen gün artmaya devam etmektedir. Bu tip ürünlerin geliştirilmesinde ortamın pH değeri, çeşitli antimikrobiyel bileşenlerin varlığı, oksijen düzeyi, raf ömrü ve tüketim sırasındaki canlı ve aktif probiyotik sayısı gibi çeşitli faktörler kritik rol oynamaktadır. Probiyotik ürünlerde hücre canlılığını maksimum seviyede tutmak adına farklı tekniklerden yararlanılmakta, ayrıca ürün formülasyonları çeşitli bileşenlerle zenginleştirilerek hücre gelişimi desteklenebilmektedir. İleride yapılacak çalışmalar sayesinde probiyotiklerin farklı ürün gruplarında kullanımı ile ürün çeşitliliğinin arttırılması mümkün olabilecektir.

10. Sonuç

Meyve suyu-bazlı fonksiyonel içecek grupları, son yıllarda, tüketicilerin sağlıklı gıda konusunda artan farkındalık ve talepleri doğrultusunda hızla büyüyen fonksiyonel gıda pazarında önemli bir yere sahiptir. Bu kapsamda geliştirilen yeni içecekler, temel besin bileşenlerinin yanı sıra, sağlığı destekleyici ve kronik hastalıklara yakalanma riskini azaltıcı etkileri ile bilinen fonksiyonel özellikteki bileşenler için de zengin birer gıda kaynağı olarak ilgi çekmektedir. Bununla birlikte, gıda üreticileri, yeni geliştirilen ürünlerde, yüksek miktarda biyoaktif madde içeriği, yüksek antioksidan kapasite ve yüksek duyusal kalite özelliklerinin hepsinin birarada bulunması hedefi ile optimum karışımların oluşturulması için çaba sarfetmelidir. Bu ürünlerin, sağlık üzerine olumlu etkilerinin detaylı bir şekilde araştırılması ve ortaya konması, tüketiciler tarafından daha yüksek oranda kabul görmelerinde kilit rolü oynamaktadır.

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Productivity, forage quality and capacity of *Thymuseta-Vicaetum-Festucosum* formation in the mountain part of Talısh

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The vegetation cover of the formation was recorded in the "Turksoba" summer (non-grazed) pasture field No. 8 in the territory of Astara region in the mountain-brown soils that have come out from under the forest. The average annual temperature of the air typical of the climate of this region is 10-140C, and the annual amount of precipitation reaches 1400-1600 mm. The research shows that the vegetation of this formation belongs to the class of diverse herbaceous- Fabaceaele- Poaceae formation. The productivity of this formation class of Thymuseta-Vicaetum-Festucosum formation varies between 19.5-29.6 s/ha in wet mass and 7.8-12.9 s/ha in dry mass (table 1) in the summer of 2019-2020-2021. According to calculations, the coefficient of conversion of wet mass to dry mass of productivity corresponds to 2.3 - 2.5. As can be seen from table No. 1, the average annual productivity of the thymuseta-vicaetum-festucosum formation is variable for botanical groups. So, in the summer of 2019 (in dry mass) - 7.8 s/ha, Poaceae 3.6 s/ha (46.1%), Fabaceae 2.7 s/ha (34.7%), Herboseta, 1.5 s/ha (19.2 %) has fluctuated; In 2020 (summer) 10.2 s/ha - Poaceae 6.1 s/ha (59.8%), Fabaceace 2.5 s/ha (24.5%), Herboseta 1.6 s/ha (15.7%) and 12.9 s/ha in 2021 - Poaceae 6.7 s/ha (51.9%), Fabaceae 3.8 s/ha (29.5%), and Herboseta 2.4 s/ha (18.6%).

Table 1 The average annual productivity of the Thymuseta-Vicaetum-Festucosum formation spread in the summer pasture area No. 8 "Turkasoba" of Astara region

Years and months	Botanical plant groups	Wet mass		Dry edible mass	
		With s/ha	With %	With s/ha	With %
2019 (July 10-20)	Poaceae	9,0	46,1	3,6	46,1
	Fabaceae	6,8	34,9	2,7	34,7
	Herboseta	3,7	19,0	1,5	19,2
	Average annual productivity	19,5	100,0	7,8	100,0
2020 (July 20-25)	Poaceae	15,2	59,6	6,1	59,8
	Fabaceae	6,3	24,7	2,5	24,5
	Herboseta	4,0	15,7	1,6	15,7
	Average annual productivity	25,5	100,0	10,2	100,0
2021 (July 25-30)	Poaceae	16,6	56,1	6,7	51,9
	Fabaceae	7,3	24,7	3,8	29,5
	herboseta	5,7	19,2	2,4	18,6
	Average annual productivity	29,6	100,0	12,9	100,0

As can be seen in table 2, the three-year average productivity of the Thymuseta-Vicaetum-Festucosum formation (10.1 s/ha), 3.0 head of cattle per hectare, and the grazing capacity (270 heads of small horned cattle can be grazed) was determined in the total area (90 ha) taking into account the fodder unit in 100 kg of dry feed (45.8 kg), shelf life of phytocenosis (120 days), the daily feed rate of cattle (sheep-goats) (1.3 feed units).

Table 2. Duration of use of phytocenoses, average productivity, feed quality and pasture capacity in the summer season of 2019-2020-2021 in some plant formations

s/s	Formations	D	AY	in 100 kg of fodder		NH	Area (in hectares)	Pasture capacity
				FU	AP			
1.	*Thymuseta-stipa festucosum*	120	8,1	44,7	4,9	2,3	333	766
2.	*Trifolium -thymuseta-festucosum*	120	10,9	55,3	5,6	3,9	296	1154
3.	*thymuseta-vicaetum-festucosum*	120	10,1	45,8	4,6	3,0	90	270

D: Duration (in days); AY: Average yield (in edible dry mass); FU: Fodder unit; AP: Absorbed protein; NH: Number (load) of small horned cattle that can be grazed per hectare

Thus, from our multi-year studies on biodiversity productivity, feed quality and grazing capacity in the mountainous ecosystem of Lankaran, we come to the conclusion that 35-40% of summer pastures in Yardimli, Lerik and Astara regions have decreased productivity due to inefficient use and overgrazing and phytodiversity has been degraded. Therefore, it is appropriate to implement measures to protect, efficiently (correctly) use and improve phytocenoses in natural summer pastures of the region.

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Structural Characterization Antioxidant, Hemolytic And Antimicrobial Activities Of *Gymnema Sylvestre*

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Abstract

Traditional medicine is based on a variety of herbs since old age for treating several diseases and maintaining health. *Gymnema sylvestre*, often known as "Gurmar", is a perennial, woody climbing plant native to the tropical woods of southern and central India. It belongs to the Apocynaceae family and the genus Gymnema. *Gymnema sylvestre* has great medicinal importance due to their anti-inflammatory, antioxidant, antidiabetic, antihypertensive, antioxidant, antithrombotic, antiseptic and hepatoprotective activities. In this study ethyl acetate, methanolic and aqueous extract of plant were prepared. Fourier Transformed Infrared Spectroscopy (FTIR) and high-performance liquid chromatography (HPLC) was used to characterize and identify the functional groups. Extract was further processed to assess antioxidant and antimicrobial hemolytic activity of *Gymnema sylvester*. Ethyl acetate exhibited the highest TPC (67.954 ± 0.79 g gallic acid equivalent/g dry weight) and highest TFC (113.02± 3.20 g catechin equivalent/ g dry weight) was noted in aqueous extract. Antioxidant activity was assessed by DPPH scavenging assay in which methanol extract had the highest DPPH scavenging activity (75%), antimicrobial activity was measured by agar well diffusion method and the maximum zone of inhibition was of methanol fraction against *Staphylococcus aureus* (12.55 mm) and *E. coli* (7.73 mm), biofilm formation inhibition assay was performed by microtiter plate method. The maximum hemolytic activity of ethyl acetate is 151.2±3.71. One way ANOVA and Tuckey test was used to find significant difference between means of different samples which revealed all the results are significant.

Keywords: *GYMNEMA SYLVESTRE, Antioxidant, antibacterial, hemolytic, biofilm*

ID: 654

Characterization And Evaluation Of Pharmacological Potential Of *Crocus Sativus* Stigma Extract

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Abstract

Saffron is one of the most beneficial plants in the world belongs to the member of Iridaceae family which is also known as saffron. The present study was designed to evaluate the biological potential and toxicological studies of the *Crocus sativus*. Ethanol, n-hexane and distilled water extracts of *Crocus sativus* was used to evaluate their antioxidant, antimicrobial, and hemolytic activity. The *Crocus sativus* extracts were characterized by FTIR. Fourier Transformed Infrared Spectroscopy (FTIR) was used to determine the functional groups present in *Crocus sativus* stigma extracts. The antioxidant activity of the *Crocus sativus* stigma extracts were measured by DPPH scavenging essay, TPC and TFC. In the DPPH assay, distilled water extract (47.04 ± 0.76) exhibited highest DPPH scavenging activity followed by *n*-hexane (28.76 ± 0.94) and ethanol (4.0 ± 0.3) extracts. Ethanol extract exhibited the highest TPC (595 ± 0.84 g gallic acid equivalent /g dry weight) and TFC (32.7 ± 0.26 g catechin equivalent /g dry weight) as compared to *n*-hexane and distilled water extracts. The antibacterial activity was performed through well diffusion method and the maximum zone of inhibition (mm) was of ethanol fraction of *Crocus sativus* stigma extract against *E.coli* (23.5 mm) and *Staphylococcus aureus* (19 mm). *Crocus sativus* showed the biofilm inhibition against the both positive strain (*S. aureus*) and negative strain (*E. coli*) of bacteria. Cytotoxicity Assay by hemolytic activity indicates that all three extracts of *Crocus sativus* were nontoxic and safe for human use. All the extracts of *Crocus sativus* stigma showed significant anti-inflammatory activity. One way ANOVA and Tuckey test was used to find significant difference between means of different sample extracts which showed that results are significant. Results of this study showed that *Crocus sativus* stigma extract can be used for medicinal purposes.

Keywords: *Crocus sativus, Antioxidant potential, Antibacterial, hemolytic assay, Saffron*

ID: 655

Sterilization effect of 0.1 HgCl2 on the invitro germination of papaya (Carica papaya Linn) seeds to produce disease-free plants

Muhammad Mudassir Iqbal, Attif Ramzan, Anees Ur Rehman

Abstract

The famous fruit plant papaya (Carica papaya L.) due its nutritive value belongs to the family Caricaceae. There are many species of papaya among them only 32 are dioecious, two trioecious and one monoecious. The first and only species of the genus Carica is the papaya, which is also the most popular and economically significant member of the family. It is a prominent fruit crop grown in tropical and subtropical regions of the world. Papaya plant facing pathogenic issues during germination of the seeds in the field. This research was conducted to minimize this problem in the papaya seed nursery development industry by taken seeds to invitro conditions, to avoid the contamination problems this research laid under Complete randomized design. It included the concentrations of 0.1 HgCl2 with different time intervals 3mint, 5mint and 7mint. Rinsed the seed 2-3 times with double sterilized water and soaked in the solution of 0.1% HgCl2 and add 2 drops of tween twenty. The results revealed that the seeds treated with 0.1 HgCl2 for 5mints gave higher germination % (96%) results and lower contamination (fungal or bacterial) growth on seeds as compared to the other treatments.

Key words: *Carica papaya L.;0.1 HgCl2, Contamination (fungal or bacterial) or pathogenic, Sterilization*

ID: 658

Interrelation Of Humic Substances With Chemical Substances And Pollutants

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Humus to some extent interacts with the mineral components of the solid phase of the soil, forming its sorption properties. In this regard, any compound entering the soil from outside interacts with both the solid phase and the organic matter of the soil solution.

Soil organic matter plays an important role in the transformation of mineral fertilizers, chemical ameliorants, pesticides and individual components of various soil pollutants. The presence of organic substances in the interaction of agrochemicals and pollutants with soil is manifested in the following:

promotes the separation of mineral nutrients from sparingly soluble fertilizers in acidic soils, for example, accelerates the separation of phosphorus from phosphorus flour or the dissolution of lime or the hydrological decomposition of some pesticides, etc.;

sorbed phosphates pass into the soil solution, replacing them in the soil absorbing complex;

Participates in the exchange and non-exchange absorption of mineral fertilizers and chemical ameliorants, pesticides, radionuclides, cations contained in heavy metals. In turn, sorbed humus reduces the scale of strong binding of phosphates and some cations, preventing the interaction of agrochemical and toxic substances with the mineral part of the soil;

Reduces the transition of phosphates into sparingly soluble forms due to active interaction with cations (Fe3+, Al3+, Ca2+, etc.) involved in the precipitation of phosphates in fertilizers;

In some soils, the possibility of the formation of complex, sparingly soluble mineral-humus compounds containing Fe and Al, as well as phosphorus has been established. Such compounds are capable of active migration;

In some cases, cations of mineral fertilizers, such as potash fertilizers in alkaline soils or alkaline fertilizers containing ammonium (liquid ammonia, ammonia water),can form soluble humates in the soil.

Soluble humus can also interact with heavy metal cations as well as artificial radionuclides. These reactions are due to the formation and behavior of simple and complex hetero polar salts and affect the migration, accumulation and entry of toxic substances into plants.

To regulate the behavior of pesticides in the soil, it is important to study the interaction of these substances with various active soil components, primarily organic substances. However, information on this issue is insufficient and sometimes contradictory. A number of studies have shown a very important effect of humus on the degradation, migration and entry of pesticides into plants. It is known that the amount of herbicides needed to kill weeds can vary by a factor of 20 depending on the nature of the interaction of the soil with humus (F. Stevenson). The interaction of various structural and functional groups of soil humus with simazine, atrazine, 2,4-D and other herbicides has been experimentally proven. It is known that clay-humus complexes adsorb pesticides better than pure humic acids. Fulvic acids, on the other hand, act as carriers for a number of sparingly soluble pesticides.

ID: 659

Cadmium And Zinc In The Environment

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Cadmium, zinc and copper are the most important metals in the study of pollution problems, as they are widely distributed in the world and have toxic properties. Cadmium and zinc (as well as lead and mercury) are found mainly in sulfide sediments. As a result of atmospheric processes, these elements easily enter the oceans. Soils contain approximately 4.5x10 -4%. Vegetation contains varying amounts of both elements, but the content of zinc in plant ash is relatively high – 0.14;, since this element plays an essential role in plant nutrition.

About 1 million kg of cadmium enters the atmosphere annually as a result of the activities of plants for its smelting, which is about 45% of the total pollution by this element. 52% of pollution comes from the combustion or processing of products containing cadmium. Cadmium has a relatively high volatility, so it easily diffuses into the atmosphere. The sources of air pollution with zinc are the same as with cadmium.

The entry of cadmium into natural waters occurs as a result of its use in galvanic processes and technology. The most serious sources of water pollution with zinc are zinc smelters and electroplating plants.

Fertilizers are a potential source of cadmium contamination. In this case, cadmium is introduced into plants that are used by humans for food, and at the end of the chain they pass into the human body. Cadmium and zinc readily enter seawater and the ocean through a network of surface and groundwater. Cadmium and zinc accumulate in certain organs of animals (especially in the liver and kidneys).

Zinc is the least toxic of all the heavy metals listed above. However, all elements become toxic if found in excess; zinc is no exception. The physiological effect of zinc is its action as an enzyme activator. In large quantities, it causes vomiting, this dose is approximately 150 mg for an adult.

Cadmium is much more toxic than zinc. He and his compounds belong to the I class of danger. It penetrates the human body over a long period. Breathing air for 8 hours at a cadmium concentration of 5 mg/m3 can cause death. In chronic cadmium poisoning, protein appears in the urine, and blood pressure rises.

When examining the presence of cadmium in food, it was found that human excretions rarely contain as much cadmium as was absorbed. There is currently no consensus on the acceptable safe content of cadmium in food.

One effective way to prevent cadmium and zinc from being released as pollution is to control the content of these metals in emissions from smelters and other industries.

ID: 660

Soil Contamination With Protein And Vitamin Preservatives

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In the last 10 years, compound feeds (feed mixtures prepared from different feeds) obtained with the use of protein-vitamin concentrates (PVC) for cattle in the 80s of the twentieth century, which manifested themselves in animal husbandry due to environmental problems, have been widely developed.

The energy use of the human body is mainly associated with the consumption of animal meat. Proteins, fats and carbohydrates in meat, milk and eggs are absorbed by people by 90-98%, and in potatoes and vegetables by 70-95%. Accordingly, for animal nutrition, it is necessary to develop foods rich in protein and vitamins.

Such substances are found in microorganisms synthesized from carbohydrate-containing raw materials. On their basis, protein-vitamin concentrates are made. However, their end products, as it turned out later, are not harmless. First, during production, they cause allergies, dermatitis, bronchial asthma and, in some cases, cancer in workers. The second is the accumulation in the body of an animal of substances harmful to human health.

As a result of feeding protein-vitamin concentrates to animals, eosinophilia develops in the intestinal mucosa, granulomatosis in the liver.

It has also been proven that protein-vitamin concentrates contain 12-15 times more nucleic acids than feed. It is known that these biological polymers provide the transfer of genetic information. So it affects the genetic code of animals, birds and ultimately humans. The basis of nucleic acid in protein-vitamin concentrates is ribonucleic acid (RNA). RNA causes an increase in uric acid in the urine and blood in the human body. Leads to diseases that contain a lot of RNA.

Excessive feeding of animals with protein and vitamin concentrates leads to the accumulation of fat in the liver, increased cholesterol levels, and metabolic disorders. In this regard, protein-vitamin concentrates can be added to feed for cattle 20%, and poultry 15%.

Currently, science is trying to study the unknown properties of protein-vitamin concentrates. Therefore, it is very important to comply with the norm when added to animal feed, so as not to endanger human health.

ID: 661

Evaluatıon Of Envıronmentally Harmful Mıneral Fertılızer Standards In Irrıgated Gray Brown Soıls In Samukh Dıstrıct

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Rye is one of the cereal plants cultivated as food and fodder in our republic. Rye grain contains 9.0-18.6% protein, 51.8-62.6% non-extractable nitrogenous substances, 1.6-1.9% fat, 2.3-2.5% depending on the characteristics of the variety and cultivation conditions. cellulose and 1.9-2.0% ash. Grain can contain up to 82% carbohydrates, most of which is starch. Starch has a positive effect on the preparation and composition of bread. Rye flour contains 3.1-4.5% gluten. The increase in gluten greatly improves its baking quality.

Ecological evaluation of lands and landscape complexes of the republic and individual regions has been studied by many authors.

In Ganja-Gazakh region, we began to study autumn rye in 2018.

If the application of agrochemical and chemical means in crop cultivation is not carried out correctly, if the given norms are not expected, it creates consequences for the environment and human health. From this point of view, optimizing the application of mineral fertilizers in crop cultivation, providing scientifically based "ecological" norms and ecological (agroecological) evaluation of soils can play an important role in preventing negative processes that may arise for the environment and human health.

The main goal of the research is to determine the ecologically harmless mineral fertilizer norms that ensure high and quality harvest from the autumn rye plant in irrigated gray-brown (chestnut) soils under the conditions of the Ganja-Gazakh region, and to determine the ecological value of these soils. It is evidence of logical evaluation.

Researches were conducted in 2018-2020 with the "Mirbashir-46" variety of winter rye on irrigated gray-brown (chestnut) soils at the Ganja Regional Agrarian Science and Innovation Center of the Ministry of Agriculture, located in the Samukh district.

The following price indicators were used during the ecological evaluation of the lands of Ganja-Gazakh region: bonity scores obtained on the basis of the internal properties of the soils (humus, nitrogen, phosphorus, potassium, UAC) during the comparative evaluation (bonitirotion) of the soils; Ecological scores obtained on the basis of special evaluation scales according to the degree of manifestation of individual characteristics of soils (pH, water-resistant aggregates, dry residue).

In the third stage of our research, the final ecological scores of dark gray-brown (chestnut), ordinary gray-brown (chestnut) and light gray-brown (chestnut) soils under ryegrass were found using "cultivation-ecological coefficients". The following formula was used for this:

$$E_{m\text{-}e} = E_b \, x T_{m\text{-}e}$$

Here, $E_{m\text{-}e}$ – is the final acculturation-ecological score of soils; E_b – soil ecological score and $T_{m\text{-}e}$ -culturalization - ecological correction coefficient.

As a result, the environmental scores of the lands used under rye crops were calculated by applying the main credit scores.

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ID: 662

Alternatives to antibiotics in the poultry diet regarding one health concept

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Abstract

In poultry industry, antibiotic substances have been widely used as a growth promoters causes serious health problems regarding one health concept. Antimicrobial resistance developed due to imprudence usage of these antibiotics as growth promoters. To overcome this problem, employing biotic or natural items as antibiotic replacements, phytochemicals, organic acids, probiotics, prebiotics, bacteriophages, in-feed enzymes and others such as phytobiotics (phytogenics or botanicals), has gotten a lot of interest. Phytobiotics or its components are a new class of natural herbs that have acquired appeal and acceptance among poultry sector. The use of a variety of phytobiotic additions in chicken feed has demonstrated their capacity to improve the productivity of both broilers and layers. Furthermore, phytobiotics shown high efficiency in combating pathogenic microorganisms in the intestine while preserving the community of typical resident useful microbiota. Moreover, substances like thymol, carvacrol, cinnamaldehyde and curcumin found in thyme, pepperwort and turmeric exert significant support of the innate immunity as well as antioxidant action. Phytobiotics have been found to have an immunostimulatory impact on both humoral and cellular immunity, along with antioxidant qualities. As a result, the purpose of this review paper was to focus on the use of various types of phytobiotics as chicken dietary supplements to boost productivity, decrease infectious intestinal flora, and augment the immunological response, particularly after vaccination. However, the phytochemical mechanisms of the growth promotion and action on microflora are still unclear and need further investigation to achieve the maximal effectiveness.

Key Words: *Microbiota, Immunity, Phytobiotics, Plants, Poultry*

ID: 665

A Modern Perspective On The Influence Of Pesticides In Some Neuropsychiatric Manifestations

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Abstract

Today, the use of pesticides has become a routine for most of the population. Pesticides can be purchased very easily, without a recommendation from a specialist, at an affordable price and guaranteeing the desired effect against pests, which can be represented by insects, mollusks, rodents, fish, plants, etc. Moreover, lately there is a growing interest in understanding the relevance of pesticide exposure in most of the neuropsychiatric disorders. We are describing here the current state of knowledge regarding the influence of some pesticides (and especially rotenone) in some neuropsychiatric manifestations, focusing mostly on the neurological and psychiatric characteristics of Parkinson's disease. Also, we are giving a lot of interest to the zebrafish model in the aforementioned context.

ID: 666

Alternative Raw Material Source for Gluten-Free Products: Cauliflower Powder

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Abstract

Gluten-free products prepared from commercial starches and gluten-free grains are thought to have low amounts of dietary fiber. For this reason, the gluten-free diet, food choices and dietary habits of celiac patients cause long-term concerns. Recent studies on this diet style; revealed that insufficient protein, carbohydrate, fat intake and unbalanced protein intake occur. For this, it is aimed to produce foodstuffs to increase dietary fiber intake with various studies. Fruits and vegetables are good sources of dietary fiber to compensate for nutritional deficiencies in gluten-free products (Arslan et al., 2018). Dietary fiber from vegetables has more nutritional value. Therefore, it is recommended to supplement the dietary fiber source with increasing vegetable intake in celiac disease.

Due to this deficiency, it is aimed to improve and enrich the foods by making use of the high dietary fiber in vegetables in gluten-free cereal products. Among the pumpkin, cabbage, broccoli, sugar beet and carrot vegetables, cauliflower can be used as the main product for enriching gluten-free bread in terms of having higher dietary fiber. Thus, cauliflower, which is very valuable as a waste product, will be used in powder form and the deficiency in nutrition will be eliminated with vegetables with high dietary fiber. Cauliflower, one of the Brassica vegetables, has been added to the bread structure, which is the main nutritional product due to its high secondary metabolite and dietary fiber feature. Bread making caused some reduction in SPMs. But Klopsch et al.2019 developed a promising, innovative and healthy product to increase bioactive consumption with high fiber content by adding fresh cauliflower and leaves to bread in their study (Lin and Zhou 2018; Świeca, Sęczyk, Gawlik-Dziki, Dzik, 2014).).

Key Words: *gluten, cauliflower, bread, celiac*

Glutensiz Ürünlerde Alternatif Hammadde Kaynağı: Karnabahar Tozu

Özet

Ticari nişastalardan ve glutensiz tahıllardan hazırlanan glutensiz ürünlerinin düşük miktarda diyet lifine sahip olduğu düşünülmektedir. Bu nedenle çölyak hastalarının glutensiz diyet yapmaları, bu yöndeki gıda seçimleri ve beslenme alışkanlıkları uzun vadeli endişelere yol açmaktadır. Bu beslenme tarzı üzerine son zamanlarda yapılan çalışmalar; yetersiz protein, karbonhidrat, yağ alımı ile dengesiz protein alımı oluştuğunu ortaya koymuştur. Bunun için çeşitli çalışmalar ile diyet lifi alımını arttırmaya yönelik gıda maddeleri üretilmesi hedeflenmektedir. Meyve ve sebzeler glutensiz ürünlerdeki beslenme eksikliklerini telafi etmek için iyi bir diyet lifi kaynağıdır (Arslan ve ark., 2018). Sebzelerden elde edilen diyet lifleri daha fazla besin değerine sahiptir. Bundan dolayı çölyak hastalığında diyet lifi kaynağının sebze alımının arttırılması ile desteklenmesi önerilmektedir.

Bu eksiklikten dolayı glutensiz tahıl ürünlerinde sebzelerdeki yüksek diyet lifinden faydalanılarak gıdaları iyileştirmek, zenginleştirmek hedeflenmektedir. Bal kabağı, lahana, brokoli, şeker pancarı, havuç sebzeleri arasından karnabahar daha yüksek diyet lifine sahip olması açısından esas ürün alınarak glutensiz ekmek zenginleştirilmesinde kullanılabilmektedir. Böylelikle hem atık ürün olarak çok kıymetli olan karnabahar, toz şeklinde kullanılacak hem de diyet lifi yüksek sebze ile beslenmedeki eksikliğin giderilmesi sağlanacaktır. Brassica sebzelerinden olan karnabahar yüksek sekonder metabolit ve diyet lifi özelliğinden dolayı temel beslenme ürünü olan ekmek yapısına ilave edilmiştir. Ekmek yapımı SPM'lerin bir miktar azalmasına neden olmuştur. Ama Klopsch ve ark.2019, yaptığı çalışmada taze karnabahar ve yapraklarının ekmeğe ilave ederek lif oranı yüksek, biyoaktif tüketimini artırmak için umut verici, yenilikçi ve sağlıklı bir ürün geliştirmiştir (Lin ve Zhou 2018; Świeca, Sęczyk, Gawlik-Dziki, Dzik, 2014).

Key Words: *gluten, karnabahar, ekmek, çölyak*

ID: 667

Aeroponic Cultivation in Türkiye and the World

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Abstract
The risks posed by natural, economic and social factors adversely affect the sustainability of agricultural production. It is aimed to reduce these risks by developing systems that will meet the food needs of the increasing population, use water resources efficiently and reduce the workload of the soil. In the modernizing world, the use of agriculture integrating with the developing technology has allowed the emergence of alternative farming methods. The advantages of the Aeroponic system, which is one of the alternative farming methods, compared to traditional farming methods are increasing the popularity of the system. Aeroponic system; It is a sustainable cultivation technology that integrates plant nutrition and agricultural automation. In this developed method, the water and nutrient concentration is circulated and given to the plant roots suspended in the air in the form of fogging. It can be installed as a single-storey system or as a multi-storey system. The water needed for aeroponic systems is 98% less than other traditional methods thanks to water recycling and uses less pesticides. In addition, since the roots are more exposed to oxygen, it has higher efficiency than other soilless methods. Aeroponic systems are generally used as a plant growing medium today. Aeroponic rooting unit was established for the rooting of wood and semi-wood cuttings within the scope of the project prepared by Tokat Gaziosmanpaşa University Faculty of Agriculture and carried out with the support of Tübitak. The project is in effect and the system installation has been completed. It is thought that the system, which has goals such as higher yield per unit area, disease and pest-free seedlings, rooting of plants that are difficult to root, and economic production, will make significant contributions to the nursery sector.
Keywords: *Aeroponic, Rooting, Wood Cutting, Semi-Wood Cutting*

Türkiye ve Dünyada Aeroponic Yetiştiricilik

Özet
Doğal, ekonomik ve sosyal faktörlerin oluşturduğu riskler tarımsal üretimde sürdürülebilirliği olumsuz yönde etkilemektedir. Artan nüfusun gıda ihtiyacını giderecek, su kaynaklarının verimli şekilde kullanılacağı ve toprağın iş yükünü azaltacak sistemler geliştirilerek bu risklerin azaltılması hedeflenmektedir. Modernleşen dünyada tarımın gelişen teknoloji ile entegre edilerek kullanılması Alternatif tarım yöntemlerinin ortaya çıkmasına olanak sağlamıştır. Alternatif tarım yöntemlerinden biri olan Aeroponic sistemin, geleneksel tarım yöntemlerine kıyasla avantajlarının fazla olması, sistemin popülaritesini giderek daha da artırmaktadır. Aeroponic sistem; bitki besleme ve tarımsal otomasyonu entegre eden sürdürülebilir yetiştirme teknolojisidir. Geliştirilen bu yöntemde su ve besin konsantrasyonu, sirküle edilerek havada asılı halde duran bitki köklerine sisleme şeklinde verilmektedir. Tek katlı sistem olarak kurulabildiği gibi çok katlı sistem şeklinde de kurulabilmektedir. Aeroponik sistemler için ihtiyaç duyulan su, suyun geri dönüşümü sayesinde diğer geleneksel yöntemlere göre %98 daha azdır ve daha az pestisit kullanır. Ayrıca kökler oksijene fazla maruz kaldığı için diğer topraksız yöntemlere göre daha yüksek verime sahiptir.
Aeroponic sistemler günümüzde genellikle bitki yetiştirme ortamı olarak kullanılmaktadır. Tokat Gaziosmanpaşa Üniversitesi Ziraat Fakültesi tarafından hazırlanan ve Tübitak desteği ile yürütülen proje kapsamında odun ve yarı odun çeliklerinin köklendirilmesi amacıyla Aeroponic köklendirme ünitesi kurulmuştur. Proje yürürlükte olup sistem kurulumu tamamlanmıştır. Birim alandan daha yüksek verim, hastalık ve zararlılardan ari fidan, köklenmesi zor olan bitkilerin köklendirilmesi, ekonomik üretim gibi hedefleri olan sistemin fidancılık sektörüne önemli katkılar sağlayacağı düşünülmektedir.
Anahtar Kelimeler: *Aeroponic, Köklendirme, Odun çeliği, Yarı Odun Çeliği*

ID: 668

Prevalence And Frequency of Diabetic autonomic neuropathy (DAN) and their Related Risk Factors in Type 1 Diabetic Patients of Hyderabad and Jamshoro.

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Abstract

Diabetic autonomic neuropathy (DAN) is an insidious complication of diabetes mellitus (DM) that develops slowly over several years and slowly robs diabetics (DM) of their ability to feel when they develop hyper/hypoglycaemia or myocardial infarction. event.. Skin exposure and appearance to any organ, the gastrointestinal (GI) tract is associated with a significant risk of death in patients with diabetes mellitus (DM). Factors commonly associated with DAN in DM patients include chronic DM duration, hyperglycemia, hypertension, and elevated LDL cholesterol levels. Tight glycaemic control is important to prevent the onset and slow the progression of diabetic autonomic neuropathy (DAN). The 5-year mortality rate in patients with diabetic autonomic neuropathy (DAN) is three times higher than in patients with diabetes mellitus (DM), excluding autonomic involvement. Causes of death in diabetic patients with symptomatic or asymptomatic autonomic neuropathy include cardiovascular disease (CVD); and nephropathy. Urinary albumin excretion (UAE) is associated with autonomic neuropathy in patients with diabetes mellitus (DM). The objective of the research was to examine the prevalence, frequency of diabetic autonomic neuropathy(DAN) and its severity in type 1 diabetic(T1DM) patients of Jamshoro and Hyderabad .It is furnished by the result found that 410 patients of T1DM were observed in this study. From the perusal of T1DM patients, it has been observed that DN 105 patients 45(43%) patients were DAN. Out of 45 DAN patients, 25 males (55.5%) were suffered and 20 (44.5%) females. Hence, the proportion of males suffering from DAN is nearly similar to that of the females.40% patients age group was 20-25 & 60% was 26-30 years. Out of 45 DAN patients 60% have positive family history and 40% patients have negative family history .Out of 45 DAN had 18% good glycemic control and 82% patients had poor glycemic control. Out of 45 DAN patients 85%were hypertensive (BP>145/95mmHG) and 15% were Normotensive (BP <145/90mmHG).Out of 25 male DAN patients 20%were smokers.. Whereas a the patients are largely come under the suffering from muscles weakness (95%). Around 85% patients suffered from the constipation or diarrhea (85%). Whereas a the patients are come under the suffering from urinary incontinence also (62%).

ID: 671

The Effect of Post-Harvest Calcium Chloride Applications on the Shelf Life Quality of Strawberry

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Abstract

The aim of this study was to examine the effects of postharvest calcium chloride applications at different doses on quality changes in Monterey cv. strawberry fruits kept on the shelf after being stored for different periods. The trial was conducted during 2021-2022. In the study; fruit skin color parameters, fruit flesh firmness and soluble solid matter (SSC) ratios, as well as total acidity, total phenolic substance, total monomeric anthocyanin amounts and total antioxidant capacity were determined. After the fruits were harvested, they were immersed in three different doses (0-2-4%) of calcium chloride (CaCl2) solution for 5 minutes. The fruits removed from the solution were kept to dry. The fruits were stored for 14 days in a cold store with a temperature of 1-2 ºC and a relative humidity of 90±5%. Before the storage and on the 7th and 14th days of storage, the fruits samples were taken and kept on the shelves in the rooms with a temperature of 21±1 oC and a relative humidity of 60±5% for 3 days. Measurements and analyzes of fruit quality parameters were made in the samples taken from the fruits that were kept on the shelf for three days. As a result of the study, it was determined that 4% CaCl2 application was effective in maintaining fruit flesh firmness. In fruits kept on the shelf for 3 days after 14 days of storage, SSC of 4% CaCl2 treatment was found to be higher than the control treatment. Compared to the control, 4% CaCl2 caused a significant increase in the total phenol content. The highest total monomeric anthocyanin content and total antioxidant capacity was determined in the control treatment. While there were no significant changes in L* values between treatments, a* and b* values were found to be higher in 2% $CaCl_2$ treatment. In the light of the data obtained, it was concluded that 4% $CaCl_2$ application had a positive effect on the shelf life of strawberry fruits.

Key Words: *Color, Phytochemical, Anthocyanin, Antioxidant, $CaCl_2$*

Hasat Sonrası Kalsiyum Klorür Uygulamalarının Çileğin Raf Ömrü Kalitesine Etkisi

Özet

Bu çalışmada, hasat sonrası farklı dozlarda kalsiyum klorür uygulamalarının, belli sürelerle depolandıktan sonra rafta bekletilen Monterey çeşidi çilek meyvelerinde ortaya çıkan kalite değişimleri üzerine etkilerini incelemek amaçlanmıştır. Deneme, 2021 ve 2022 yıllarında yürütülmüştür. Çalışmada; meyve kabuğu renk parametreleri, meyve eti sertliği ve suda çözünür kuru madde (SÇKM) oranları yanında toplam asitlik, toplam fenolik madde, toplam monomerik antosiyanin miktarları ve toplam antioksidan kapasite belirlenmiştir. Meyveler hasat edildikten sonra, üç farklı dozda (%0-2-4) kalsiyum klorür ($CaCl_2$) çözeltisi içerisine 5 dakika boyunca daldırılmıştır. Daldırma işleminden sonra meyveler kurumaya bırakılmıştır. Meyveler, sıcaklık 1-2 ºC, bağıl nemi %90±5 olan soğuk hava deposunda 14 gün süreyle muhafaza edilmiştir. Depolama öncesinde ve depolamanın 7 ve 14. günlerde alınan meyve örnekleri, sıcaklığı 21±1 ºC ve bağıl nemi %60±5 olan odalardaki raflarda 3 gün bekletilmiştir. Üç gün rafta bekletilen meyvelerden alınan örneklerde meyve kalite parametrelerine ait ölçüm ve analizler yapılmıştır. Çalışma sonucunda, %4 $CaCl_2$ uygulamasının meyve eti sertliğinin korunmasında etkili sonuç verdiği belirlenmiştir. 14 gün depolamanın ardından 3 gün rafta bekletilen meveylerde, %4 $CaCl_2$ uygulamasının SÇKM içeriği kontrol uygulamasından daha yüksek bulunmuştur. Kontrole kıyasla %4 $CaCl_2$ toplam fenol içeriğinde belirgin bir artışa neden olmuştur. En yüksek toplam monomerik antosiyanin içeriği ve toplam antioksidan kapasite kontrol uygulamasında tespit edilmiştir. L* değerlerinde önemli değişiklikler olmazken, a* ve b* değerleri %2 $CaCl_2$ uygulamasında daha yüksek bulunmuştur. Elde edilen veriler ışığında, %4 $CaCl_2$ uygulaması ile çilek meyvelerinin raf ömürlerinin uzatılabileceği görülmüştür.

Anahtar Kelimeler: *Renk, Fitokimyasal, Antosiyanin, Antioksidan, $CaCl_2$*

Giriş

Çilek, *Fragaria* × *ananassa* Duch., *Rosales* takımı, *Rosaceae* familyası, *Fragaria* cinsi içerisinde yer alan (Hancock 1999), çeşitli bölgelere ve kültürel sistemlere uyarlanabilen çok yönlü bir üzümsü meyvedir (Chandler ve ark., 2012). Türkiye'de yetiştiriciliği 1970'li yıllarda yapılmaya başlanmıştır (Tarım ve Orman Bakanlığı [TOB], 2020). Çilek, değişik iklim ve toprak şartlarında yetiştirilebilen, adaptasyon kabiliyeti yüksek bir bitkidir ve bu sayede her mevsim üretimi yapılabilmektedir (Erenoğlu ve ark., 2000). 2020 yılında dünyada çilek üretimi 8 861 381 ton, Türkiye'de ise 546 525 ton olarak gerçekleşmiştir (FAO, 2020). Dünya çilek üretiminde %36.2 ile Çin birinci, %11.5 ile ABD ikinci, %9.7 ile Meksika üçüncü, %5.5 ile Türkiye dördüncü ve %5.2 ile Mısır beşinci sırada yer almaktadır (TOB, 2020). 2021 yılına gelindiğinde Türkiye'de çilek üretimi biraz daha artarak 669 195

tona çıkmıştır (TÜİK, 2021). Türkiye'de en çok çilek üretimi yapılan yerler; Mersin (%37.4), Aydın (%12.9), Konya (%9.3), Antalya (%9.3), Bursa (%9.3), Çanakkale (%5.5), Manisa (%5), Hatay (%2.1), Elazığ (%1.8) ve Sakarya (%1.3) illeridir (TOB, 2020). Çilek yetiştiriciliğinin bir diğer önemli tarafı, diğer tarımsal ürünlerle karşılaştırıldığında birim alandan elde edilen gelirin yüksekliği ve yapılan yatırımın kısa sürede dönüş yapması ile küçük aile işletmeciliğine uygun olmasıdır (Ağaoğlu, 1986; Aybak, 2000). Tüm bunlara ek olarak taze tüketiminin yanında işlenerek de (reçel, marmelât, dondurma ve pasta) tüketimi yapılmaktadır (Özdemir,1999; Erenoğlu ve ark., 2000; Kılıçel, 2005). Çilek üretiminin avantajları olduğu gibi dezavantajları da vardır. Çilek, bir üzümsü meyvedir ve hassas dokuları sebebi ile hasat sonrası çok çabuk bozulabilmekte ve bunun sonucunda üreticiden tüketiciye ulaşıncaya kadar meyvelerde büyük kayıplar yaşanabilmektedir. Yaşanan kayıpların önüne geçebilmek için yapılması gerekenlerin başında fizyolojik bozuklukların kontrolü gelmektedir. Bu noktada kalsiyum (Ca), temel bir makro besin maddesi olarak, bitkilerin temel fizyolojik süreçlerinin düzenlenmesine katkıda bulunur. Kalsiyum, meyvenin kalitesini ve depolanabilirliğini korumada önemli bir rol oynar ve hücre zarlarının bütünlüğünü koruduğu ve zar geçirgenliğini azalttığı ifade edilmektedir (Kou ve ark., 2015; Bhat ve ark., 2012). Kalsiyum laktat ve kalsiyum klorür gibi farklı kalsiyum tuzları ile hasat öncesi ve sonrası yapılan uygulamalar meyve ve sebzelerin fizyolojik bozukluklarının azaltılmasında etkili olmuştur (Tulin ve Eryol, 2019; Naser ve ark., 2018). Bu çalışmada, farklı dozlarda $CaCl_2$ uygulamaları ile depolamanın ardından rafta bekletilen çilek meyvelerinin kalite kayıplarını azaltmak amaçlanmıştır.

Materyal ve Yöntem

Çalışmada kullanılan meyveler 2021 yılının Mayıs ayında sabah erken saatlerde hasat edilerek Tokat Gaziosmanpaşa Üniversitesi Ziraat Fakültesi Bahçe Bitkileri Bölümü Meyvecilik Laboratuvarı'na getirilerek bir gün boyunca 1-2°C ve %90±5 bağıl nemde ön soğutma işlemine tabi tutulmuştur. Sonrasında meyveler üç farklı dozda (%0 (kontrol), %2 ve %4) kalsiyum klorür ($CaCl_2$) çözeltisi içerisine 5 dakika boyunca daldırılmıştır. Uygulama sonrası meyveler kurumaya bırakılmıştır. Daha sonra meyveler 3 tekerrürlü ve her tekerrürde 500 gram meyve olacak şekilde şalelere yerleştirilmiştir. Meyveler 1-2 °C'de ve %90±5 bağıl nemde 14 gün süreyle soğuk hava deposunda tutulmuştur. Hasat döneminin yanı sıra meyveler 7 ve 14. günlerde soğuk hava deposundan çıkarılmış ve 3 gün boyunca 21±1 ºC ve %60±5 bağıl nemde bekletilmiştir. 0+3, 7+3 ve 14+3 günlerde meyvelerde fiziksel ve kimyasal ölçümler yapılmıştır.

Meyvelerde Yapılan Ölçümler

Meyve Dış Rengi

Çilek meyvelerinin renk tayini Minolta renk ölçer cihazı (CR-400 model) ile yapılmıştır. Ölçüm yapılmadan önce renk ölçer, beyaz standart bir plakada kalibre edildikten sonra Hunter renk ölçüm parametreleri olan L, a ve b değerleri ile meyvelerin dış rengi ölçülerek belirlenmiştir. L, parlaklığı ifade eder ve 0 ile 100 arasında değerler alır. L değeri, parlaklık artarsa 100'e yaklaşır, parlaklık azalırsa 0'a yaklaşır. a, kırmızı ve yeşil renkleri temsil eder: a'nın pozitif değeri kırmızı ve tonlarını, negatif değeri yeşil ve tonlarını. b ise sarı ve mavi renkleri temsil eder: b'nin pozitif değeri sarı ve tonlarını, negatif değeri mavi ve tonlarını. Ölçümler her bir tekerrürden tesadüfen seçilen 10 meyve ile yapılıp, her meyvenin meyve dış rengi dikine iki yanından birer değer olacak şekilde yapılmıştır.

Meyve Eti Sertliği

Meyve eti sertliğini belirlemek için her tekerrüründen tesadüfen seçilen 10 meyvenin iki yanından olacak şekilde dijital sertlik test cihazı ile (Agrosta® 100, Fransa) ölçüm gerçekleştirilmiştir. Cihaz ölçüm aralığı sertlik değerleri 0-100 arasında değişmektedir.

Toplam asitlik (TA, %)

Meyvelerin toplam asitliğini belirlemek için püre haline getirilmiş meyvelerden 5 g tartılıp üzerine 95 ml saf su ilave edilmiştir. Çözelti pH'ı sabitlendikten sonra 0.1 N NaOH (sodyum hidroksit) solüsyonu pH 8.1 oluncaya kadar eklenmiştir. Tüketilen NaOH miktarına göre titrasyon asitliği, sitrik asit cinsinden formül ile hesaplanarak % olarak ifade edilmiştir.

Suda Çözünebilir Kuru Madde (SÇKM, %)

Meyveler homojenizetörde püre haline getirildikten sonra santifüj yapılarak meyve suları çıkartılmıştır. Sonrasında saf suya göre kalibre edilmiş dijital refraktometrede (Atago PAL-1, USA) okumalar yapılmış ve değerler % olarak ifade edilmiştir.

Toplam Fenolik Madde

Toplam fenol tayini Singleton ve Rossi (1965)' nin tarif ettiği şekilde Folin-Ciocalteu's kimyasalı kullanılarak yapılmıştır. Homojenizatörde püre haline getirilmiş meyve örneklerinden 2 g tartılıp üzerine aseton, su ve asetik asit (70:29.5:0.5) çözeltisi eklenerek 24 saat süresince ekstraksiyon işlemi uygulanmıştır. Sonraki gün dolaptan çıkarılan örneklerden 0.5 mL alınıp üzerine 0.5 mL Folin-Ciocalteu's kimyasalı ve 9 mL saf su eklenmiştir. 8 dk sonra ise 2.5 mL %7'lik sodyum karbonat ilave edilmiştir. İki saat inkübasyondan sonra mavimsi bir renk alan çözelti spektrafotometrede 750 nm dalga boyunda okuması yapılmıştır. Elde edilen değerler gallik asit cinsinden µg gallik asit eşdeğer/g taze ağırlık (ta) olarak hesaplanmıştır.

Toplam Antioksidan Kapasite

Meyvelerin toplam anitioksidan kapasitesi Özgen ve ark. (2006) göre TEAC (Trolox eşdeğer antioxidan kapasitesi) metodu kullanılarak yapılmıştır. TEAC için 7 nm ABTS (2,2'-Azino-bis 3- ethylbenzothiazoline-6-sulfonic acid) 2,45 mM potasyumbisülfat ile karıştırılarak +4 ^{0}C'de karanlıkta 12-16 saat bekletilmiştir. Daha sonra bu solüsyon 20 mM sodium asetat (pH 4.5) bafırı ile spectrofotometrede 734 nm dalga boyunda 0,700±0,01 absorbans olacak şekilde sadeleştirilmiştir. Sonunda 30 µL örneğin üzerine 2.97 mL hazırlanan TEAC çözeltisi eklenerek 10 dakika inkubasyon süresi sonunda spektrafotometrede 734 nm dalga boyunda okumalar yapılmıştır. Ölçüm sonrası absorbans değerleri Trolox (10–100 µmol/L) standart eğim çizelgesi ile hesaplanarak µmol Troloks eşdeğeri/g yaş ağırlık olarak sunulmuştur.

Toplam Monomerik Antosiyanin

Meyvelerdeki toplam monomerik antosiyanin tayini pH diferansiyel farkı yöntemiyle belirlenmiştir (Giusti ve ark., 1999). 0.3 mL örneklerin üzerine ayrı ayrı toplam hacim 3 mL olacak şekilde pH 1,0 ve pH 4,5 bafırları eklenerek, 15 dk sonra spectrofotometrede 520 ve 700 nm dalga boylarında okumaları yapılmıştır. Toplam antosiyanin miktarı, absorbanslar [pH 1,0 (A520–A700) - pH 4,5 (A520–A700)] µg pelargonidin-3-glucoside/g taze meyve olarak hesaplanmıştır (pelargonidin-3- glucoside: molekül ağırlığı 433.2, molar sönümleme katsayısı 22 400) .

İstatistiksel Analizler

Deneme her bir uygulamadaki her bir analiz dönemi için 3 tekerrürlü ve her tekerrürde 1 şale olacak şekilde kurulmuştur. Deneme neticesinde elde edilen veriler SAS paket programı kullanılarak varyans analizine tabii tutulduktan sonra uygulama ortalamaları arasındaki farkın önemli olup olmadığı Tukey çoklu karşılaştırma testi yapılarak belirlenmiştir.

Bulgular ve Tartışma

Meyve dış Rengi

Meyve dış rengine ait L*, a* ve b* değerleri Çizelge 1'de verilmiştir. L* değerlerinde sadece 7 günlük depolamanın ardından 3 gün rafta bekletilen meyvelerde depolama süresi ve $CaCl_2$ uygulamalarından kaynaklanan önemli bir değişim gözlemlenmiştir. % 4 $CaCl_2$ uygulamasında, yedi günlük depolamanın ardından 3 gün rafta bekletilen meyvelerin L* değeri diğer ölçüm dönemlerinde belirlenen L* değerlerinden daha düşük çıkmıştır. Hem kontrol hem de $CaCl_2$ uygulamalarında, ilk 3 günlük raf ömrü sonunda ölçülen a değerinin depolama süresine bağlı olarak azalma eğilimi gösterdiği tespit edilmiştir. 14 günlük depolamanın ardından 3 gün rarfta beletilen meyvelerde, %2 $CaCl_2$ uygulanan mevelerin kabuk rengi a değeri diğer uygulamalardan daha yüksek bulunmuştur. Uygulamaların b değeri üzerine etkisi depolama süresine bağlı olarak farklılık göstermiştir. 7 günlük depolamanın ardından 3 gün rafta bekletilen meyvelerde her iki $CaCl_2$ uygulaması da b* değerinde azalmaya neden olmuştur. 14 günlük depolamanın ardından 3 gün rafta bekletilen meyvelerde ise %2 $CaCl_2$ uygulamasının b* değeri kontrol ve %4 $CaCl_2$ uygulamasının b* değerlerinden daha yüksek çıkmıştır.

Çizelge 1. Çilek meyvelerinde farklı $CaCl_2$ dozlarının raf ömrü boyunca meyve dış rengi (L* a*b*) üzerine etkileri

Uygulama (%$CaCl_2$)	**L***		
	0+3	7+3	14+3
Kontrol	34,17 Aa	33,01 Aa	32,94 Aa
2	34,17 Aa	32,93 Aa	32,85 Aa
4	34,17 Aa	31,70 Ba	33,53 Aa
	a*		
	0+3	7+3	14+3
Kontrol	29,44 Aa	28,00 ABa	26,66 Bb
2	29,44 Aa	27,44 Ba	28,24 ABa
4	29,44 Aa	27,07 Ba	25,77 Bb
	b*		
	0+3	7+3	14+3
Kontrol	13,02 Aa	11,86 Aa	8,87 Bb
2	13,02 Aa	10,25 Ba	12,69 Aa
4	13,02 Aa	10,25 Ba	9,45 Bb

*Aynı satırda aynı büyük harfle gösterilen raf ömrü ortalamaları arasında ve aynı sütunda aynı küçük harfle gösterilen uygulama ortalamaları arasındaki farklar önemli değildir ($P<0.05$).

Benzer konuda daha önce yapılan çalışmalardan birinde (Demir 2014), $CaCI_2$ ve lysophosphatidylethanolamine uygulamalarının çileğin dış rengi (L, a, b, C, H°) parametrelerinde önemli bir değişme neden olmadığı ifade edilmiştir. Bu çalışmada da benzer şekilde L değerinde $CaCI_2$ uygulamalarından kaynaklanan önemli bir değişim gözlenmemiş ancak a ve b değerlerinde bazı önemli faklılıkların ortaya çıktığı tespit edilmiştir. Bu tür farklı

sonuçlar, kullanılan çeşitlerin faklılığından kaynaklanmış olabilir. Depolama ve raf ömrü süresinde renk gelişimi üzerinde yapılan çalışmalarda farklı sonuçlar rapor edilmiştir. Akın, (2014) 12 gün modifiye atmosferde depoladıktan sonra 2 gün rafta beklettiği çilek meyvelerindeki renk parametlerini ölçmüş ve muhafaza başlangıcına göre renk değerlerinde azalmaların olduğunu bildirmiştir. Diğer taraftan Öz ve Kafkas (2015) çilekte yapmış oldukları bir çalışmada, 12 günlük muhafaza süresi boyunca ölçülen L*, a* ve b* renk parametrelerinin başlangıç değerlerine yakın bulunduğunu ve istatistiksel açıdan önemli bir farkın olmadığını belirtmiştir. Bu çalışmada, depolama süresi depolamanın ardından rafta bekletilen meveylerin L değerinde önemli bir değişime neden olmazken, a ve b değerlerinde bir miktar düşüşe neden olmuştur. Bu tür farklı sonuçlar depolama koşulları ve çalışmalarda kullanılan çeşitlerin farklılığı yanında hasat önceki gelişme döneminde uygulanan kültürel işlemlerin farklılığından da kaynaklanmış olabilir.

Meyve Eti Sertliği, Titre Edilebilir Asitlik, SÇKM

Çizelge 2'de meyve eti sertliği, titre edilebilir asitlik ve SÇKM değerleri verilmiştir.

Meyve eti sertliği değerlerinde, depolama süresi ve $CaCl_2$ uygulamalarından kaynaklanan önemli farklılıklar görülmüştür. 7 günlük depolamanın ardından 3 gün rafta bekletilen meyvelerin meyve eti sertliği değerleri % 4 $CaCl_2$ uygulamasında, diğer ölçüm dönemlerinde belirlenen değerlerden daha yüksek çıkmıştır. Son ölçüm tarihine gelindiğinde (14+3) tüm uygulamalarda meyve eti sertliği azalmış, en yüksek değer yine % 4 $CaCl_2$ uygulamasından elde edilmiştir.

Titre edilebilir asit (TA, %) değerleri depolama süresi ve $CaCl_2$ uygulamaları sonucunda önemli değişikliklere uğramıştır. 7 günlük depolamanın ardından 3 gün rafta bekletilen meyvelerde uygulamalara bağlı olarak değişiklik meydana gelmiştir: Kontrol ve %2 $CaCl_2$ uygulamalarına kıyasla %4 $CaCl_2$ uygulaması TA değerinde azalmaya neden olmuştur. 14 günlük depolamanın ardından 3 gün rafta bekletilen meyvelerde ise TA değerlerinde düşüş yaşanmıştır. Burada en yüksek TA değerine %4 $CaCl_2$ uygulamasından ulaşılmıştır.

SÇKM değerlerinde depolama süresi ve $CaCl_2$ uygulamaları sonucunda önemli değişiklikler meydana gelmiştir. Uygulamaların SÇKM değeri üzerine etkisi depolama süresine bağlı olarak farklılık göstermiştir. 7 günlük depolamanın ardından 3 gün rafta bekletilen meyvelerde SÇKM değerleri düşmüş, her iki $CaCl_2$ uygulamasına kıyasla kontrol uygulamasında SÇKM değeri daha düşük çıkmıştır. 14 günlük depolamanın ardından 3 gün rafta bekletilen meyvelerde ise %4 $CaCl_2$ uygulamasının SÇKM değeri diğer uygulamalarınkinden daha yüksek çıkmıştır.

Çizelge 2. Çilek meyvelerinde farklı $CaCl_2$ dozlarının raf ömrü boyunca meyve eti sertliği, toplam asitlik (%), sçkm (%) üzerine etkileri

Uygulama (%$CaCl_2$)	**Meyve Eti Sertliği**		
	0+3	7+3	14+3
Kontrol	52,06 Aa	51,21 Ab	48,75 Bab
2	52,06 Aa	52,40 Ab	48,03 Bb
4	52,06 Ba	56,60 Aa	50,42 Ba
	Titre Edilebilir Asit (%)		
	0+3	7+3	14+3
Kontrol	1,57 Aa	1,58 Aa	1,48 Bab
2	1,57 Aa	1,59 Aa	1,47 Bb
4	1,57 Aa	1,54 ABb	1,52 Ba
	SÇKM (%)		
	0+3	7+3	14+3
Kontrol	9,70 Aa	8,36 Ca	8,66 Bb
2	9,70 Aa	9,10 Ba	8,93 Bb
4	9,70 Aa	9,03 Ba	9,36 Aa

*Aynı satırda aynı büyük harfle gösterilen raf ömrü ortalamaları arasında ve aynı sütunda aynı küçük harfle gösterilen uygulama ortalamaları arasındaki farklar önemli değildir ($P<0.05$).

Meyve eti sertliği açısından literatür incelenirse, Öz ve Kafkas, (2015) yaptıkları çalışmada, 12 gün boyunca 5 °C'de ve %85-90 bağıl nemde polivenilpropilen kutularda tutulan 'Festival' çilek çeşidi meyvelerin muhafaza süresinin sonunda meyve eti sertliklerinin düştüğünü belirtmiştir. Benzer sonuçlar Rahimi ve ark., (2018) tarafından da ifade edilmiştir: $CaCl_2$ ve kitosan uygulamaları sonucunda çileklerin meyve eti sertlikleri muhafaza süresi boyunca azalmıştır. Elde ettiğimiz sonuçlar bu iki çalışma ile uyum içerisinde olmuştur. Nguyen ve ark., (2020) tarafından yapılan başka bir çalışmada, hasat sonrası çileklere nano-kitosan kaplama ve $CaCl_2$ uygulaması yapılarak meyveler 4 ºC'de 15 gün boyunca muhafaza edilmiştir. Muhafaza süresince meyvelerin sertliği ilk başlarda azalırken 3. günden sonra meyve sertliklerinin arttığı belirtilmiş ve bu artışta özellikle %3 ve %4'lük $CaCl_2$ uygulamalarının daha etkili olduğu rapor edilmiştir. Bizim çalışmamızda da %4 $CaCl_2$ uygulaması meyve eti sertliğini daha iyi muhafaza etmiştir.

Daha önce yapılan çalışmalarda, çileklerin toplam asit içeriklerinin muhafaza süresi sonunda azaldığı rapor edilmiştir (Rahimi ve ark., 2018; Akın, 2014). Yapılan bu çalışmada da çileklerin toplam asit içeriği raf ömrü süreleri boyunca azalmış ve yapılan uygulamalar sonucunda değişiklik göstermiştir. %2 $CaCl_2$ ve kontrol uygulamalarına kıyasla %4 $CaCl_2$ uygulamasında toplam asit içeriği daha iyi muhafaza edilmiştir.
Olgunlaşma olayı sırasında meyvelerin solunum sürecinde organik asitlerin tüketildiği ve bunun TA'nın azalmasına ve SÇKM değerlerinin artışına neden olduğu bildirilmektedir (Hosseinifarahi ve ark., 2020). Yaptığımız çalışma sonucunda, TA değerlerinde azalma meydana gelmiştir fakat, SÇKM değerlerinde de azalma meydana gelmiştir. Öz ve Kafkas, (2015) ve Korkut, (2019) da yaptıkları çalışma sonucunda SÇKM değerlerinin azaldığını bildirmiştir. Bu konuda Öz ve Kafkas, (2015) SÇKM değerlerindeki düşüşlerin, çilek meyvelerinde artan solunum hızından kaynaklanabileceğini ifade etmiştir.

Toplam Fenolik Madde, Toplam Antioksidan Kapasite, Toplam Monomerik Antosiyanin

Çizelge 3.de toplam fenolik madde, toplam antioksidan ve toplam monomerik antosiyanin değerleri verilmiştir.
Toplam fenolik madde değerleri, depolama süresi ve uygulamalardan kaynaklı önemli değişikliklere uğramıştır. İlk 3 günlük raf ömrü sonunda ölçülen toplam fenol değerlerinin 7+3 dönemine kadar artma eğilimi gösterdiği tespit edilmiştir. 7 günlük depolamanın ardından 3 gün rafta bekletilen meyvelerin, kontrol ve %2 $CaCl_2$ uygulamalarına kıyasla %4 $CaCl_2$ uygulaması sonucunda toplam fenol değeri daha yüksek çıkmıştır. 14 günlük depolamanın ardından 3 gün rafta bekletilen meyvelerin toplam fenol içeriğinde düşüşler görülmüştür. Burada yine %4 $CaCl_2$ uygulamasında toplam fenol içeriği daha yüksek bulunmuştur.
Toplam antioksidan kapasite değerlerinde, kontrol uygulaması hariç, depolama sürelerinden kaynaklı önemli farklılıklar bulunmuştur. İlk 3 günlük raf ömrü sonunda ölçülen toplam fenol değerinin %4 $CaCI_2$ uygulaması sonucunda 7+3 dönemine kadar artma eğilimi gösterdiği tespit edilmiştir. 7+3 döneminden sonra $CaCI_2$ uygulamalarında, toplam antioksidan kapasite değerleri düşüşe geçmiştir. Nitekim, 14 günlük depolamanın ardından 3 gün rafta bekletilen meyvelerin en yüksek toplam antioksidan kapasite değeri kontrol uygulamasından elde edilmiştir.
Toplam monomerik antosiyanin değerlerinde, depolama süresi ve uygulamalardan kaynaklı önemli farklılıklar meydana gelmiştir. Tüm uygulamalarda, ilk 3 günlük raf ömrü sonunda ölçülen antosiyanin değerleri, 7+3 dönemine kadar artış göstermiştir. Burada en yüksek toplam monomerik antosiyanin değerine %4 $CaCI_2$ uygulamasından ulaşılmıştır. 7+3 döneminden sonra kontrol hariç $CaCI_2$ uygulamalarında, meyvelerin antosiyanin içeriğinde düşüşler görülmüştür. 14 günlük depolamanın sonuna gelindiğinde 3 gün rafta bekletilen meyvelerde en yüksek toplam monomerik antosiyanin değeri kontrol uygulamasından elde edilmiştir.

Çizelge 3. Çilek meyvelerinde farklı $CaCl_2$ dozlarının raf ömrü boyunca toplam fenolik madde, toplam antioksidan ve toplam monomerik antosiyanin üzerine etkileri

Uygulama (%$CaCl_2$)	**Toplam Fenolik Madde (µg GAE/g ta)**		
	0+3	7+3	14+3
Kontrol	2760,56 ABa	2818,89 Ab	2573,89 Bb
2	2760,56 Aa	2802,22 Ab	2499,72 Bb
4	2760,56 Ca	3529,72 Aa	3246,39 Ba
	Toplam Antioksidan Kapasite (µmol TE/g ta)		
	0+3	7+3	14+3
Kontrol	17,42 Aa	17,71 Aa	16,95 Aa
2	17,42 Aa	17,94 Aa	15,27 Bb
4	17,42 Ba	19,14 Aa	16,36 Bab
	Toplam Monomerik Antosiyanin (µg cy-3-glu/g ta)		
	0+3	7+3	14+3
Kontrol	178,39 Ba	232,75 Aab	219,05 Aa
2	178,39 Ba	218,53 Ab	180,45 Bb
4	178,39 Ba	241,09 Aa	182,90 Bb

*Aynı satırda aynı büyük harfle gösterilen raf ömrü ortalamaları arasında ve aynı sütunda aynı küçük harfle gösterilen uygulama ortalamaları arasındaki farklar önemli değildir ($P<0.05$).

Üzümsü meyveler, antioksidan aktiviteye sahip çok çeşitli flavonoidler (flavan-3-oller, flavonoller, antosiyaninler, prosiyanidinler) ve fenolik asit türevleri (hidroksisinnamik, ellajik) bakımından zengindir (González-Aguilar ve ark., 2008; Heinonen ve ark., 1998). Meyvelerde bulunan bu fitokimyasallar ve sahip oldukları antioksidan aktiviteleri; çeşide, agronomik koşullara, büyüme mevsimine, hasat olgunluğuna, ışığa ve depolama koşullarına göre değişiklik gösterebilmektedir (Kalt ve ark., 2008; Howard ve ark., 2003; Connor ve ark., 2002; Wang ve Stretch, 2001; Wang ve Lin, 2000). Nitekim çalışmamız sonucunda da, raf ömrü süresi boyunca, çileklerin fitokimyasal içeriğinde değişmeler meydana gelmiştir. Raf ömrünün son gününde, toplam fenolik madde içeriği; kontrol ve %2 $CaCI_2$ uygulamları sonucunda azalırken, %4 $CaCI_2$ uygulamasında artmıştır. Daha önce yapılan bir çalışmada, çileklerin muhafaza süresi boyunca toplam fenol içeriklerinin azaldığı rapor edilmiştir (Çeler ve ark.,

2019). Başka bir çalışmada ise, erik meyvelerinin muhafaza süresi boyunca toplam fenol içeriklerinde dalgalanmaların olduğu, en iyi sonuçların 20.günde ultrasound+$CaCl_2$ uygulamasında görüldüğü bildirilmiştir (Bal, 2016). Yaptığımız çalışma, literatürde ifade edilenlerle uyum içerisinde olmuştur.

Raf ömrünün sonunda, çileklerin toplam antioksidan kapasiteleri %2 $CaCI_2$ uygulamasında azalırken, kontrol ve %4 $CaCI_2$ uygulamasında önemli bir değişikliğe uğramamıştır (Çizelge 3.). Bu konuda literatüre bakıldığında, Korkut (2019) yaptığı çalışmasında, raf ömrü süresi sonunda (15+2) çileklerin toplam antioksidan kapasitelerinin azaldığını belirtmiştir. Benzer sonuçlar Nguyen ve ark. (2020) tarafından da bildirilmiştir.

Çalışmamızda, çileklerin toplam monomerik antosiyanin içerikleri 7+3. günde tüm uygulamalarda artmış, 14+3. günde ise kontrol uygulaması hariç $CaCl_2$ içeren uygulamalarda azalmıştır. Çilek üzerine yapılan önceki bir çalışmada Rahimi ve ark. (2018), üç gün muhafaza edilen meyvelerde, farklı dozlarda $CaCl_2$ ve kitosan uygulamaları sonucunda, antosiyanin miktarının arttığını belirtmiştir. Bu sonuç, çalışmamızın 7+3 döneminde yapılan ölçümleri ile parelellik göstermektedir. Korkut (2019) ise yaptığı çalışmada, çileklerin muhafaza (15 gün) ve raf ömrü (15+2 gün) sonunda toplam monomerik antosiyanin içeriğinde düşüşler olduğunu bildirmiştir. Bu ise çalışmamızın 14+3 döneminde yapılan ölçümler ile benzerlik göstermektedir.

Sonuç

Hasat sonrası $CaCl_2$ uygulamalarının çileğin raf ömrüne etkisinin incelendiği bu çalışmada, kalsiyum klorürün herhangi bir olumsuz etkisine rastlanmamakla birlikte olumlu etkileri görülmüştür. Raf ömrü sonunda, L* değerlerinde önemli değişiklikler olmamıştır. En yüksek a* ve b* değerleri, kontrol ve %4 $CaCl_2$ uygulamalarına kıyasla %2 $CaCl_2$ uygulamasında görülmüştür. Meyve eti sertliği, toplam asit içeriği, SÇKM ve toplam fenolik madde içeriği %4 $CaCl_2$ uygulamasında daha yüksek bulunmuştur. En yüksek toplam antioksidan kapasite ve toplam monomerik antosiyanin içeriği ise kontrol uygulamasında tespit edilmiştir. Elde edilen veriler ışığında, %4 $CaCl_2$'un Monterey çeşidi çilek meyvelerinin kalite özelliklerini muhafaza etmesi açısından en iyi doz olduğu belirlenmiştir.

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Rooting Performances of Promising Black Mulberry (*Morus nigra* L.) Genotypes Determined in Tokat Province under Same Environmental Conditions

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Abstract

In this study, it was aimed to examine the rooting performance of hardwood cuttings taken from the promising black mulberry genotypes Kemalpaşa, Yelpe, Merkez 3, Merkez 6, Kocacık, Çamdere and Merkez 7 determined in the province of Tokat under the same environmental conditions. All cuttings were immersed in 6000 ppm IBA solution for 5 seconds before planting and planted on heated bottom tables. The cuttings, which were kept in rooting units for about 3 months, were then removed and measurements were made on them. As a result of the study, statistically differences were found in root length, root diameter, root number, callus formation rate and rooting rates in the parameters examined. There was no statistically significant difference between genotypes in decay rates. Decay rates of genotypes are between 12.96% - 41.67%, callus formation rates are between 70.83% - 95.39%, rooting rates are between 60.41% - 92.64%, root lengths are between 5.85 - 7.52 cm, root diameters are between 1.42 - 1.75 mm, and root numbers are between 7.87 - 12.67 root/cutting has taken values. In the light of the information obtained as a result of the study, it was determined that Yelpe, Çamdere and Merkez 6 genotypes showed high rooting success. These results are important in terms of shedding light on the researches to be done in order to determine the variety studies and the performance of the saplings. It is also a determining factor for enterprises producing saplings.

Key Words: *IBA, Callus, Decay, Hardwood cutting*

Tokat İlinde Belirlenen Ümitvar Kara Dut (*Morus nigra* L.) Genotiplerinin Aynı Ortam Koşullarındaki Köklenme Performansları

Özet

Bu çalışmada, Tokat ilinde belirlenmiş Kemalpaşa, Yelpe, Merkez 3, Merkez 6, Kocacık, Çamdere ve Merkez 7 ümit var kara dut genotiplerinden alınan odun çeliklerinin aynı ortam koşullarında köklenme performanslarının incelenmesi amaçlanmıştır. Bütün çelikler dikim öncesi 5 saniye süresince 6000 ppm IBA çözeltisine batırılıp alttan ısıtmalı masalara dikilmiştir. Yaklaşık 3 ay köklendirme ünitelerinde bekletilen çelikler daha sonra çıkarılıp üzerlerinde ölçümler yapılmıştır. Çalışma sonucunda, incelenen parametrelerde kök uzunluğu, kök çapı, kök sayısı, kallus oluşum oranı ve köklenme oranlarında istatistiki açıdan farklar tespit edilmiştir. Çürüme oranlarında ise genotipler arasında istatistiki açıdan önemli bir fark bulunmamıştır. Genotiplerin çürüme oranı %12.96 - %41.67, kallus oluşturma oranları %70.83 - %95.39, köklenme oranları %60.41 - %92.64, kök uzunlukları 5.85 – 7.52 cm, kök çapları 1.42 – 1.75 mm ve kök sayıları 7.87 – 12.67 kök/çelik arasında değerler almıştır. Çalışma sonucunda elde edilen bilgiler ışığında Yelpe, Çamdere ve Merkez 6 genotiplerinin yüksek köklenme başarısı gösterdiği tespit edilmiştir. Bu sonuçlar çeşit çalışmaları ve fidan performanslarının belirlenmesi amacıyla yapılacak araştırmalara ışık tutması açısından önem arz etmektedir. Ayrıca fidan üretimi yapan işletmeler için de belirleyici nitelik taşımaktadır.

Anahtar Kelimeler: *IBA, Kallus, Çürüme, Odun çeliği*

Giriş

Dut (*Morus spp.) Moraceae* familyasına ait olup başta Afrika ve Güney Amerika'nın kuzeybatısı olmak üzere dünyanın birçok bölgesine yaygın olarak dağılmıştır. Anadolu'da yetiştiriciliği önceden beri bilinmektir (Özbek, 1977). Dolayısıyla Türkiye'de önemli bir genetik dut varyasyonu vardır. Yetiştiriciliği yoğun yapılan dut türleri ise Beyaz dut (*Morus alba*), Kırmızı dut (*Morus rubra*) ve Karadut (*Morus nigra*)'tur. Ülkemiz meyveciliği açısından önemli bir yere sahip olan dut, zengin besin içeriği ve birçok kulanım alanından faydalanılması sebebiyle giderek önemi artmıştır. Dut bitkisinin yapraklarının ipek böceği yetiştiriciliğinde ve gövde kabuğunun idrar yolu hastalıklarının tedavisinde kullanıldığı bilinmektedir. Dut meyvesinin ise taze tüketiminin yanında şurup, reçel ve farmakoloji gibi birçok alanda kullanımı mevcuttur. Halk arasında özellikle karadutun ağız yaralarına iyi geldiği ve kalp rahatsızlıkları yaşayan kişilerin taze meyvesini tükettikleri bilinmektedir. Besin içeriği üzerine yapılan çalışmalarda araştırmacılar karadutun kayda değer antosiyanin ve antioksidan içeriğine sahip olduklarını belirtmişlerdir (Wang ve ark., 1997; Stintzing ve ark., 2002; Özgen ve ark., 2009). Bununla birlikte karadut her geçen gün kullanım alanının artmasına ve pazar talebinin yükselmesiyle aranan bir meyve olmuştur. Ancak karadutta bu olumlu gelişmelerle birlikte çözülmesi gereken bazı önemli sorunlar da vardır. Bu sorunların başında fidan üretiminde yaşanan sorunlar gelmektedir. Fidan üretiminde karşılaşılan sorunlar ise aşıyla çoğaltmada başarı oranın düşük olması ve karadut bitkisinin kök oluşumunda yaşanan sıkıntılardır. Fidan üretiminde çeşitli vejatatif

çoğaltma metotları kullanılmaktadır. Bu metotlar; doku kültürü, aşılama, daldırma ve çelikle çoğaltmadır (Yıldız ve ark., 2009). Karadut ağaçlarının sürgünleri kesildiğinde süt salgılar (Güneş,2013; Saraçoğlu ve ark., 2016). Bu süt salgısı aşılamada, aşı bölgesinin deformasyona uğramasına neden olmaktadır. Bu da aşıyla üretimde zorluklar meydana getirmektedir. Çelikle çoğaltma karadut gibi bitkilerde pratik ve ucuz bir yöntemdir. Çelikle çoğaltmadaki en büyük sorunlardan biri ise köklenme sorunudur. Köklenme sorunu yaşayan çeliklerde büyüme düzenleyiciler güçlü kök sistemi ve köklenme hızını artırabilmektedir (Kumlay ve Eryiğit, 2011). Oksin grubu büyüme düzenleyiciler tarımda kullanılan en yaygın hormonlardır (Halloran ve Kasım, 2002; Kumlay ve Eryiğit, 2011). Oksin grubundan olan IBA (Indol-3-Bütirik Asit) çeliklerin köklenmesinde en çok kullanılan hormondur (Kaynak ve Ersoy, 1997). IBA'nın köklenmeyi teşvik edip kök sayısı ve kalitesini artırmasının yanında etki süresi de daha uzundur. Karadutta köklenme üzerine yapılan çalışmalarda farklı sonuçlar ortaya çıkmıştır. Yapılan bazı çalışmalarda düşük köklenme oranları bulunurken (Ayfer ve ark., 1986; Ünal ve ark., 1992; Koyuncu ve Şenel, 2003; Karadeniz ve Şişman 2004; Koyuncu ve ark., 2004; Yıldız ve ark., 2009), bazı çalışmalarda ise yüksek köklenme oranlarına ulaşılmıştır (Yıldız ve Koyuncu, 2016; Erdoğan ve Aygün, 2006). Karadut çalışmalarında henüz tescilli bir çeşit olmamasından dolayı yapılan araştırmalarda bölgedeki karadut ağaçları kullanılmaktadır. Çalışmamızda kullandığımız karadut genotipleri daha önce Dinçer ve Saraçoğlu (2020) 'nun Tokat bölgesinde fenolojik, morfolojik ve pomolojik özelliklerini inceledikleri karadut genotiplerinden ümitvar olan 7 genotip kullanılmıştır. Bu çalışmada, seçilmiş ümitvar genotiplerin aynı ortam şartlarında 6000 ppm IBA' ya daldırılıp köklenme performanslarının belirlenmesi amaçlanmıştır.

Materyal ve Yöntem

Çalışma 2020-2021 yıllarında Tokat Gaziosmanpaşa Üniversitesi Tarımsal Araştırma ve Uygulama Merkezinde'ki köklenme serasında yürütülmüştür. Çalışmada daha önceden belirlenen 7 farklı genotiplerden alınan odun çelikleri 15 cm kesilerek her genotipten 15 adet çelik olacak şekilde ve üç tekerrür halinde dizayn edilmiştir. Dikime hazırlanan çelikler dikim öncesi 6000 ppm IBA çözeltisine batırılıp yaklaşık 5 saniye beklendikten sonra perlit ile doldurulmuş sıcaklık kontrollü (22±2 °C) masalara dikimi gerçekleştirilmiştir. Yaklaşık 3 ay köklendirme ünitelerinde bekletilen çelikler daha sonra sökülüp gerekli ölçümler yapılmıştır. Deneme tam şansa bağlı deneme desenine göre 3 tekerrürlü olacak şekilde kurulmuş ve her tekerrürde 15 çelik kullanılmıştır.

Araştırmada İncelenen Özellikler

Kallus oluşum oranı (%): Yara dokusu oluşturan çeliklerin sayısının toplam çelik sayısına oranı (%) olarak ifade edilmiştir.

Köklenme oranı (%): Adventif kök oluşturan çeliklerin sayısının toplam çelik sayısına oranı (%) olarak ifade edilmiştir.

Çürüme oranı (%): Kök bölgesinde çürüme (köklerin yumuşaması ve kararması) gösteren çeliklerin sayısının toplam çelik sayısına oranı (%) olarak ifade edilmiştir.

Kök sayısı(adet): Her tekerrürde çeliklerde oluşan kökler sayılıp ortalamaları alınmıştır.

Kök uzunluğu(mm): Köklenmiş çeliklerin kök uzunlukları bir cetvel yardımıyla ölçülerek ortalamaları cm olarak ifade edilmiştir.

Kök çapı(mm): Köklenmiş çeliklerin kök çapları dijital kumpasla ölçülerek ortalamaları mm olarak ifade edilmiştir.

İstatistiksel Analiz: Deneme neticesinde elde edilen veriler SAS paket programı kullanılarak varyans analizine tabii tutulduktan sonra uygulamaların ortalamaları arasındaki farkların önemli olup olmadığı Duncan çoklu karşılaştırma testi ($P<0.05$) yapılarak belirlenmiştir.

Bulgular ve Tartışma

Çürüme oranı, kallus oranı, köklenme oranı

Yapılan bu çalışmada Dinçer ve Saraçoğlu'nun (2020) önceki çalışmasında belirlenen ümitvar genotiplerin köklenme performansları değerlendirilmiştir. Karadut çeliklerinin çürüme oranı, kallus oranı ve köklenme oranları Çizelge 1'de verilmiştir. Çürüme oranları açısından genotipler arasında farklılık oluşmasına rağmen bu farklılıklar istatistiksel olarak önemli bulunmamıştır. Çürüme oranları Merkez 7 genotipinde %41.67, Merkez 6 genotipinde ise %12.96 olarak tespit edilmiştir. Bu değerler arasında istatistiki açıdan bir farklılık oluşmamıştır. Konuyla ilgili benzer çalışmalara bakıldığında, Macit, (2019) karadut çelikleri ile yapmış olduğu çalışmasında, çeliklerdeki en yüksek çürüme oranlarını sırasıyla %37.07 ve %31.68, en düşük çürüme oranlarını ise sırasıyla %15.57 ve %21.10 olarak bulduğunu bildirmiştir. Altuncu, (2019) ise farklı pH dozlarında IBA uygulamasının karadut köklenmesi üzerine etkilerini incelemiş ve en yüksek çürüme oranını %34.11, en düşük çürüme oranını %27.55 olarak bulduğunu rapor etmiştir. Macit, (2019) ve Altuncu, (2019)'nun bildirmiş oldukları değerler çalışmamızdaki çürüme oranıyla benzerlik göstermektedir. Çeliklerde meydana gelen çürümelerin köklenme ortamındaki aşırı nemlilikten kaynaklandığı düşülmektedir. Köklenme ortamının hava alma kapasitesinin arttırılması koşuluyla aşırı nemliliğin azalacağı dolayısıyla da çürüme oranlarının azalacağı beklenmektedir.

Bitkilerde meydana gelen yaralanmaların onarılması için yaralı bölgedeki hücrelerin farklılaşmasıyla yara dokusu meydana gelerek kallus oluşumu gerçekleşir. Çalışmadaki genotiplerin kallus oranı incelendiğinde en yüksek değer Çamdere genotipinde (%95.39) elde edilirken, en düşük kallus oluşumu Merkez 7 (%70.83) genotipinde tespit edilip bu iki genotip arasında istatistiki açıdan fark bulunmuştur. Çalışmamızda genotipler %70'in üzerinde kallus oluşumu gerçekleştirmiştir. Literatürde, kallus oluşumunun köklenme ile ilgili direk etkisinin olmadığı ancak çürüme oranını azalttığı ve çeliğin canlılık süresini uzattığına dair bilgiler mevcuttur. Bu yargıyı doğrular nitelikte çalışmamızda Merkez 7 genotipi en yüksek çürüme oranına sahipken aynı zamanda en düşük kallus oluşumuna sahiptir. Öte yandan diğer araştırmacılar çalışmamıza yakın yüksek kalluslenme değerleri tespit ettiklerini bildirmişlerdir (Saraçoğlu ve ark., 2016; Yıldız ve Koyuncu, 2016; Ekizoğlu, 2010).

Genotipler arasında en düşük köklenme oranı %60.41 ile Merkez 7 genotipinde tespit edilip diğer genotipler ile arasında istatistiksel açıdan fark bulunmuştur. İstatiksel açıdan farkın olmadığı genotipler arasında ise köklenme oranı %79.49 ile %92.64 arasında değerler almıştır. Bugüne kadar birçok araştırmacı karadut çeliklerinin köklenmesi üzerine yapmış oldukları çalışmalarda köklenme oranları açısından farklı sonuçlara ulaşmıştır. Yapılan çalışmalarda %60'ın üzerinde köklenme başarısına ulaşmış olan çalışmalar mevcuttur (Yıldız ve Koyuncu, 2016; Sezgin, 2009; Ekizoğlu, 2010; Erdoğan ve Aygün, 2006; Macit, 2019; Yağlioğlu, 2015; Altuncu, 2019; Saraçoğlu ve ark., 2016; Zenginbal ve Demir, 2018). Diğer araştırıcılar ise %60'ın altında köklenme değerlerine ulaşmıştır (Ünal ve ark., 1992; Karadeniz ve Şişman, 2004; Koyuncu ve ark., 2004; Yıldız ve ark., 2009; Özkan ve Arslan., 1996). Yapılan çalışmalar arasında köklenme üzerine bu denli farkın oluşmasına neden olacak birçok unsur vardır. Yıldız ve ark., (2009) yapmış oldukları çalışmada bu konuya değinip olabilecek sebepler arasında; genotipik farklılık, çelik alma zamanı, çelik alınan ağacın lokasyon ve beslenme durumu aynı zamanda ağaç yaşı ve uygulama farklılıklarının etki edebileceğini bildirmişlerdir. Yaptığımız çalışmada da meydana gelen farklılıklar sayılan bu sebeplerden kaynaklanmış olabilir.

Çizelge. 1 Karadut genotiplerinin çürüme oranı, kallus oranı ve köklenme oranı

Lokasyon	Çürüme Oranı (%) [öd]	Kallus Oranı (%)	Köklenme Oranı (%)
Kemalpaşa	13,33 ± 6,67	86,66 ± 7,70 AB	84,44 ± 4,44 A
Yelpe	22,34 ± 11,53	76,13 ± 9,52 AB	92,64 ± 4,46 A
Merkez 3	21,06 ± 2,04	82,27 ± 4,34 AB	79,49 ± 6,84 A
Merkez 6	12,96 ± 6,86	91,84 ± 4,13 AB	89,62 ± 1,96 A
Kocacık	36,39 ± 16,22	89,30 ± 5,57 AB	82,77 ± 3,89 A
Çamdere	21,56 ± 11,31	95,39 ± 2,31 A	90,63 ± 6,33 A
Merkez 7	41,67 ± 4,17	70,83 ± 8,33 B	60,41 ± 9,08 B

[Öd]: 0.05 seviyesinde ortalamalar arasındaki fark önemli değildir. Aynı harflerle gösterilen değerler istatistiki açıdan önemsizdir.

Kök uzunluğu, kök çapı ve kök sayısı

Karadut çeliklerinin kök uzunluğu, kök çapı ve kök sayısına ait değerler Çizelge 2'de verilmiştir. Genotiplerin kök uzunluğu değerlerinde istatistiki açıdan farklılıklar oluşmuştur. Kök uzunluğu 5.85 ve 7.52 cm arasında değerler almıştır. En yüksek kök uzunluğu değeri Merkez 3 genotipinde, en düşük ise Yelpe genotipinde tespit edilmiştir. Yapılan diğer çalışmalarda Zenginbal ve Demir (2018) 2.75 – 8.57 cm arasında, Sezgin (2009) ise 2.5- 6.16 cm arasında değerler bulduğunu bildirmiştir. Çalışmamızda bulmuş olduğumuz değerler literatürle uyum içerisinde olmuştur. Saraçoğlu ve ark., (2016) yaptıkları çalışmada, kök uzunluklarını 0 – 4.34 cm arasında bulmuştur. Bu değerler çalışmamıza kıyasla daha düşük kalmıştır. Yıldız ve Koyuncu, (2016) yaptıkları çalışmada kök uzunluğu değerlerinin 7.9 – 12.2 cm arasında olduğunu bildirmiştir. Bu değerler ise çalışmamıza kıyasla daha yüksek bulunmuştur.

Kök çapı açısından genotipler değerlendirildiğinde en yüksek değer 1.75 mm ile Kocacık genotipinde tespit edilmiştir. En düşük kök çapı değeri ise 1.42 mm ile Merkez 6 genotipinde belirlenmiştir. Literatürdeki yapılan diğer çalışmalarda Yıldız ve ark., (2009) 0 – 2.03 mm, Yağlıoğlu, (2015) 0.9 – 1.5 mm, Altuncu, (2019) 0.92 – 0.98 mm arasında değerler bulmuştur. Literatürde belirtilen bu sonuçlar, çalışmamızda elde ettiğimiz sonuçlarla uyum içerisinde olmuştur. Farklılık gösteren değerler ise yapılan uygulama ve çelik alma zamanı gibi kriterlerden kaynaklanmış olabilir.

Kök sayısı açısından bakıldığında, Merkez 3 genotipi Yelpe, Kocacık ve Çamdere genotiplerine kıyasla daha yüksek değerlere ulaşmıştır. Kök sayısı değerleri 7.87– 12.67 adet/çelik arasında değişiklik göstermiştir. Zenginbal (2018) yapmış olduğu çalışmada kök sayısı değerlerini 2.05 – 9.79 arasında bularak çalışmamıza nispeten yakın değerlere ulaşmıştır. Yapılan diğer çalışmalarda, Saraçoğlu ve ark., (2016) 0 – 2.97 arasında, Yıldız ve ark., (2009) 0 – 3.5 arasında, Yıldız ve Koyuncu, (2016) 1.9 – 5.9 arasında değerler bulduklarını bildirmiştir. Çalışmamıza kıyasla bu bulunan değerler düşük kalmıştır.

Çizelge 2 Karadut Genotiplerinin Kök Uzunluğu, Kök Çapı ve Kök Sayısı

Lokasyon	Kök Uzunluğu(cm)	Kök Çapı(mm)	Kök Sayısı (adet/çelik)
Kemalpaşa	7,01 ± 0,39 AB	1,72 ± 0,05 A	8,95 ± 0,95 AB
Yelpe	5,85 ± 0,42 B	1,68 ± 0,06 A	8,00 ± 0,96 B
Merkez 3	7,52 ± 0,34 A	1,54 ± 0,06 AB	12,67 ± 1,95 A
Merkez 6	6,03 ± 0,34 B	1,42 ± 0,04 B	11,46 ± 1,46 AB
Kocacık	6,60 ± 0,30 AB	1,75 ± 0,05 A	8,12 ± 1,03 B
Çamdere	6,98 ± 0,31 AB	1,62 ± 0,04 AB	7,87 ± 0,69 B
Merkez 7	6,05 ±0,35 B	1,65 ± 0,05 A	9,17 ± 1,33 AB

Aynı harflerle gösterilen değerler istatistiki açıdan önemsizdir ($p<0,05$).

Sonuç

Yapılan bu çalışmada Dinçer ve Saraçoğlu (2020) 'nun Tokat bölgesinde belirlemiş oldukları karadut genotipleri kullanılarak onların çelikle köklenme performansları incelenmiştir. Karadut üzerine yapılan bazı çalışmalara kıyasla yoğun köklenme oranı, kök sayısı ve kök uzunluğunda yüksek değerlere ulaşılmıştır. Bu yüksek değerlerin daha önceden belirlenmiş karadut genotiplerinin ön seleksiyonla seçilmiş olmasından kaynaklandığı düşünülmektedir. Elde edilen sonuçlarla birlikte ilerleyen zamanlarda, çalışmada kullanılan Kemalpaşa, Yelpe, Merkez 3, Merkez 6, Kocacık, Çamdere ve Merkez 7 karadut genotipleri üzerine çalışmaların devam etmesi ve sonunda bir çeşit ıslahına gidilecek yol haritası çizilmesi gerektiği düşünülmektedir. Ayrıca sonuçlar ticari fidan üretimi yapan firmalara önem arz etmektedir.

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Investigation of Antibacterial Activity of Aromatized Kombucha

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Abstract
Kombucha (Kombu tea) is the beverage obtained from fermentation of black or green tea with sugar via the kombucha scoby. Its market is on the rise all over the world. This is the result of the health benefits of kombucha raised by the polyphenols and probiotic bacteria in the beverage. Polyphenols make the beverage have antibacterial, anti-inflammatory and anticarcinogenic features, while probiotic bacteria make the beverage a functional drink because of its benefits for the gut flora. In this study, the kombucha was aromatized after the end of fermentation by addition of either lavender, sage, clove, or bay leaf and kept at the refrigerator for 24 hours. This was followed by the analysis of antibacterial activity of kombucha on *E. coli*, *P. aeruginosa*, *S. aureus*, and *S. mutans*. Moreover, a few dominant bacterial species were determined. The results showed that kombucha had antibacterial activity especially on *S. aureus* and this activity reduced by the addition of aromatizers.
Key Words: *Kombucha, antibacterial activity, aromatic plants*

Kombu Çayının Aromalandırılmasının Antibakteriyel Aktivitesi Üzerine Etkilerinin İncelenmesi

Özet
Kombuça (Kombu çayı) bakteri ve mayalardan oluşan bir çay mantarı tarafından siyah çay veya yeşil çayın ve şekerin fermente edilmesinden elde edilen içeceğe verilen addır. Dünya piyasasında payı giderek artan ve tüketimi gittikçe artan bir içecektir. Bunun nedeni içeriğindeki polifenoller ve probiyotik bakterilerdir. Polifenoller içeceğe antibakteriyel, anti karsinojen, anti enflamatuvar özellik kazandırırken, içeriğindeki probiyotikler de özellikle bağırsak florasına olan katkıları sebebiyle kombu çayının fonksiyonel bir içecek olmasını sağlamaktardır. Bu çalışmada probiyotik değerli bir içecek olan Kombuçanın fermentasyondan sonra lavanta, adaçayı, karanfil, defne yaprağı ile 24 saat buzdolabında bekletilmesi ile aromalandırılmasının kombuçanın antibakteriyel etkisi üzerinde etkisi *E. coli*, *P. aeruginosa*, *S. aureus*, ve *S. mutans* bakterileri üzerinde denenmiştir. Ayrıca hazırlanan kombuçalardaki baskın olan bakteri türü de tespit edilmiştir. Sonuçlar kombuçanın özellikle *S. aureus* üzerinde antibakteriyel etki gösterdiğini ve bu etkinin eklenen tıbbi aromatik bitkiler ile azaldığını göstermiştir.
Anahtar Kelimeler: *Kombuça, antibakteriyel aktivite, aromatik bitkiler*

Introduction

Kombucha is beverage formed by the fermentation of tea and sugar by a combination of yeasts and bacteria. The history of this drink goes back to ancient China, and nowadays a preferable drink worldwide, especially in Europe and USA. In 2020, the global kombucha market worth approximately 2.2 billion US dollars. Kombucha may contain a low concentration of alcohol (1-3%), but usually considered to be a non-alcoholic beverage. The microorganism combination that ferments tea and sugar is called SCOBY (Symbiotic Colony of Bacteria and Yeast) (Figure 1). The microorganisms which consist of yeast, acetic acid bacteria and lactic acid bacteria from a biofilm which results in the formation of this SCOBY pellicle on top of the liquid during the fermentation of tea and sugar, since the microorganisms are aerobic. The SCOBY gets thicker through the fermentation process and it can be reused for next fermentation processes. First, the brewed tea is mixed with table sugar (5-25%) and let to cool to room temperature. Then SCOBY from the previous process is placed on top of the liquid solution and the jar (usually glass) is covered with a porous clean cloth. The yeasts in the SCOBY metabolize sugar in the mix to ethanol which is the substrate for bacteria which form acetic acid as a result. At the end of 7-10 days of fermentation, SCOBY is removed and the beverage is ready to consume. The end product has a pH of 2.5-4.2. Lower or higher pH values are undesirable. The beverage is full of probiotic microorganisms which are very healthy and beneficial for human gut microbiota. This property makes the beverage more and more preferable in recent times and it is accepted as a functional beverage (Coelho et al., 2020; de Filippis et al., 2018).

The examples of acetic acid bacteria found in the SCOBY are *Acetobacter nitrogenifigens*, *Acetobacter aceti*, *Lactococcus species*, *Leuconostoc species*, *Lactobacillus brevis*, *Lactabacillus kefiranofaciens*, etc. The examples of yeast found in SCOBY are *S. cerevisiae*, *Brettanomyces bruxellensi*, *Zygosaccharomyces kombuchaensis*, *Hanseniaspora vineae*, etc. (Antolak et al., 2021).

The polyphenols are the bioactive chemicals found in kombucha which comes from the tea. Different tea types can result in different concentrations and types of polyphenols. Such bioactive chemicals are responsible for the health benefits of kombucha as well as the probiotic bacteria. They make kombucha have anti-carcinogenic, antibacterial, anti-diabetic features. In order to diversify the bioactive chemicals, different plant infusions and medicinal aromatic plants can be added to kombucha (Jakubczyk et al., 2020; Vázquez-Cabral et al., 2017). The

combination of polyphenols from different sources can hence make the beverage healthier. However, plant infusions or medicinal aromatic plants can themselves have antibacterial and anti-fungal effects which can decrease the bacterial number and diversity in kombucha. In this study we investigated the change of antibacterial activity of kombucha mixed with different plants after the end of fermentation process.

Materials and Methods

Black tea obtained from market was brewed with boiling drinking water. Table sugar (was added to the tea and let the solution cool down to room temperature. A SCOBY from a previous fermentation was washed with drinking water and placed into the tea-sugar solution. The head of jar was covered with a clean cloth (Figure 1). The preparations were done following hygiene rules. The jar was placed into a dark cupboard and let for 10 days for the fermentation to take place.

The dry medicinal aromatic plants used in this study (clove, lavender, sage, bay leaf) were bought from a market. After the fermentation was over and the SCOBY was removed, kombucha was aliquoted. The dry plants were added to the kombucha aliquots and they were kept at the refrigerator (4°C) for 24 hours.



Figure 1. Kombucha fermentation jar with the SCOBY on top of the solution (Original photo)

The bacteria used in the antibiogram test (*E. coli*, *P. aeruginosa, S. aureus*, and *S. mutans)* were obtained from Middle East Technical University, Ankara, Turkey. The bacteria were grown on blood agar and adjusted to be 0.5 McFarland. The bacteria were spread on Mueller Hinton agar plates and wells of 8mm diameter were formed with a sterile pipette tip. 100 µL kombucha mix were added to the wells. The plates were kept at 37°C for 24 h. The antibacterial activity of kombucha was evaluated by the measurement of clearance around the wells.

The pH of the samples was measured using a pH meter. The McFarland turbidity of the samples was measured using a densitometer. The statistics of the measurements were determined using Minitab 13. The results were analyzed with one-way and two-way ANOVA with the same software. The dominant bacterial species in kombucha samples was determined by spreading the sample on TSA agar followed by determination of three colonies using VITEK system. Each experiment was carried out in duplicate.

Results and Discussion

In this study, the fermented beverage kombucha prepared from black tea was aromatized with different medicinal aromatic plants. The antibacterial activities of each kombucha were tested against two Gram-positive and two Gram-negative bacteria. The clearance around the wells on the agar plates were measured to evaluate the antibacterial activity of each kombucha. The results of the well diffusion test are given in Table 1.

Table 1. Diameter of antibacterial activity around the wells. Values are given as mean ± SEM

	E. coli	*P. aeruginosa*	*S. aureus*	*S. mutans*
Control	11.0±0.00	10.0±0.00	15±1.41	8.0±0.00
Lavender	12.75±1.06	11.75±2.47	13.5±0.71	11.0±0.00
Sage	13.25±1.06	9.5±2.12	12.0±0.00	8.0±0.00
Clove	12.50.71	11.5±0.71	12.0±0.00	12.5±0.71
Bayleaf	12.5±0.71	11.0±2.83	13.25±0.35	13.25±0.35

The highest antibacterial activity of kombucha was seen against *S. aureus* in the control group where no aromatizer was added (p=0.039). Kombucha with sage had the lowest activity against the same bacterium. Also decrease of

antibacterial activity of the kombucha with sage was obvious against *P. aeruginosa* and *S. mutans*, too. This suggests that the antibacterial activity of kombucha decreases with aromatization with sage. Bay leaf usage in kombucha increased antibacterial activity compared to sage against *S. aureus*, *P. aeruginosa*, and *S. mutans*. The difference can be explained by the different cell wall structures of Gram positive and Gram-negative bacteria, as well as the polyphenols that can come with the plant aromatizers. Two-way ANOVA results revealed that the type of aromatic plant significantly affected the antibacterial activity ($p=0.014$). Moreover, interaction of bacterial species tested in this study and the plant species is significant ($p=0.007$).

Table 2. pH and McFarland turbidity values of kombucha samples. Values are given as mean ± SEM. * means significant difference ($p<0.05$).

	pH	McFarland Turbidity
Control	3.45±0.005	2.405±0.005
Lavender	3.65±0.145	2.45±0.05
Sage	4.10±0.03*	2.55±0.15
Clove	3.56±0.03	2.45±0.05
Bayleaf	3.51±0.00*	2.30±0.1

The pH of each kombucha was determined after 24 hours of aromatization. The results are given in Table 2. Moreover, the microorganism density in kombucha samples were measured as the McFarland turbidity. It is clear that the highest pH value was obtained in the kombucha aromatized with sage ($p=0.006$)., and the lowest is in the control. Moreover, kombucha with sage added has the highest turbidity (Table 2). For kombucha, the lowest pH acceptable is 3 and it should not be over 5. The bacterial combination and density would change the pH of the kombucha, as seen in this study. This can also be related to the decreased antibacterial activity as different pH values would support different types of bacteria in the mixture. Therefore, in order to detect the reason well, microbial analyses should be carried out to determine the bacterial and fungal flora in kombucha. In this study, only 3 bacterial species which were observed to be dominant were detected. They were *Staphylococcus hominis*, *Pasteurella pneumotropica* and *Leuconostoc mesenterroides.* The agar plates where the colonies were picked are given in Figure 2. *S. hominis* is a Gram positive, commensal bacterium normally found on human skin. It is known for its aerobic thioalcohol production. *Pasteurella pneumotropica* is a Gram-negative bacterium with both oxidative and fermentative metabolism It can produce acid from glucose (Public Health England, 2015). Therefore, this bacterium is one of the acid producing bacteria in the SCOBY. L. *mesenterroides* is a lactic acid bacterium used in the fermentation of vegetables (Zubaidah et al., 2020). Therefore, this bacterium is one of the many bacteria responsible for the fermentation process in kombucha making.



Figure 2. Agar plates with kombucha samples spread after dilution.

Conclusion

The probiotic beverage Kombucha is gaining attention day by day with an increased market value. The beverage is prepared by the fermentation of black or green tea and the resulting flavor is sometimes tried to be enriches together with the polyphenol ingredients of the beverage by adding different medicinal aromatic plants which are sources of polyphenols. Although, the polyphenols and bioactive chemicals can be enriched in the beverage, the plant additives can lower the diversity and number of probiotic bacteria in the beverage, since the bioactive compounds can themselves be antibacterial agents. Therefore, the aromatization of kombucha should be carried out by the consideration of lowered probiotic content. The consumers should be informed by this fact together with the enrichment of anti-carcinogenic, anti-inflammatory, anti-bacterial bioactive chemicals.

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ID: 675

Nutritional strategies particularly Lactic acid bacteria to reduce methane production in ruminants

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Abstract

Ruminant enteric fermentation is the single greatest anthropogenic source of agricultural methane and contributes significantly to global warming. As a result, creative ways to minimize methane emissions from cattle farms are essential to maintain long-term food production sustainability. Lactic acid bacteria (LAB), Gram positive bacteria that create lactic acid as a primary end product of carbohydrate fermentation, are one viable strategy. LAB are natural occupants of animals' intestines and are one of the most important families of bacteria employed in food fermentations. LAB are easily extracted from ruminant animals and are now employed as direct-fed microbials (DFMs) and silage inoculants on farms. While it has been hypothesized that LAB can be utilized to reduce methane generation in ruminant animals, research has been limited thus far, and compelling animal data to back up the hypothesis is absent. This study critically examined the existing research and offered a thorough analysis and overview of the possible usage and mechanisms of LAB as a methane mitigation method. Although some encouraging findings have been obtained, additional study is required to determine if the use of LAB may be an effective methane mitigation solution for ruminant animals.

Key Words: *Direct fed microbes, Lactic acid bacteria, Methane mitigation, Ruminants, Silage*

ID: 676

Investigation of Stray Dogs Problem in Sivas Province Animal Shelter Example

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Abstract

Parallel to the increasing number of pet breeding in Turkey, the increase in the number of dogs abandoned to the street or shelter creates significant problems both for the loyal friendly dogs of people and for the society.With this study, which is expected to serve to solve this increasing problem, the dog traffic in the animal shelter in Sivas province was investigated together with the reasons for abandonment. For this purpose, in this study, dog traffic in the animal shelter of Sivas province was investigated both quantitatively on the basis of years and the reasons for abandonment, as well as the attitudes and behaviors of the animal owners. In the study, besides the dog traffic records of the stray animal rehabilitation center operated by Sivas Municipality, the survey data made with the owners who left their dogs there were analyzed. According to the four-year records covering the years 2019-2022, the average number of dogs staying in the Sivas Municipality Animal Shelter is 1058 (963-1150), while the average number of dogs collected from the street per month is 50.7, the average number of spayed female and male dogs per month is 17.33 and 33.44, respectively. The average number of adopted female and male dogs was 2.8 and 4.3 respectively. The average number of dog deaths per month in the shelter was 21.9. Every month, an average of 15 dogs were released back to the point where they were taken after the spayed and treated at the animal shelter. In addition, a face-to-face survey was conducted with a total of 50 people (49 men, 1 women) who left their dogs in the shelter and 15 questions were asked to the participants, including the reasons for adopting/abandonment and form of care-feeding. While there was no statistically significant effect of marital status in the answers given by the participants to the questions, it was observed that their educational status had an effect on dog breeding due to dog ownership. Again, a relationship was found between the age of the dog owners and the level of vaccination of their dogs, and between the occupation of the dog owners and the reasons for dog abandonment. In addition, it has been understood that the dog owners' living in a province, district or village is also a determining factor in their dog breed preferences. As a result, it can be said that it would be beneficial to deal with the process in many different provinces with more detailed studies in terms of the ever-increasing number of dog acquisitions in the society and the prevention of their abandonment.

Key Words: *Dog, Stray Dog, Animal Shelter, Abandoned Dog, Sivas.*

Sokak Köpekleri Sorununun Sivas İli Hayvan Barınağı Örneğinde Araştırılması

Özet

Türkiye'de her geçen gün artan pet yetiştiriciliğine paralel olarak, sokağa veya barınağa terk edilen köpeklerin sayısındaki artış, hem insanların vefalı dostu köpekler için hem de toplum nezdinde önemli sorunlar yaratmaktadır. Bu olumsuz gidişin bir an önce önlenmesi, mevcut durumun iyi anlaşılıp tahlil edilmesiyle mümkün görünmektedir. İşte bu amaçla yapılan bu çalışmada, Sivas İli hayvan barınağındaki köpek trafiği, hem yıllar bazında nicel olarak hem de terkedilme nedenleri ile birlikte hayvan sahiplerinin tutum ve davranışları açısından araştırılmıştır. Çalışmada, Sivas Belediyesi tarafından işletilen sokak hayvanları rehabilitasyon merkezinin köpek trafiği kayıtları yanında, buraya köpeğini bırakan sahipleriyle yapılan anket verileri analiz edilmiştir. 2019-2022 yıllarını kapsayan dört yıllık kayıtlara göre Sivas Belediyesi Hayvan Barınağında konaklayan köpek sayısı ortalama 1058 (963-1150) olurken, aylık sokaktan toplanan köpek sayısı ortalama 50,7, aylık kısırlaştırılan dişi ve erkek köpek sayısı ortalamaları sırasıyla 17,33 ve 33,44, aylık sahiplendirilen dişi ve erkek köpek sayıları ortalama 2,8 ve 4,3 barınakta her ay görülen ortalama köpek ölümü sayısı da 21,9 olmuştur. Her ay barınakta kısırlaştırılıp tedavisi tamamlanan ortalama 15 köpek de alındıkları noktaya geri bırakılmıştır. Ayrıca barınağa köpeklerini terk eden toplam 50 kişiyle (49 bay, 1 bayan) yüz yüze anket yapılmış ve katılımcılara sahiplenme, bakım-besleme ve terk etme nedenlerini de içeren 15 soru yöneltilmiştir. Katılımcıların sorulara verdikleri cevaplarda istatistiki olarak medeni durumlarının bir etkisi görülmezken, eğitim durumlarının köpek edinme nedeni ile köpek besleme üzerine etkili olduğu görülmüştür. Yine köpek sahiplerinin yaşı ile köpeklerine aşı yaptırma düzeyleri arasında, köpek sahiplerinin mesleği ile köpek terk etme nedenleri arasında da ilişki bulunmuştur. Ayrıca köpek sahiplerinin il, ilçe veya köyde yaşamasının da köpek ırklarını tercihlerinde belirleyici olduğu anlaşılmıştır. Sonuç olarak, toplumda sürekli artan köpek edinme ve sonrasında terk etmelerinin önlenmesi açısından sürecin birçok farklı ilde her yönüyle daha ayrıntılı çalışmalarla ele alınmasının yararlı olacağı söylenebilir.

Anahtar Kelimeler: *Köpek, Sokak Köpeği, Hayvan Barınağı, Terk Edilmiş Köpek, Sivas.*

ID: 677

The Role of E-commerce in the Daily Food Sector

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Abstract
New commerce ecosystems such as social media platforms and all-in-one apps are also becoming incredibly powerful ways to connect to and engage with consumers. E-commerce sales have been rising yearly and during Covid-19 more consumers began shopping online in greater numbers and frequency. Food Industry professionals also believe that this is a permanent change. In this presentation, we focus on the use of electronic commerce for quality control and cost cutting efficiencies by the food and agricultural industries such as daily food products in the world.
Keywords: E-commerce, Food, Daily Food.

ID: 679

The Testosterone Role In Adolescent Males From Hospital Of Hyderabad And Jamshoro

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Abstract

Testosterone is a principal sex hormone needed for the normal physiological processes during all life stages. In males, testosterone is essential for the development and maintenance of secondary sexual traits. Testosterone also influences bone mass, muscle strength, mood, and intellectual capacity. Testosterone imbalances lead to reproductive dysfunction during multiple life stages in human males. Low testosterone levels are related to reduce semen quality in men, increased genital malformations, and changes in the time of onset or progression of puberty. In the recent study of adolescent males, a clear positive relationship between testosterone level and energy relationship and muscle tone in adolescent males. The partakers were 120 adolescent males 15-17 years old with median age of 16. Level of testosterone obtained during present study ranging from 270ng/dl to 720ng/dl with mean testosterone level during adolescent males is 495ng/dl. Adolescent males with normal testosterone show 70% well muscle tone while 30% show weak muscle tone. 27% males with normal testosterone feel tired while 73% don't show tiredness. 56 % Adolescent males with normal testosterone follows biorhythms & having normal energy and well muscle tone while 44% males with low testosterone don't follows biorhythms and having low energy and weak muscle tone.

ID: 680

Investigation of Genetic Structure of Dogs in Sivas Animal Shelter with Nuclear and Mitochondrial DNA Markers

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Abstract
The aim of this study was to investigate the genetic structure of dogs in Sivas Municipality shelter and compare them with the known dog breeds using mitochondrial and nuclear gene information. DNA isolation was performed with commercially available spin column kits. Using total genomic DNA, different microsatellite gene regions and the COI gene region of mtDNA were amplified by Polymerase Chain Reaction (PCR). Gene sequencing analysis were made on this gene regions and in this way, differences in DNA were investigated. Molecular genetic markers are used to identify, and differentiate the characteristics of both plants and animals. By revealing morphological characters, roughly a classification or description of organisms can be made. However, since genetic markers based on genetic material are less affected by environmental factors such as physiological conditions and age of organisms, they can be more effective in revealing the kinship relationships of living things and comparing differences and similarities. This study is important to determine the gene polymorphisms of a group of stray dogs in Sivas province and to reveal their genetic similarities and differences with some known dog breeds. Indeed, in this study a wide geography like Turkiye as well as for the proper identification and naming of the dog breeds found, as well as correctly identified dog breeds to maintain their own characteristics, will serve to protect.
Key words: *DNA, Gene polymorphisms, Genetics diversity, Stray Dog, Sivas.*

Sivas Hayvan Barınağındaki Köpeklerin Genetik Yapısının Nükleer ve Mitokondriyal DNA Belirteçleri ile Araştırılması

Özet
Bu çalışmada, Sivas İli Belediye barınağında bulunan köpeklerin genetik yapılarının, mitokondriyal ve nüklear DNA gen bölgesi bilgileri kullanılarak araştırılması ve bilindik köpek ırklarıyla karşılaştırılması amaçlanmıştır. DNA izolasyonu, ticari olarak satılan spin kolon kitleriyle gerçekleştirilmiştir. Total genomik DNA kullanılarak, farklı mikrosatellit gen bölgeleri ve mtDNA' ya ait COI gen bölgesi Polimeraz Zincir Reaksiyonu (PCR) yöntemi ile çoğaltılmıştır. Bu şekilde mitokondriyal DNA üzerindeki farklılıklar araştırılmıştır. Moleküler genetik belirteçler hem bitki hem de hayvanların özelliklerinin belirlenmesi, tanımlanmaları ve farklılıklarının çıkarılması için kullanılmaktadır. Morfolojik karakterlerin ortaya konulmasıyla kabaca bir sınıflama veya organizmaların tanımlaması yapılabilir. Fakat genetik materyal esaslı belirteçler fizyolojik şartlar ve organizmaların yaşı gibi çevresel faktörlerden çok az etkilendiği için canlıların akrabalık ilişkilerinin ortaya konulmasında, farklılıkların ve benzerliklerin karşılaştırılmasında daha etkili olabilmektedir. Bu çalışma, Sivas ilindeki sahipsiz bir grup köpeğin gen polimorfizmlerinin belirlenmesi ve sahipli -bilinen bazı köpek ırklarıyla genetik benzerlik ve farklılıklarının ortaya konulması için önemlidir. Nitekim bu çalışma Türkiye gibi geniş bir coğrafyada bulunan köpek ırklarının doğru şekilde tanımlanması ve adlandırılması için önemli olduğu kadar, doğru bir şekilde belirlenmiş köpek ırklarının kendi özelliklerini muhafaza edecek şekilde yetiştirilip, korunmalarına da hizmet edecektir.
Anahtar kelimeler: *DNA, Gen polimorfizmleri, Genetik çeşitlilik, Sokak Köpeği, Sivas.*

Giriş

Sorumluluk sahibi gerçek hayvan severler tarafından evlerin bir ferdi gibi yetiştirilen köpekler, ilk evcilleştirilen hayvan türü olarak binlerce yıldır insanlarla birliktedirler (Oğrak, 2009). Ancak, sorumsuz kişilerce sokağa terk edilen veya kaybolan köpeklerin hızlı üremelerine bağlı olarak bugün dünyada 600 milyon sokak köpeği bulunduğu tahmin edilmektedir ki bu ciddi sorunları beraberinde getirmektedir (Anonim, 2022a). Her yıl binlerce insanın köpek saldırısı/ısırığı ve kuduzdan hayatını kaybetmesi nedeniyle Dünya Sağlık Örgütü, sokak köpekleri sorununa yönelik çalışmalar yürüterek, 2030 yılına kadar "Sıfır Kuduz" hedefiyle, "Tek Sağlık" hizmetinin güçlendirilmesini benimsemiştir (Anonim, 2022b).

Moleküler genetik belirteçler hem bitki hem de hayvanların özelliklerinin belirlenmesi, tanımlanmaları ve farklılıkların açığa çıkarılması için kullanılmaktadır. Morfolojik karakterlerin ortaya konulmasıyla kabaca bir sınıflama, organizmaların tanımlaması yapılabilir ve hatta klasik olarak morfolojik karakterlerin iyi gözlenmesi, düzenli kayıtların tutulması ve referans karakterlerin iyi belirlenmesi ile organizma ırklarının ıslah edilmesi, belirli özellikler yönünden kültüre edilmiş ırkların yoğun bir şekilde üretiminin yapılması mümkündür. Fakat bitkisel veya hayvansal organizmalarda genetik materyal esaslı belirteçler fizyolojik şartlar ve organizmanın yaşı gibi

çevresel faktörlerden çok az etkilendiği için, canlıların akrabalık ilişkilerinin ortaya konulmasında, farklılıkların ve benzerliklerin karşılaştırılmasında, verim özelliklerinin belirlenmesinde, belirli bir hastalığa yatkınlıkların belirlenmesinde veya çeşitli dirençlilik-duyarlılık niteliklerinin belirlenmesinde daha etkili olabilmektedir (Durna, 2006). Ayrıca tür veya ırk kategorilerinde tanımlama, sınıflama ve çeşitli verimsel karakter özelliklerinin belirlenmesinde genetik belirteçlerin kullanılması zaman bakımından da avantaj oluşturmaktadır, nitekim canlının tam olarak ırkın morfolojik ve üreme olgunluğu dönemine gelmesini beklemeden, doğar doğmaz ve hatta embriyonik gelişimlerinin erken safhalarında bile genetik olarak tanımlanması, özelliklerinin belirlenmesi kolayca yapılabilmektedir. Bunlara ilaveten morfometrik ölçümlere dayalı yöntemler, özellikle fenotipik benzerliklerin söz konusu olduğu ırkların ayrımlarında yetersiz kalmaktadır. Bu yüzden son yıllarda genetik bilimindeki gelişmelerin sayesinde genotipik çalışmalar, benzerliklerin ve ayrımların yapılmasında sıkça başvurulan, güvenilir bir yöntem olarak kullanılmaktadır. Bu sebeple, tür altı kategoriler olan ırk ve/ya varyete gibi alt gruplar arasında Single Nükleotid Polimorfizmi analizlerinin yapılması, tüm genomu kapayacak karşılaştırmalı çalışmaların yapılması, mitokondri gibi organel gnomlarının veya mikrosatellit lokuslarının karşılaştırılarak gruplar arasındaki akrabalığın ortaya konulması çalışmaları ciddi olarak ele alınmaktadır. Diğer taraftan genetik analizler, miktarı az olan örneklerin analizi için uygundur ve çok yakınlık gösteren varyetelerin, ırkların tespit edilmesinde de başarıyla kullanılmaktadır (Durna, 2006). Bir türün populasyonları gibi evrimsel olarak yakın canlı grupların karşılaştırmalı olarak çalışılacağı ya da populasyonlarda yakın zamanda oluşmuş olan bir olayın sebep ve tarihlerinin aranacağı bir durumda en çok kullanılan genetik işaretlerden biri de genom üzerinde çeşitli bölgelerin PCR yöntemiyle çoğaltılıp karşılaştırılmasıdır (Togan ve ark 2003). Genomik materyal, hem çekirdekte bulunan DNA molekülü hem de organellerde bulunan DNA ve RNA moleküllerinden oluşmaktadır. Her bir organizma için sayıları binlerceden milyonlara kadar erişen gen bölgeleri ve bunlar arasındaki intron denilen DNA alanların olması nedeniyle, genomda şifrelenen bilgi birikimi çok fazladır. Genetik belirteç olarak hem nüklear DNA gen bölgeleri hem de organel DNA'ları kullanılabilmektedir (Brown et al., 2011; Bruford et al., 2003). Mitokondriyal DNA (mtDNA), genel olarak maternal kökenli olup, zigotun oluşumu sırasında yumurta hücresinde bulunan mitokondrilerdeki DNA'nın kalıtımı ile yeni jenerasyonlara aktarılmaktadır (Watson, 2004; Durna, 2006). Bu özelliğiyle mtDNA canlıların filogenetik analizlerinin yapılmasında, popülasyon yapısının değerlendirilmesinde, popülasyon genomiği, filogenetik ve filocoğrafik çalışmalarda kullanılan moleküler belirteçlerden biridir (Watson, 2004; Durna, 2006). Mitokondriyal DNA, türlerin ayrılma zamanı, coğrafik olarak dağılımları, türlerin yayılışı ve tarihi süreçteki dağılımları hakkında bilgiler verir, genomik DNA'ya oranla daha hızlı evrimleşir ve maternal kalıtıma sahip olduğu için canlıların moleküler saati ve anasal atasının bilgisi mitokondriyal DNA çalışmalarından elde edilebilir (Anderson ve ark., 1982; Avise ve ark., 1987; Bradley ve ark., 1996; Troy ve ark., 2001; Watson, 2004; Durna, 2006). İnsanoğlu teknolojik gelişmelere bağlı olarak genetik teknolojileri alanlarında da çok hızlı gelişmeler kaydetmiştir. Ancak ulaştığımız nokta itibariyle hala araştırmamız gereken çok konu ve soru bulunmaktadır. Bu çalışma kapsamında mitokondriyal DNA ve nüklear DNA gen bölgeleri kullanılarak Sivas Hayvan Barınağındaki köpeklerin genetik çeşitliliğin tespit edilmesi amaçlanmıştır. Sivas İli Belediye barınağında bulunan köpeklerin DNA gen bölgeleri kullanılarak, genetik yapılarının araştırılması ve bilindik köpek ırklarıyla karşılaştırılması amaçlanmıştır.

Materyal ve Metot

Örneklerin Toplanması:

Hayvan materyalinin bulunduğu Sivas Belediyesi Hayvan Bakımevi ilk olarak 2007 yılında kurulmuş, daha sonra 2018 yılında köpek kapasitesi artırılarak Seyfebeli mevkiinde bulunan yeni binalarına taşınmıştır. Bu barınakta, 2004 yılında yayınlanan 5199 Sayılı "Hayvanları Koruma Kanunu" gereği, sokak hayvanlarının rehabilitasyon hizmeti, Sivas Belediyesi tarafından yürütülmektedir. İlgili mevzuatlarda belirtildiği gibi sokaklardaki sahipsiz köpekler, bakımevine getirilip, kısırlaştırma, aşılama ve küpeleme hizmetinden sonra ya barınakta tutulmakta ya da alındıkları bölgeye geri bırakılmaktadır.

Çalışmada, Sivas Belediye Hayvan Bakımevinde bulunan saf/melez çeşitli ırklardan 45 köpeğin vena brachialislerinden 2cc miktardaki kan, holder yardımı ile içerisinde antikoagulant (EDTA) bulunan vakumlu tüplere alınarak, tüplerin üzerine köpeğin adı ve alındığı yer yazılarak numaralandırıldı. Genetik analizler yapılıncaya kadar, K_3-EDTA'lı tüplerdeki kanlar -20 ^{0}C'de saklandı.

DNA izolasyon prosedürü:

Uygun şekilde saklanan kan örneklerinden, ticari olarak satılan spin kolon esaslı kandan DNA izolasyon kitleri kullanılarak (GeneAll) DNA saflaştırma işlemi yapıldı. Elde edilen DNA'ların saflık ve miktarlarının belirlenmesine yönelik kalitatif ve kantitatif değerlendirmeler, % 1 lik agaroz jel elektroforezi ile UV görüntüleme esaslı olarak ve 260/280 nm UV absorbanslarına bakılmak suretiyle nanodrop spektrofotometre (deNovix cihazı)'de ölçülerek gerçekleştirildi. Tüm örneklerde standart miktarda ve kalitede DNA molekülü elde edilmesine çalışıldı. Stok DNA solüsyonları sulandırılarak, her bir örnek için 50 ng/µl yoğunluğunda standart DNA çözeltileri oluşturuldu.

Polimeraz Zincir Reaksiyonu:
Genomik DNA çözeltileri kullanılarak, literatüre göre köpeklere spesifik yapılmış başka çalışmalarda kullanılan sitokrom oksidaz bölgesini çoğaltmaya uygun primer dizileri de kullanılarak, mtDNA üzerindeki korunumu yüksek olan gen bölgelerine ilişkin genotipik farklılıklarda belirlenmeye çalışıldı. Bu işlem için ilk olarak uygun primerlerin seçilip sentezlettirilmesinden sonra, standart PCR reaksiyonu yapıldı ve gen bölgeleri amplifiye edildi. Uygun PCR içeriği ve sıcaklık koşullarının belirlenmesi için gradient PCR uygulamasına başvuruldu. Kulanılan primerlerin listesi aşağıda verilmiştir:

COIF: 5′CCG GAC ATG GCA TTC CCC CG-3' (Kim ve ark., 1998).
COIR: 5′ GGCGGACGTAAAGTACGCTCGTG-3' (Kim ve ark., 1998).
LCO1490: 5'-GGT CAA CAA ATC ATA AAG ATA TTG G-3' (Folmer ve ark., 1994).
HC02198: 5'-TAA ACT TCA GGG TGA CCA AAA AAT CA-3' (Folmer ve ark., 1994).

PCR Koşulları: PCR karışımı 25µl'lik son reaksiyon hacminin içeriğine; ddH2O, 2.5 µl 10X reaksiyon tamponu (KCL tampon), 1.25 µl (1.5 mM/µl) MgCl2, primerlerin her birinden 10pmol, 0.5 µl (0.2 mM) dNTPs, 5 U Taq DNA polimeraz (Fermantas) ve 1 µl (50 ng/µl) kalıp DNA eklenerek optimize edildi. PCR reaksiyonları "Applied Biosystems" marka termal cycler cihazında aşağıdaki koşullar altında gerçekleştirildi.

Başlangıç denatürasyonu	94°C	2 dk	
Denatürasyon	94°C	30 sn	35 döngü
Primer bağlanma (Annealing)	51-53°C	1 dk	
Uzama- Sentez (Extension)	72°C	1 dk	
Son Uzama (Final Extension)	72°C	10dk	

Sonraki basamakta da agaroz jel elektroforezi yapılarak fragment farklılıkları araştırıldı. Çoğaltılan gen bölgeleri agaroz jel elektroforezinde yürütülerek, görünür hale getirildi.

Agaroz jel elektroforezi:
Elde edilen PCR ürünlerinden 10 µl alınarak, 3 µl yükleme tamponu (6x Fermantas Loading dye: %50 gliserol, 0.1 M EDTA, %1 SDS, %0.1 Bromfenol mavisi, %0.1 Ksilen siyanol) ile karıştırıldı. Tris-Borikasit-EDTA (TBE) tamponu (10x Stok Tampon: 0.089 M Tris, 0.089 M Borik asit ve 0.011 M EDTA, pH: 8.3) içerisinde hazırlanan %1'lik agaroz jelde (1 g agaroz, 100 ml 1xTBE tamponu) yürütülerek saflaştırılan DNA örnekleri ve PCR ürünleri ayrıştırıldı. Elektroforez işlemi, 80 mA'de 2 saat süresince yapıldı (Agagel maxi Biometra). PCR işlemi sonucunda elde edilen ve elektroforez ile ayrıştırılan PCR ürünlerine ait bant modelleri, her bir örnek için 100 bç'lik DNA standartlarıyla (DNA ladder, Fermantas) kıyaslanarak kaydedildi ve Etidyum Bromid boyası ile hazırlanmış jel görüntüleri UV ışık altında incelenerek fotoğrafları çekildi.

Mikrosatellit Bölgelerinin Çoğaltılması:
Köpeklerde yüksek çeşitlilik gösteren önemli mikrosatellit bölgeleri mevcut literatürün incelenmesiyle belirlendi (Eichman et al., 2005; Irion et al., 2003; 2005; Kim et al., 2001; Leigh et al., 2004; Oishi et al., 2005; Richman et al., 2001; Sargan et al., 2007). 5 mikrosatellit bölgesinin PCR yöntemiyle ile çoğaltılması gerçekleştirildi. Seçilen 5 mikrosatellit bölgesinin isimleri ve bu bölgelerinin çoğaltılması için tasarlanan primer dizileri tablo 1'de gösterildi. Primer tasarımı esnasında, mültipleks PCR yöntemi uygulanacağı için primerlerin T_m sıcaklıklarının yakın olmasına, primerlerin hairpin yapısı oluşturmamasına ve sadece ilgili bölgeyi çoğaltan tasarımın yapılmasına dikkat edildi.

Tablo 1. Kullanılan mikrosatellit belirteçler **(** Eichman et al., 2005; Irion et al., 2003; 2005; Kim et al., 2001; Leigh et al., 2004; Oishi et al., 2005; Richman et al., 2001; Sargan et al., 2007)**.**

Primer Adı	Floresan İşaret	Kromozom	Primer Sekansı
FH2309-F	FAM	1	ACTGAGTTCTTTCAGCACAGTGT
FH2309-R		1	AAGAAATGCAGGGGTGCCT
FH2010-F	TAMRA	24	TCCTCCTATTAACAATGTCAGACTCTCA
FH2010-R		24	TGGATGCTTCTGGAGAGATCCA
FH2107-F	FAM	3	TGGATCATGTTGCACATACAATGAATCA
FH2107-R		3	TTGTTTGAGATTCTTCGTCCCCT
FH2054-F	HEX	12	ACTACCTCCGCTGTGATCACAT
FH2054-R		12	TCATTACACTGTAACACTGGCCTCA
FH2001-F	TAMRA	23	TGGCAGTATCCTCGACTGTAACA
FH2001-R		23	ATGAAGCAGTTGCATTCTTCTTGCA

Bütün primer alikotları 5µM Forward ve 5µM Reverse olacak şekilde hazırlandı ve PCR aşamasında KCl Buffer ve Thermo Taq Polymerase enzimi kullanıldı. Singlepleks PCR aşamasında kullanılan protokol 95 °C de 5 dakika, 40 döngü olmak üzere 95 °C' de 30 s, 56 °C'de 20s ve 72 °C'de 30 saniyedir. Genetik Analizör cihazı kullanılarak

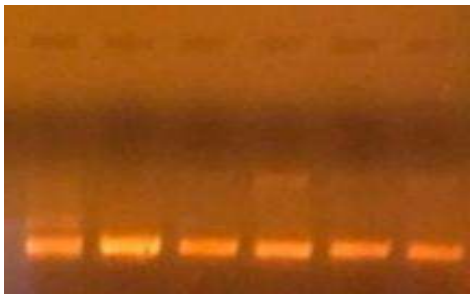
fragman analizi kapiler elektroforez yöntemi kullanılarak gerçekleştirildi. Forward primerlerin floresan işaretli olması sayesinde, çoğaltılan amplikonlar da floresan işaretli olarak oluşturuldu.

Bulgular ve Tartışma

Total genomik DNA'nın saflaştırılmasından sonra kalite ve kantitesinin belirlenmesi amacıyla yapılan elektroforez sonucu Resim 1' de; mitokondriyal Sitokrom oksidaz I gen bölgesinin amplifikasyonunun görüntülenmesi ise Resim 2' de görülmektedir. Elektroforez işlemi sonucunda Singlepleks olarak çoğaltılan mikrosatellit bölgelerinin jel görüntüsü Resim 3'te gösterilmiştir.



Resim 1. Saflaştırılan DNA örneklerinin agaroz jel görüntüsü.



Resim 2. Köpek örneklerinden, spesifik primerler ile çoğaltılan mitokondriyal Sitokrom oksidaz I gen bölgesinin Led Görüntüleme sisteminden elde edilen agaroz jel görüntüsü.



Resim 3. Elektroforez işlemi sonucunda Singlepleks olarak çoğaltılan bazı mikrosatellit bölgelerinin jel görüntüsü.

Multipleks fragman analizi sonucunda 45 DNA örneğinden sadece B14, B42, B43, B44 ve B46 kodlu örnekler hariç 40 örneğin 5 mikrosatellit bölgesine göre sonuçları oluşturulmuştur. Cervus 3.0.6 programı kullanarak her mikrosatellit bölgesi için frekans analizi ve heterozigotluk/homozigotluk analizi yapılmıştır (Tablo 2). Barınak köpekleri (40 adet) ile kangal örnekleri karşılaştırılmıştır. Elde edilen sonuçlarda barınak köpeklerinde düşük frekansta olması sebebi ile kayda değer olmayan bazı alleller tespit edilmiş olmasına rağmen örnek sayısının düşüklüğünden kaynaklı ayırt edici alleller olarak isimlendirilmemiştir. Bunlar dışında bazı allellerin barınak köpekleri ve kangal köpekleri arasında ortak olduğu görülmüştür.

Tablo 2: Mikrosatellit belirteçlerin adları ve frekansları.

Locus	k	HObs	HExp
FH2309	31	0.867	0.904
FH2107	32	0.812	0.850
FH2054	21	0.805	0.851
FH2001	13	0.823	0.845
FH2010	16	0.645	0.772

k:Allel sayısı, HObs: Gözlenen Heterozigotluk,HExp: Beklenen Heterozigotluk.

Sonuç

Çalışmada farklı ırkları ayırmada kullanılacak genetik belirteç bölgelerinin seçilmesi amacına uygun olarak çalışmanın ilk ayağını oluşturmuş ve bunun mümkün olabileceğini göstermiştir. Irkları ayırmak ya da sınıflandırmak için nüklear veya mitokondriyal çeşitli genetik bölgelerin seçilmesi olasıdır. Ancak çok sayıda örnek ile çalışma yapılmasıyla birlikte çok sayıda gen bölgesinin de analiz edilmesi gerekir. Daha kapsamlı benzer çalışmalarla, barınak köpeklerinin sahiplendirilmesinde, mikrosatellit veya mitokondriyal gen sonuçlarının bir sertifika gibi kullanılabilmesi mümkün olabilir. Barınak köpeklerinin de cins köpek ırklarıyla çeşitli gen düzeylerinde benzerliklerine vurgu yapılarak onların sahiplendirilmesi boyutunda kullanılabilir. Ancak genetik analizler şu anki geldiğimiz noktada rutin işlemlerde kullanılamayacak kadar maliyetlidir ve uzman kişiler tarafından analizlerin yapılması gerekli olup uygulanması kolay değildir.

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Evaluation Of Diabetic Foot Complications In Outdoor Patients At Different Hospitals From District Naushahro Feroze Sindh

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Abstract

Diabetic foot is a global epidemic of 21th century and it is a major health problem. Foot complication in patients with diabetes mellitus (DM) is a major health problem and account for 20% annual diabetes ralated hospital admissions. This study was made in order to evaluate diabetic foot complications in out door patients (OPD) at different hospitals from district Naushahro Feroze Sindh. This cross-sectional descriptive study was carried out from June – November 2021. It aims to find out the prevalence and causes of foot complications in type I and type II diabetes mellitus patients and to find out the commonest complication in the area. The data was collected from the predesigned proforma and frequence, percentage, mean were analysis and culculated statistically. During research period total 74 patients of type I and type II diabetes mellitus patients were evaluated for diabetic foot complications. Out of 74 patients 42 (56.7%) were male patients and 32 (43.3%) were female patients. Male to female ratio was 1.3:1. 10 patients (13.5%) were suffered with type I DM and 64 (86.5%) patients were suffered with type II DM. The ratio of type I and type II DM was 1:6.4. The commonest age group of patients was between 31- 45 years. The mean age of male patients was 47.11 years and of females was 49.8 years. Mean weight of male patients was 83.1kg (ranged from 65-105) and female patients was 74.5kg (ranged from 65-95). Majority of the patients 54 patients (32 male and 22 female) were moderate build, 10 patients were thin build (6 male and 4 females) and 10 patients were obese (4 male and 6 female) patients. The literacy rate is very poor in district Naushahro feroze, 44 (59.4%) patients were educated (hardly five to seven or eight class) out of 44 educated patienrs 34 (80.9%) were male and 10 (31.25%) were female patients. 30 (40.54%) patients were uneducated (8 “19.04%” patients were male and 22 “68.75” were female patients) During my study most common foot complication found was diabetic foot ulcer/wound infection. 25 (33.7%) patients were effected in diabetic foot ulcer/wound infection, 20 patients (27.03%) were effected in diabetic foot gangrene, 18 patients (24.32%) were have peripheral neuropathy, 8 patients (10.81%) presented abscess and 3 (4.05%) patients were presented with cellulitis of foot or leg. Out of 10 patients of type-I DM, 7 patients (70%) have peripheral neuropathy, 2 patient (20%) were infected with diabetic foot ulcer/ wound infection and 1 patient (10%) presented with gangrene. Out of 64 (86.5%) patients of type-II DM 23 patients (35.93%) presented with diabetic foot ulcer/ wound infection, 19 (29.68%) patients presented with foot gangrene, 11 patients (17.8%) suffered with peripheral neuropathy 8 (12.5%) patient presented with foot abscess and 3 (4.68%) patients presented with cellulitis. Out of 74 patients 20 patients (29.7%) were on insulin injection and 54 patients (70.3%) were taking oral hypoglycaemic drugs. 35 patients (47.2%) cames with history of hereditary (genetics) and 39 (52.7%) patients have history of acquired disease. People educated/uneducated in District Naushahro feroze are unaware of DM and its complications Therefore public (patients) awareness about DM, foot complications and foot care is strongly needed in District Naushahro feroze Sindh.

ID: 683

The Hepato-Therapeutique Effect Of Honey-Sidr From The Algerian Sahara On The Pathology Of Alzheimer Disease Study In Mice

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Abstract

The objective of this study is to determine the hepato-therapeutic effect of Honey-Sidr from the Algerian Sahara on mice caused by Alzheimer's disease whose liver damage could be one of the several pathologies caused by this disease providing more of the key lipids needed by the brain.

Experimental animal models make it possible to demonstrate the hépato-pathology effects of honey on this disease, females mices were given by the oral route of Alcl3 at 100mg/kg/d, and D-galactose intraperitoneally at 120mg / kg / day for 45 days, after this period we proceeded to treatment with three doses of honey (100mg/kg/j, 200mg/kg/d and 300mg/kg/d) what were administrated by oral route for 45 days.

An analysis of the biochemical parameters (cholesterol, TGO, TGP, gamma GT) was carried out before and after treatment with Miel-Sidr.

The results of this analysis show a significant decrease in cholesterol levels in mice treated with the three doses of Honey, these values are at (0.9g/L, 0.78g/L, 0.6g/L) compared to mice affected by the disease Alzheimer's which is at 1.4g/L and the control which is at 0.6g/L and, this means that Honey has both anti-stress and anti-cholesterolemia activity, regarding the values of (TGO, TGP, gamma GT) are at (680IU/L, 100IU/L, -160IU/L) for mice affected by Alzheimer's disease, these values are very high compared to those treated with Honey which are at (300UI/L, 80UI/L, -190UI/L), these enzymes are found in the cells, their levels can be modified in the event of hepatic cell damage, these results show a decrease in the high rate of these enzymes, this confirms the effect of Honey on the hepatic balance which contributes to the proper functioning of the liver.

Keywords : *Alzheimer, Honey, Hepato-therapy, Mice.*

ID: 685

Comparative effect of wild type of *Pseudomonas moraviensis* and its mutants on Chickpea under salinity

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Abstract

Pseudomonas is most important member of Plant growth promoting rhizobacteria that improves the plant growth and yield under different stresses. *Pseudomonas moraviensis* and its indole acetic acid (IAA) deficient mutants were examined on chick pea as bio-inoculant under salinity stress and foliar spray of tryptophan. Inoculum of wild type and mutants of *P. moraviensis* were applied on the chickpea seeds. Salinity stress and foliar application of tryptophan was applied after 10 days of germination and after that plants were after one week of applying the treatments. The germination percentage was significantly greater in seeds that were inoculated with wild type but germination percentage was reduced significantly in seeds that were inoculated with mutants. Tryptophan application enhanced the chlorophyll contents and fresh weight of shoots and roots. However, protein contents were significantly higher in plants inoculated with mutants. Tryptophan application further improved proline and protein contents of the *P. moraviensis* and its mutants. Foliar application of tryptophan significantly reduced the effect of salinity in both wild type and mutants. Thus, it can be concluded that IAA have significant role in the growth and development of plants and tryptophan enhanced the IAA production ultimately improve the growth and yield of crops.

ID: 687

The Effect of Hesperidin Added to Japanese Quail Rations on Some Nutrient Contents of Egg

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Abstract

The present study was carried out to determine whether hesperidin, a citrus extract, has an effect on the nutrient content and pH of layer quails. In the study, 225 Japanese (*Coturnix coturnix japonica*) quails at 6 weeks of age with an average live weight of 165-178 g were used as animal material. The study was created in 3 groups. The Control group was fed only with basal ration. Hesperidin (group I and group II) was added to the basal ration at the levels of 1 g/kg and 2 g/kg, respectively, to the experimental groups. It was determined that egg white pH was statistically higher in the experimental groups compared to the control group due to hesperidin supplementation ($P < 0.05$). Egg yolk pH; in general moisture, crude ash and crude protein parameters in the whole egg were found to be similar in the groups ($P > 0.05$). As a result, it is thought that hesperidin supplement can be added to poultry rations as a result of the findings obtained in this study.

Key Words: *Quail, Crude ash, Crude protein, Egg white, Hesperidin*

Japon Bıldırcını Rasyonlarına Katılan Hesperidinin Yumurtada Bazı Besin Madde İçerikleri Üzerine Etkisi

Özet

Mevcut çalışma yumurtacı bıldırcınlarda turunçgil ekstraktı olan hesperidinin yumurtada besin madde içeriği ve pH üzerine etkisini belirlemek amacıyla yapılmıştır. Araştırmada hayvan materyali olarak 225 adet 6 haftalık yaşta 165-178 g ortalama canlı ağırlığında Japon cinsi (*Coturnix coturnix japonica*) bıldırcınlar kullanıldı. Çalışma kapsamında 3 grup oluşturuldu. Kontrol grubu sadece bazal rasyon ile beslendi. Deneme gruplarına (grup I ve grup II) bazal rasyona hesperidin sırasıyla 1 g/kg ve 2 g/kg düzeylerinde ilave edilmiştir. Yumurta akı pH'sının hesperidin takviyesine bağlı olarak Kontrol grubuna göre deneme gruplarında istatistiksel olarak yüksek olduğu belirlendi ($P<0.05$). Yumurta sarısı pH'sı, genel olarak tüm yumurtada ise nem, ham kül ve ham protein parametrelerinin gruplarda benzer olduğu tespit edildi ($P>0.05$). Sonuç olarak ise hesperidin takviyesinin bu çalışmada elde edilen bulgular neticesinde kanatlı rasyonlarına katılabileceği düşünülmektedir

Anahtar Kelimeler: *Bıldırcın, Ham kül, Ham protein, Hesperidin, Yumurta akı*

ID: 688

Bursa ve Aydın'da Çevre Koşulları Benzer İki İşletmede Yetiştirilen Siyah Alaca Sığırların Performanslarının Karşılaştırılması

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Özet

Bu araştırma Bursa ve Aydında süt sığırcılığı yapan iki işletmenin süt verimi ve üreme performansını karşılaştırmak için yapılmıştır. Araştırmada toplam 125 ineğin laktasyon ve 154 ineğin döl verimi kaydı değerlendirilmiştir. Sürüler arasındaki farkı belirlemek için varyans analizi yapılmıştır. Buzağılama yılı, buzağılama mevsimi ve laktasyon sayısı analizde kullanılan diğer fixed faktörlerdir. İşletmenin gebelik başına tohumlama sayısına (GBTS), buzağılama aralığına (BA), kuruda kalma süresi (KKS) ve 305 gün süt verimine (305 GSV) etkisi önemli bulunmasına rağmen diğer özelliklere etkisi önemsizdir. GBTS, BİTAS, SP ve BA için Aydın ve Bursa'da bulunan ortalamalar 1.3, 1.8 tohumlama, 91.4, 101.2 gün, 120.6, 132.0 gün, 384.1, 407.7 gün, LS, KKS, 305 GSV için 325.4, 318.7 gün, 75.6, 96.3 gün ve 6636 ve 7214 kg'dır. İşletmeler arasındaki farkta hayvanların genetik düzeyleri kadar işletmede hayvanlara sağlanan çevre şartları da etkilidir. İşletmelerin verimliliğini sadece süt verimi değil aynı zamanda döl verimi de etkiler. Hayvanların genotiplerine uygun çevre koşullarında bulunması başarılı bir sürü yönetimiyle birleşince karlılığı arttırılabilir. Aydındaki işletmede özellikle süt verimini artırıcı önlemler alınması, Bursa'daki işletme için ise süt verimini artırmanın yanında döl verimini iyileştirici çalışmalar yapılması gerekir.

Anahtar Kelimeler: *Siyah Alaca, süt verimi, döl verimi, çevre faktörleri*

Comparison of Performance of Holstein Cattle Raised in Two Farms with Similar Environmental Conditions in Bursa and Aydın

Abstract

This research was conducted to compare the milk yield and reproductive performance of two dairy farms in Bursa and Aydın. In the research, lactation records of 125 cows and reproduction records of 154 cows were evaluated. Analysis of variance was performed to determine the difference between herds. Calving year, calving season and lactation number are other fixed factors used in the analysis. Although the effect of herd on the number of inseminations per pregnancy (GBTS), calving interval (BA), dry period (KKS) and 305 day milk yield (305 GSV) was found to be significant, its effect on other characteristics was insignificant. The averages found in Aydın and Bursa for GBTS, BİTAS, SP and BA were 1.3, 1.8 insemination, 91.4, 101.2 days, 120.6, 132.0 days, 384.1, 407.7 days, for LS, KKS, 305 GSV 325.4, 318.7 days, 75.6, 96.3 days and 6636 and 7214 kg. The environmental conditions provided to the animals in the herd are as effective as the genetic levels of the animals in the difference between the herds. The productivity of the farms affects not only the milk yield, but also the fertility. The profitability of the animals can be increased when the environmental conditions suitable for their genotypes are combined with a successful herd management. It is necessary to take measures to increase milk yield in the herd in Aydın, and to increase the milk yield for the herd in Bursa, as well as to improve the fertility of the herd.

Key Words: *Holstein, milk yield, reproductive performance, environmental factors*

Giriş

Dünyada birçok bölgede bulunan Holstein sığırları Türkiye'de de yaygın bir şekilde yetiştirilmektedir. Tüm sığırlar içinde sayıca en yüksek olan Holstein ve melezlerinin dişileri damızlık olarak süt üretiminde kullanılırken, erkekleri ise et üretimi için kullanılmaktadır. Türkiye'de Holstein sığırlarının genetik kapasitelerini tam olarak yansıttığı söylenemez. İyi genotipin iyi çevre isteği gerçeğine karşın, olumsuz çevre koşulları adaptasyonu yüksek olmasına rağmen Holstein sığırlarında istenilen performansın ortaya çıkmasını engellemektedir.

Türkiye'de sığırcılık için önemli iki il Bursa ve Aydın'dır. Bursa ve Aydın Damızlık Sığır Yetiştiricileri Birliği 1995 yılında kurulmuştur. 2022 yılı başında Aydında işletme sayısı 29107 toplam sığır sayısı 423071 baştır. Buna karşın Bursa'da 11045 işletme ve 186503 sığır bulunmaktadır (Anonim, 2022). Türkiye'de sığır sayısı en fazla olan iller Konya, İzmir, Erzurum, Balıkesir, Kars'tır. Aydın ve Bursa'nın Türkiye sığır varlığındaki payları sırasıyla %2.8 ve %1.33'tür. Her iki ilde de kültür ırkı ve melezlerinin payı %90'ın üzerindedir. Bursa ve Aydın'da sırasıyla Siyah Alaca ve melezleri %49, %54, Simmental ve melezleri %35, %14, Esmer ve melezleri %9, %17 oranında bulunmaktadır (Anonim, 2021). Bursa ve Aydın için uzun yıllar ortalama sıcaklığı 14.6 °C, 17.7 °C, ortalama yağış 708 mm, 653 mm'dir (Anonim, 2021).

Süt sığırı yetiştiriciliğinde sürü yönetiminin temeli kayıt tutmaya dayanır. Tutulan kayıtların sürü yönetiminde ve damızlık seçiminde kullanılması, işletmenin hem bugün hem de gelecekte olumlu sonuçlar almasını sağlar. Ayrıca kayıtlardan elde edilecek bazı bilgiler işletmenin genel durumunu ortaya koyarak, izlenecek politikanın

belirlenmesinde kullanılır. Türkiye'de süt sığırcılığı işletmelerinde sürü yönetimi genellikle somut olarak değerlendirilmez. Sürü yönetimini değerlendirmenin en etkili yolu teknik analiz yapmaktır. Bunun için sürüdeki kayıtlar zaman zaman incelenmeli ve süt ve döl verimi özellikleri açısından sürünün durumu değerlendirilmelidir. İnceleme sonrası varsa ideal değerlerden sapmalar ve bu sapmaların nedenleri ortaya konmalıdır.
Bu araştırmada benzer büyüklükteki iki işletmede yetiştirilen Holstein sığırların yetiştirici koşullarındaki performansı karşılaştırılmıştır.

Materyal ve Yöntem
İşletmeler Bursa'nın Mustafakemalpaşa (Bursa) ve Aydın'ın Köşk (Aydın) ilçelerinde bulunmaktadır ve Damızlık Sığır Yetiştiricileri Birliği üyesidirler. Araştırma 2019 yılı Mart-Haziran ayları arasında yürütülmüştür. Söz konusu dönemde her iki işletme kayıtları değerlendirilmiştir. Araştırma sırasında Bursa'daki işletmede 26 inek, Aydındaki işletmede 23 inek bulunmakla birlikte Bursa'daki işletmede sürüden çıkan hayvanların bilgilerine de ulaşılmıştır. İşletmelerin karşılaştırılması için bazı döl ve süt verimi özellikleri değerlendirilmiştir.
Ön incelemede hemen her özellik için biyolojik sınırların dışında aşırı (uç) değerler olduğu gözlenmiştir. Bu tip çalışmalarda verilerin normal dağılımını sağlamak için bu uç değerler değerlendirme dışı tutulmaktadır. Bu çalışmada da gebelik başına tohumlama sayısı (GBTS) 7 ve üzeri, buzağılama ilk tohumlama arası süre (BİTAS) 30 günden kısa 300 günden uzun, servis periyodu (SP) 30 günden kısa 330 günden uzun, buzağılama aralığı (BA) 310 günden kısa 600 günden uzun, laktasyon süresi (LS) 220 günden kısa 550 günden uzun, kuruda kalma süresi (KKS) 20 günden kısa 200 günden uzun olanlar değerlendirilmemiştir. Söz konusu aşırı değerlerin bazı tohumlama ve buzağılamaların kayıt edilmemesi sonucu oluştuğu düşünülebilir. Ancak bazı ineklerin gerçekten çok uzun süre gebe kalamaması ve sağılması hatta neredeyse iki yılda bir buzağılamış olması da kuvvetle muhtemeldir.
Sığırlarda söz konusu özellikleri etkileyen faktörler genellikle; buzağılama yılı, buzağılama mevsimi ve laktasyon sayısıdır. Aşağıda görüldüğü gibi verilerin değerlendirilmesinde kullanılan istatiksel modele bu faktörlerin yanı sıra işletme faktörü de dahil edilmiştir. Faktörlerin alt gruplarında çok fazla veri olmadığı için interaksiyonlar dikkate alınmamıştır.

$Y_{ijklm} = \mu + a_i + b_j + c_k + d_l + e_{ijklm}$
Y_{ijklm} : Herhangi bir özellik için fenotipi
μ : Bir özellikle için beklenen ortalamayı
a_i : i. buzağılama yılının etkisini (+2008,2009 … 2019)
b_j : j. buzağılama mevsiminin etkisisini (ilkbahar, yaz, sonbahar, kış),
c_k : k. laktasyon sayısının etkisini (1, 2, 3, 4, 5+)
d_l : l. işletmenin etkisini (Bursa, Aydın)
e_{ijklm} : hata etkisini göstermektedir.

Elde edilen veriler MsExcel ile düzenlenmiş, faktörler arasında fark olup olmadığı varyans analizi ile alt gruplar arası karşılaştırmalar ise Fisher'in LSD testiyle yapılmıştır (Minitab, 2020).

Sonuçlar ve Tartışma
Araştırmada döl ve süt verimi özelliklerine etkisi araştırılan faktörlerden işletme dışında kalanlara ait ortalama ve standart hatalar verilmemiş sadece önemlilikleri hakkında bilgi verilmekle yetinilmiştir.
Buzağılama yılının gebelik başına tohumlama sayısına (GBTS) etkisi önemlidir ($P<0.05$). Buzağılama mevsiminin buzağılama ilk tohumlama arası süre (BİTAS), servis periyodu (SP) ve buzağılama aralığına (BA) etkisi önemlidir ($P<0.01$). Laktasyon sayısının döl verimi özelliklerine etkisi önemli değildir.
İşletmenin GBTS ($P<0.01$) BA'ya etkisi önemlidir ($P<0.05$) (Tablo 1). Döl verimi özelliklerinden GBTS ve BA bakımından Aydındaki işletmenin, Bursa'daki işletmeden genel olarak daha başarılı olduğu söylenebilir. Bursa'da gebelik için daha fazla tohumlama yapıldığı görülmektedir. GBTS'nın artmasının doğal sonuçlarından birisi SP'yi diğeri de BA'yı artırmaktır. Nitekim Bursa'da SP Aydına göre 12 gün daha uzun ve 132 gün, BA 23 gün daha uzun ve 407.7 gün olarak hesaplanmıştır. Aydın ve Bursa'da BİTAS sırasıyla 91.4 ve 101.2 gün, SP 120.6 ve 132 gün bulunmuştur. Her ne kadar bu iki özellik bakımından her iki işletme arasında yaklaşık 10 günlük bir fark olsa da istatistiki olarak önemli değildir. Her iki işletmede SP ideal değer olarak kabul edilebilecek 85 günden 1-1.5 ay daha uzundur.

Table 1. Differences between Aydın farm and Bursa farm for reproductive performance

Özellik	İşletme	n	Ortalama	Standart Hata	Minimum	Maksimum	P
GBTS	Aydın	68	1.3	0.13	1	3	0.000
	Bursa	271	1.8	0.07	1	5	
BİTAS	Aydın	59	91.4	7.8	32	290	0.256
	Bursa	228	101.2	4.2	39	299	
SP	Aydın	60	120.6	9.1	32	313	0.262
	Bursa	215	132.0	5.0	39	322	
BA	Aydın	58	384.1	8.5	312	576	0.016
	Bursa	182	407.7	4.9	320	572	

GBTS: gebelik başına tohumlama sayısı, GS: gebelik süresi, BİTAS: buzağılama ilk tohumlama arası süre, SP: servis periyodu, BA: buzağılama aralığı

Aydındaki işletmede bulunan 1.3 adet tohumlama ortalaması bazı araştırmalarda bulunan 1.42 – 1.47 arasındaki tohumlama sonuçlarına yakındır (Erdem ve ark., 2007; Bayrıl ve Yılmaz, 2010; Şahin ve Ulutaş, 2011; Cura, 2016). Bursa'daki işletmede bulunan 1.8 tohumlama değeri Güngör (2019) 1.8, E-Islah (2015) 1.9 değerlerine benzerdir. Buna karşın Kaygısız (1997) tarafından bildirilen 2.2 ve Alkoyak (2016) tarafından bildirilen 2.7 tohumlama her iki işletmede bulunan değerlerden oldukça yüksektir.

BİTAS için her iki işletmede hesaplanan 91 ve 101 günlük ortalamalar Alkoyak (2016) tarafından bu özellik için bildirilen 84 günden uzundur.

SP için Aydında bulunan değer (120 gün) bazı araştırma sonuçlarına benzer (Erdem ve ark. (2007) 122, Akkaş ve Şahin (2008) 124, Özçakır ve Bakır (2010) 120, Gürses ve Bayraktar (2012) 127, bazılarından yüksek (Kaygısız (1997) 108, Bayrıl ve Yılmaz (2010) 99, Cura (2016) 92) bazılarından ise düşüktür (Şahin ve Ulutaş (2010, 2011) 135, Alkoyak (2016) 162 gün).

Bu araştırmada BA için bulunan değerler (384 ve 407 gün) bazı araştırma sonuçlarında 379 – 404 gün arasında bildirilen değerlere benzer (Kaygısız, 1997; Erdem ve ark., 2007; Akkaş ve Şahin, 2008; Şahin ve Ulutaş, 2011; Bayrıl ve Yılmaz, 2010; Özçakır ve Bakır, 2010; Gürses ve Bayraktar, 2012; Güngör, 2019), 411 – 422 gün arasında bildiren bazılarından düşüktür (Şahin ve Ulutaş, 2010; Cura, 2016; E-Islah, 2015; Alkoyak, 2016).

Buzağılama yılının etkisi LS'ye $P<0.05$ diğer süt verimi özelliklerine $P<0.01$ düzeyinde önemlidir. Buzağılama mevsiminin KKS'ye etkisi önemli ($P<0.05$) diğer özelliklere etkisi önemsizdir. Laktasyon sayısının LS ve 305 gün süt verimine (305 GSV) etkisi önemli ($P<0.01$), KKS'ye etkisi önemsizdir.

İşletme faktörünün LS'ne etkisi önemsiz bulunmasına karşın KKS ve 305GSV'ye etkisi önemlidir ($P<0.01$) (Tablo 2). Araştırmada LS Aydın ve Bursa'da 325.4 ve 318.7 gün bulunmuştur. Bulunan bu değerler ideal değerden yüksek olsa bile, LS'ni 343-364 gün arasında bildiren bazı araştırma sonuçlarından oldukça düşüktür (Türkyılmaz ve ark., 2005; Bakır ve Kaygısız, 2009; Boğokşayan ve Bakır, 2013; Genç, 2014; Keser, 2016; Cura, 2016). Bazı araştırmalarda bildirilen 312-331 günlük değerlere benzerdir (Koçak ve ark., 2007; Bakır ve ark., 2009; Şahin, 2009; Tekerli ve Koçak, 2009; Şahin ve Ulutaş, 2010; Keskin ve Boztepe, 2011; Şahin ve Ulutaş, 2011; Sarar ve Tapkı, 2017. Buna karşın Erdem ve ark., (2007)'nın bildirdikleri 301 günlük değerden büyük bulunmuştur.

Table 2. Differences between Aydın farm and Bursa farm for milk yield traits

Özellik	İşletme	n	Ortalama	Standart Hata	Minimum	Maksimum	P
LS	Aydın	64	325.4	9.2	222	520	0.256
	Bursa	216	318.7	4.5	220	533	
KKS	Aydın	58	75.6	4.9	21	200	0.000
	Bursa	161	96.3	2.5	23	186	
305GSV	Aydın	78	6636	48	5530	7453	0.000
	Bursa	265	7214	100	3823	11336	

KKS Aydın ve Bursa'da sırasıyla 75.6 ve 96.3 gün olarak bulunmuştur. Bursa'da KKS yaklaşık 20 gün daha uzun olmasına karşın LS 7 gün daha kısadır. Her iki işletmede de ineklerin kuruya çıkarılmasında bir sorun olduğu söylenebilir. Özellikle Bursa'daki işletmede bu konuda daha dikkatli olunması gerektiği açıktır.

Araştırmada bulunan değerler Karaağaç ve Genç, (2019) 62,5 gün, Genç (2014) 61 gün, Tuna (2017) 61 gün, Türkyılmaz ve ark. (2005) 48 gün, Cura (2016) 56 gün, Keser (2016) 57 gün ve Sarar ve Tapkı (2017) 67 gün olarak bildirdikleri değerlerden oldukça yüksektir. Buna karşın Bilgiç ve Alıç (2005) 79 gün, Erdem ve ark. (2007) 82 gün, Koçak ve ark. (2007) 86 gün, Bakır ve ark. (2009) 79 gün, Şahin (2009) 86 gün, Şahin ve Ulutaş (2010) 82 gün, Şahin ve Ulutaş (2011) 85 gün ve olarak bildirdikleri değerlere benzerdir.

Süt sığırcılığında kuruda kalma süresi üzerinde önemle durulması gereken bir özelliktir. Bu sürenin uzun olması sürüde üreme problemlerinin yaşandığını gösterirken, kısa olması doğacak buzağının yeterince gelişememesine ve

hayvanın süt veriminde azalmaya yol açabilir (Akman ve Kumlu (2004), Duru ve Tuncel (2004), Genç ve Soysal (2019).

Bu araştırmada Aydın ve Bursa'daki işletmelerde 305 GSV ortalamaları 6636 ve 7214 kg'dır. 2020'de Aydında 305 GSV ortalaması 29823 laktasyonda 6204 kg, Bursa'da 15822 laktasyonda 7880 kg olarak bildirilmiştir (Anonim, 2022). Aydındaki işletme il ortalamasından daha yüksek süt verimine sahipken Bursa'daki işletme il ortalamasından düşüktür. Ancak her iki işletmede Türkiye ortalamasından yüksek süt verimine sahiptir. Bursa'da 305 gün süt verim ortalaması Aydın'dan yaklaşık 1600 kg daha fazlayken işletmeler arası fark 600 kg'dır. Türkiye'de kayıtlı sürülerdeki Siyah Alaca sığırlarda 3.8 milyon laktasyonda LS'nin 371 gün ve 305 GSV'nin 6041 kg olduğu bildirilmektedir (E-Islah 2018).

Araştırmada Aydında 305 GSV için bulunan sonuç, Türkyılmaz ve ark. (2005) 6491 kg, Erdem ve ark. (2007) 6467 kg, Bakır ve Kaygısız (2009) 6798 kg, Şahin (2009) 6589 kg, Bakır ve ark. (2009) 6810 kg; Duru ve ark. (2012) 6010 kg, Sarar ve Tapkı (2017)'nın 6588 kg olarak buldukları değerlere yakın bulunmuştur. Bununla birlikte Tekerli ve Koçak (2009) 5620 kg, Keskin ve Boztepe (2011) 5997 kg, Galiç ve Kumlu (2012) 6100 kg, Katok ve Yanar (2012) 3408 kg, Boğokşayan ve Bakır (2013) 5673 kg, Kaygısız (2013) 5319 kg, Genç (2014) 6010 kg, Keser (2016) 5630 kg ve Cura (2016) 5755 kg olarak belirledikleri değerlerden yüksek olduğu saptanmıştır. Buna karşın Koçak ve ark. (2007) 7704 kg ve Tuna (2017) 9816 kg olarak bildirdikleri değerlerden düşük bulunmuştur.

Sonuç olarak, döl ve süt verimi özellikleri için işletmeler arasındaki farkta tohumlama, bakım-besleme, organizasyon, pazarlama, kayıt tutma ve değerlendirme gibi sürü yönetim konularının etkileri söz konusudur. Süt veriminin düşmesinin yanı sıra döl veriminin gerilemesi verimliliği önemli ölçüde düşürür. Hayvanlara genotiplerine uygun çevre koşullarının sağlanması ve başarılı bir sürü yönetimiyle döl veriminin yanında süt verimi de arttırılabilir. Aydındaki işletmede özellikle süt verimini artırıcı önlemler alınması, Bursa'daki işletme için ise süt verimini artırmanın yanında döl verimini iyileştirici çalışmalar yapılması gerekir. Her iki işletmede sürü yönetiminin daha başarılı olması birim başına geliri artıracaktır.

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Turkey's Foreign Trade Competitiveness in Quince

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Abstract
Turkey is the leading country in the world quince production and exports. Turkey as of 2021 in terms of the total amount of exports in the world has realized quince alone was 36% and in the first place. The main objective of this study is to demonstrate the competitiveness of the quince in foreign trade and to emphasize the importance of the quince in terms of agricultural production as an important export potential and the need to be careful on the subject. In the study, battery analysis was widely used to measure competitiveness. According to the results of the study, Turkey is the country with the highest share in the export value of quince (40 %). When the RCA index values of Turkey for 2010-2020 were examined, it was understood that although 2015 was relatively low compared to other years, quince was very competitive in all of the periods examined. However, although Turkey is below the export of quince quince is able to produce the first in the world, though only 11% of exports and quince average unit price in the world.
Key Words: *Quince, International Trade, Competitiveness*

Türkiye'nin Ayva Dış Ticaretinde Rekabet Gücü

Özet
Türkiye, ayva üretim ve ihracatında dünyada lider ülkedir. Türkiye 2021 yılı itibariyle dünyada toplam ayva ihracatını miktar bakımından %45'ini tek başına gerçekleştirmiş ve ilk sırada yer almıştır. Ayvanın dış ticarette rekabet gücünü ortaya koymak, tarımsal üretim bakımından ayvanın önemli bir ihracat potansiyeline sahip olduğunu ve konunun üzerinde dikkatli bir şekilde durulması gerekliliği bu çalışmanın temel amacını oluşturmaktadır. Çalışmada rekabet gücünün ölçülmesinde AKÜ analizi yaygın olarak kullanılmıştır. Araştırma sonuçlarına göre Ayva ihracat değerlerinde en yüksek paya sahip olan ülke Türkiye'dir (%36). Türkiye'nin 2010-2020 yılları AKÜ indeks değerleri incelendiğinde 2015 yılı nispeten diğer yıllara göre düşük seyirde olsa da incelenen dönemlerin hepsinde ayvada rekabet gücünde çok yüksek olduğu anlaşılmıştır. Fakat Türkiye her ne kadar ayva ihracatında dünyada birinci olsa da ürettiği ayvanın sadece %11'ini ihraç edebilmekte ve ayva birim fiyat olarak dünya ortalamasının altındadır.
Anahtar Kelimeler: *Ayva, Dış Ticaret, Rekabet Gücü*

ID: 690

Studies on Nutritional Profile and Mineral Bioavailability of some Solanum Species Consumed as Fruits in Ekiti State, Nigeria

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Abstract
African eggplants are highly valued constituents of the Nigerian food. However, their nutritional potentials have not been fully tapped due to inadequate information on their nutritional and anti-nutritional qualities. This present study investigated the proximate, minerals, anti-nutrient contents as well as the estimation of mineral ratios and Mineral Safety Index of four selected edible solanum species namely, *Solanum anguivi*, *S. gilo*, *S. menalogena* and *S. aethiopicum*. The proximate contents (%) ranged from 4.19-5.46 (moisture content), 1.71-2.49 (crude fat), 4.57-5.45 (crude ash), 3.76-4.93 (crude protein), 5.20-6.30 (crude fiber) and 77.14-78.58 (carbohydrate). The solanum species were good sources of energy with total metabolizable energy of 1.458MJ-1.484MJ. The four solanum species contained high K, Ca, Mg, low Fe, Mn, Zn and Cu, while amount of Cd, Ni and Pb were very low. The mineral ratios of K/Na, Ca/Mg, Ca/K, Zn/Cu and [K/(Ca+Mg)] were below the minimum good ratios levels of 1.0, 4.17, 4.0, 8.0 and 2.2 respectively which are good for man. The anti-nutrient contents revealed low phytate, oxalate and cyanide levels. The calculated Phytate/Zn, Phytate/Ca and Oxalate/Ca were lower than the threshold levels and would support absorption and bioavailability of Zn and Ca in the samples while that of Phytate/Fe was above the critical value and this indicates unavailability of iron in these eggplant fruits. The mineral differences observed showed that *S. menalogena* and *S. aethiopicum* had greater minerals while the Mineral Safety Index results revealed that the body could not be overloaded with any of the minerals investigated. The eggplants are rich in fiber, ash, carbohydrate and minerals with moderate protein. The low level of the anti-nutrient is good and poses no deleterious effect when consumed. The eggplants have nutritional health benefits; hence, their consumption should be encouraged to address food insecurity in Nigeria
Keywords*: eggplant, solanum, anti-nutrient, mineral, food security, Nigeria*

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Effect of sweetening type on the quality and acceptability of Roselle tea

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Abstract

Roselle tea, also known as Bissap, is prepared as a hot infusion extract of dried Roselle leaves and marketed as a health drink. The tea, however, is usually consumed after adding sweeteners to milden the sour, sharp and sometimes tart tones of the leaf extract. In this study, sucrose, caramel, honey and sucralose were assessed for the potential to be used as sweeteners in the production of Bissap by determining their effect on physicochemical (pH, Brix, colour, non-enzymatic browning and cloud value), phytochemical (ascorbate level, phenolic content, flavonoid content and antioxidant capacity), sensory acceptability and storage quality. Using sucralose did not have an effect on physicochemical quality, although using caramel and honey increased the occurrence of non-enzymatic browning and cloud value. Additionally, using honey enhanced ascorbate levels, phenolic and flavonoid contents and antioxidant capacity. Sensory analysis revealed almost equal scores for beverages prepared using sucrose and sucralose, however, using caramel and honey resulted in lower scores for taste, aroma, aftertaste and overall acceptability. In addition, using these sweeteners did not have an effect on the physicochemical and phytochemical quality of Bissap during storage at 4°C for 18days.

Key Words: *KRoselle tea, Sweeteners, Sensory analysis, Phytochemicals, Shelf life*

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Interrelation Of Humic Substances With Chemical Substances And Pollutants

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Abstract

Humus to some extent interacts with the mineral components of the solid phase of the soil, forming its sorption properties. In this regard, any compound entering the soil from outside interacts with both the solid phase and the organic matter of the soil solution.

Soil organic matter plays an important role in the transformation of mineral fertilizers, chemical ameliorants, pesticides and individual components of various soil pollutants. The presence of organic substances in the interaction of agrochemicals and pollutants with soil is manifested in the following:

promotes the separation of mineral nutrients from sparingly soluble fertilizers in acidic soils, for example, accelerates the separation of phosphorus from phosphorus flour or the dissolution of lime or the hydrological decomposition of some pesticides, etc.;

sorbed phosphates pass into the soil solution, replacing them in the soil absorbing complex;

Participates in the exchange and non-exchange absorption of mineral fertilizers and chemical ameliorants, pesticides, radionuclides, cations contained in heavy metals. In turn, sorbed humus reduces the scale of strong binding of phosphates and some cations, preventing the interaction of agrochemical and toxic substances with the mineral part of the soil;

Reduces the transition of phosphates into sparingly soluble forms due to active interaction with cations (Fe3+, Al3+, Ca2+, etc.) involved in the precipitation of phosphates in fertilizers;

In some soils, the possibility of the formation of complex, sparingly soluble mineral-humus compounds containing Fe and Al, as well as phosphorus has been established. Such compounds are capable of active migration;

In some cases, cations of mineral fertilizers, such as potash fertilizers in alkaline soils or alkaline fertilizers containing ammonium (liquid ammonia, ammonia water),can form soluble humates in the soil.

Soluble humus can also interact with heavy metal cations as well as artificial radionuclides. These reactions are due to the formation and behavior of simple and complex hetero polar salts and affect the migration, accumulation and entry of toxic substances into plants.

To regulate the behavior of pesticides in the soil, it is important to study the interaction of these substances with various active soil components, primarily organic substances. However, information on this issue is insufficient and sometimes contradictory. A number of studies have shown a very important effect of humus on the degradation, migration and entry of pesticides into plants. It is known that the amount of herbicides needed to kill weeds can vary by a factor of 20 depending on the nature of the interaction of the soil with humus (F. Stevenson). The interaction of various structural and functional groups of soil humus with simazine, atrazine, 2,4-D and other herbicides has been experimentally proven. It is known that clay-humus complexes adsorb pesticides better than pure humic acids. Fulvic acids, on the other hand, act as carriers for a number of sparingly soluble pesticides.

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A Study on the Taxonomy of *Gentiana lutea* (Gentianaceae)

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Abstract
Gentiana lutea, which has a natural distribution in Turkey, Albania, Austria, Bosnia and Herzegovina, Bulgaria, Croatia, France, Germany, Greece, Italy, Portugal, Romania, Serbia, Slovenia, Spain, Switzerland, Ukraine, is has medical and economic importance in the world and is forbidden to collect from nature. According to the literature records, there are two subspecies in Turkey and *G. lutea* subsp. *symphyandra* is spreaded in Sinop, Bursa, Bilecik, İzmir and Kütahya; *G. lutea* subsp. *lutea* is spreaded in İzmir. In 2019, a species action plan was prepared for this species, which is located within the provincial border of Kütahya, under the responsibility of the Republic of Türkiye Ministry of Agriculture and Forestry 5. Regional Directorate Kütahya Provincial Branch Office. Field trips and herbarium samples belonging to other provinces was examined, the presence of *G. lutea* subsp. *symphyandra* could not be detected. It has been determined that the plant samples were *G. lutea* subp. *lutea*. With this study, it is aimed to contribute to the taxonomy of the *G. lutea*
Key Words: *Plant systematics, Gentiana, Kütahya*

Gentiana lutea (Gentianaceae) Taksonomisi Üzerine Bir Çalışma

Özet
Türkiye, Arnavutluk, Avusturya, Bosna Hersek, Bulgaristan, Hırvatistan, Fransa, Almanya, Yunanistan, İtalya, Portekiz, Romanya, Sırbistan, Slovenya, İspanya, İsviçre, Ukrayna' da doğal yayılış gösteren *Gentiana lutea* Dünya'da tıbbi ve ekonomik önemi olan ve doğadan toplanması yasak bir bitki türüdür. Literatür kayıtlarına göre Türkiye'de iki alttürü mevcut olup *G. lutea* subsp. *symphyandra* Sinop**,** Bursa, Bilecik, İzmir ve Kütahya'da; *G. lutea* subsp. *lutea* ise İzmir'de doğal yayılış gösterdiği belirtilmektedir. 2019 yılında Tarım ve Orman Bakanlığı 5. Bölge Müdürlüğü Kütahya İl Şube Müdürlüğü sorumluluğunda Kütahya il sınırı içerisinde yer alan bu tür için tür eylem planı hazırlanmıştır. Arazi çalışmaları sırasında ve diğer illere ait bitki örnekleri incelendiğinde *G. lutea* subsp. *symphyandra*' nın varlığı tespit edilememiştir. Bitki örneklerinin *G. lutea* subsp. *lutea* olduğu belirlenmiştir. Bu çalışma ile *G. lutea* türünün taksonomisine katkı sağlanması amaçlanmıştır.
Anahtar Kelimeler: *Bitki sistematiği, Gentiana, Kütahya*

Giriş

Gentianaceae familyası dünyada yaklaşık 86 cins, 1665 tür içermektedir (Struwe and Albert, 2002). *Gentiana* L. cinsi dünyada 15 seksiyona bölünmüş olup yaklaşık 362 tür içermektedir. Çoğu türü Asya, Avrupa, Kuzey Amerika'da küçük bir kısmı Güney Amerika'daki And Dağları, Orta Amerika, Doğu Avustralya, Kuzeybatı Afrika'da yayılış gösterir (Ho and Pringle, 2001; Shabir, 2018; Struwe and Albert, 2002). Türkiye'de Gentianaceae familyası 8 cins, 36 tür ve tür altı takson ile temsil edilir (Güner ve ark., 2012). Ülkemizde *Gentiana* cinsi 14 tür ve türaltı seviyesinde takson içermektedir. Bunlardan sadece *Gentiana boissieri* Schott & Kotschy ex Boiss. endemiktir (Çiçek, 2012; Ekim ve ark., 2000).

Gentianaceae ailesinden *Gentiana* cinsi içerisinde yer alan ve çalışmanın konusu olan *Gentiana lutea* L. taksonu ülkemizde halk arasında Güşadotu, Kürşat, Cimtiyen, Cimtiyane, Defneyezit, Sarı censiyan, Sivri kök, Büyük kantaron, Kantaron-u kebir, Sarı ot, Sarı kök ve Acı kök olarak bilinmektedir (Pritchard, 1978, Davis, 1988; Özer ve ark. 2011). *G. lutea* endemik bir tür değildir. Avrupa-Sibirya elementi olan bu bitki Türkiye dışında Arnavutluk, Avusturya, Bosna Hersek, Bulgaristan, Hırvatistan, Fransa, Almanya, Yunanistan, İtalya, Portekiz, Romanya, Sırbistan, Slovenya, İspanya, İsviçre, Ukrayna' da doğal olarak yayılış göstermektedir (IUCN Red list, 2022). Ülkemizde ise Ayancık, Zindan, Handere Dağı (Sinop); Ödemiş, Bozdağ (İzmir); Bozdağ, Birgi'nin kuzeyi (İzmir); Uludağ (Bursa); Bozüyük Kömürsu Dağı (Bilecik)'nda bulunduğu literatürlerde yer almaktadır (Pritchard, 1978, Davis, 1988). Flora of Turkey and the East Aegean Islands' da kaydı bulunmayan ancak sonraki yıllarda yapılan çalışmalar ile Kütahya ilinin Darıtepe Yangın Kulesi ve çevresi, Üçtepeler Yangın Kulesi ve çevresi, Domuzkertiği Mevkii, Acısu- Çiçekli Yayla Mevkii (Domaniç), Gümüş Dağı- Radar Mevkii (Merkez)'nde tespit edilmiştir (Köse, 2019).

G. lutea çeşitli mevzuatlarla doğadan toplanması yasak bir bitki olup tıbbi bir bitkidir (Erken, 2016; Özer ve ark., 2011). Kökleri Avrupa Farmakopesi, Hint Ayurvedik Farmakope, Alman Farmakopesi, Komisyon E Monografları, European Scientific Cooperative on Phytotherapy (ESCOP) Monografları ve FFD Monografları gibi farmakope ve monograflarda kayıtlıdır. Bitkinin kök ve rizomları antiflamatuvar, enflamasyon ve yara iyi edici etkileri yanı sıra karın ağrısı, mide yanması, gastrit, diyare ve kusma gibi gastrointestinal rahatsızlıkların geleneksel tedavisinde kullanılmaktadır. Bitki eskiden ülkemizde ateş düşürücü olarak da kullanılmıştır. Antalya,

Aydın, Sakarya ve Bursa'da mesane iltihaplarında kullanıldığı kayıt edilmiştir (Başer, 1986; The European Pharmacopoeia Commission, 1996). Ayrıca yapılan çalışmalarda alyuvarları arttırıcı, antioksidan özellikte olduğu, koleretik, hepatoprotektif ve antifungal etkisinin olduğu saptanmıştır. Bitkinin köklerinin anoreksiada kullanılışı olduğu gibi gastrik asit sekresyonunu stimüle ettiği ve iştah açıcı özelliği olduğu da bilinmektedir (Baytop, 1999; Demirezer ve ark, 2011).
Bu çalışma ile tıbbi önemi olan *G. lutea* türünün periyodik olarak yapılan arazi çalışmaları ve diğer illere ait örnekler incelenmesi sonucunda lokasyonları güncellenmiş, populasyon durumları hakkında bilgi sahibi olunmuş ve taksonomik olarak değerlendirilmiştir.

Materyal ve Yöntem
2019 yılında vejetasyon döneminde periyodik olarak Kütahya il sınırları içerisinde arazi çalışması yapılmıştır. Arazi çalışması sırasında bitki örnekleri toplanmış ve herbaryum tekniklerine uygun olarak preslenmiştir. Ülkemizde Kütahya ili haricindeki diğer illerde ise arazide bitkiler gözlenmiş olup bitki örnekleri incelenmiştir. Bitki teşhisi için Flora of Turkey and the East Aegean Islands vol. 6, Flora of Turkey and the East Aegean Islands (suppl. 1) vol. 10 kullanılmıştır (Pritchard, 1978; Davis, 1988). Bitkinin tehlike kategorisinin belirlenmesi için Türkiye Bitkileri Kırmızı Kitabı (Ekim, Koyuncu vd., 2000) ve Guidelines for Using the IUCN Red List Categories and Criteria (Standards and Petitions Subcommittee of the IUCN Species Survival Commission, 2019) kaynaklarından yararlanılmıştır.

Bulgular ve Tartışma
Gentiana lutea türünün ülkemizde iki alttürü mevcuttur. Bu iki alttürün farkları Tablo 1'de verilmiştir. (Pritchard, 1978; Davis, 1988).

Tablo 1. *G. lutea* subsp. *lutea* ve *G. lutea* subsp. *symphyandra* morfolojik olarak karşılaştırılması

	Stigma	**Anter**
G. lutea* subsp. *lutea	spiral şekilde kıvrık	serbest
G. lutea* subsp. *symphyandra	spiral şekilde kıvrık değil	Tüp şeklinde birleşik



Şekil 1. *Gentiana lutea* subsp. *lutea* alttürüne ait çiçek durumu ve çiçek görüntüsü

Arazi çalışmaları ve bitki örnekleri (Şekil 1) tarafımızca incelendiğinde *G. lutea* L. subsp. *symphyandra* (Murb.) Hayek' in varlığı tespit edilememiştir. Bitki örneklerinin hepsinin *G. lutea* L. subsp. *lutea* olduğu belirlenmiştir (Sinop örneği hariç, bitki örneğine rastlanamamıştır).
Çalışma sonucunda; *G. lutea* subsp. *lutea* çoğunlukla orman sınırının sonunda ve subalpin kuşakta, nadiren de orman açıklıklarında yaklaşık 1650-1850 m arasında yayılış gösterdiği gözlenmiştir. Mayıs ayında rozet yaprakları gözlenmiştir (Şekil 2a). Haziran ayında ise birçok bireyin uzadığı ve çiçeklerin tomurcukta olduğu belirlenmiştir (Şekil 2b). Temmuz ayında yapılan arazi çalışması sonucunda ise türün çiçeklendiği (Şekil 2c-d); Ağustos ve Eylül aylarında ise olgun meyveler (Şekil 2e-f) gözlenmiştir.



Şekil 2. Bitkinin farklı zamanlardaki görünümleri

G. lutea subsp. *lutea* literatür kayıtlarına göre ülkemizde Ayancık, Zindan, Handere Dağı (Sinop); Ödemiş, Bozdağ (İzmir); Uludağ (Bursa); Bozüyük Kömürsu Dağı (Bilecik); Domaniç, Darıtepe Yangın Kulesi ve çevresi (Kütahya); Domaniç, Üçtepeler Yangın Kulesi ve çevresi (Kütahya); Domaniç, Domuzkertiği Mevkii (Kütahya); Domaniç, Acısu- Çiçekli Yayla Mevkii (Kütahya); Merkez, Gümüş Dağı- Radar Mevkii (Kütahya)' da yayılış gösterdiği bilinmektedir (Pritchard, 1978; Davis, 1988; Köse, 2019). Literatür kayıtlarındaki lokasyonlara ait -Sinop hariç- bitki örnekleri incelenmiştir. Sinop iline ait bitki örneği ve lokasyonda bitki kaydına ulaşılamamıştır. Yapmış olduğumuz arazi çalışmaları sırasında Kütahya Orman Bölge Müdürlüğü, Domaniç İşletme Müdürlüğü,

Gürgenyayla Şefliği sınırları içerisinde bulunan Karagöz Alanı Mevkii'nde de bitkinin varlığı tespit edilmiştir. Türün doğal olarak yayılış gösterdiği lokalitelerin tamamı doğal bir alandır.

Arazide yapılan saha gözlemleri ve bitki örnekleri incelendiğinde;

1. Bursa (Uludağ) populasyonları turizm faaliyetleri ve otlatmadan dolayı tehdit altında olduğu,
2. İzmir (Bozdağ) populasyonları kayak merkezi civarında bulunduğu, burada 50'den az birey yetişmekte olduğu ve tür, bu alanda yok olma tehlikesi ile karşı karşıya olduğu,
3. Bilecik (Bozüyük,Kömürsu Yaylası) populasyonları ise Kütahya (Domaniç, Acısu-Çiçekli Yayla) populasyonlarının yakınında ve yaklaşık 200 bireyle temsil edildiği,
4. Türkiye Florasına göre türün Sinop (Ayancık) ilinde de kaydı olsa da bu türe ait bitki örneğine rastlanmadığı
5. Kütahya lokalitelerinde ise yaklaşık 5400 birey tespit edildiği, bu sayı *G. lutea*' nın ülkemizde en fazla populasyonunun Kütahya ilinde olduğu sonucu çıkarılmıştır.

Kütahya ili içerisinde türün yetiştiği lokasyonlardaki yaşamlarını tehdit eden veya edebilecek unsurlar;

1. Kütahya şehir merkezinden Radar Bölgesi olarak bilinen ve bölgenin hemen yanında bulunan askeri bölgeye ve TV vericisine asfalt bir yol ile ulaşılmaktadır. Bu yol üzerinde halk tarafından rekreasyonel faaliyetler amacıyla kullanılan bir alan dikkati çekmektedir. Fakat bu faaliyetlerin türün doğal yayılışına herhangi bir etkisi bulunmamaktadır. Radar Bölgesi'nin askeri bir bölge olması ve türünde bu alan etrafında yayılış göstermesinden dolayı ilk bakışta tür üzerinde herhangi bir tehdit görülmemekle birlikte, bölgede hayvancılık faaliyetlerinin yapıldığı gözlenmiştir. Gelecekte askeri bölgenin taşınması veya küçülmesi gibi sebeplerin olması halinde tür üzerindeki tehditlerin artması da kuvvetle muhtemeldir.
2. Türün yayılış gösterdiği diğer lokasyonlara (Darıtepe Yangın Kulesi ve çevresi, Karagöz Alanı Mevkii, Üçtepeler Yangın Kulesi ve çevresi, Acısu-Çiçekli Yayla Mevkii ve Domuzkertiği Mevkii) ulaşım orman yollarından sağlanmaktadır. Bu lokasyonlarda hayvancılık faaliyetleri, orman yangınları, antropojenik faktörler ve doğadan toplama tehdit olarak tespit edilmiştir.

Endemik olmayıp ülkemiz sınırları dışında da doğal olarak yayılış gösteren *G. lutea* IUCN'e göre tehlike kategorisi LC yani en az endişe vericidir, ancak türün ergin bireylerinin populasyonların da bir azalma söz konusudur (IUCN Red list, 2022). Türkiye Bitkileri Kırmızı Kitabı'nda (Ekim ve ark. 2000) endemik bitkilerin yanı sıra muhakkak korunması gerektiğine inanılan ve ülkemizde çok lokal yayılış gösteren bazı endemik olmayan bitkiler ile ilgili liste hazırlanmıştır. Bu listelere ekonomik değere sahip olan türler de dahil edilmiştir. Bu kapsamda ekonomik değere sahip *G. lutea* subsp. *lutea* tehlike kategorisi "EN (Endangered/Tehlikede)" olarak değerlendirilmiştir. Tüm bu veriler ışığında *G. lutea* subsp *lutea*'nın ülkemizde yayılış gösterdiği tüm lokaliteler göz önünde bulundurulduğunda yayılış alanının 20000 km^2'den az olduğu, ancak yaşam alanının 10 km^2'den az olması ve yayılış gösterdiği alanlarda otlatma, turizm faaliyetleri, doğadan toplama ve yangın gibi türü tehdit eden faktörlerinde olması nedeniyle IUCN (2019)'in Kritik (CR) ölçütlerini sağlamasından dolayı tehlike kategorisi ülkemiz için CR (Critically Endangered/ Kritik) olarak önerilmiştir.

Bu çalışma daha sonraki çalışmalar için örnek teşkil etmekte olup, tarafımızca bitki örneği bulunamayan ancak literatüre göre kaydı olan Sinop ilindeki örneğin varlığı hakkında detaylıca çalışma yapılması gerekmektedir.

Teşekkür

Bu araştırma T.C. Tarım ve Orman Bakanlığı 5. Bölge Müdürlüğü Kütahya İl Şube Müdürlüğü sorumluluğunda yapılmıştır. İzmir örnekleri konusunda bize yardımcı olan Öğr. Gör. Dr. Volkan EROĞLU'na, ayrıca T.C. Tarım ve Orman Bakanlığı 5. Bölge Müdürlüğü Kütahya İl Şube Müdürlüğü ve T.C. Orman Genel Müdürlüğü Kütahya Orman Bölge Müdürlüğü Domaniç Orman İşletme Müdürlüğü'ne teşekkür ederim.

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The Using of Probiotics for Aquatic Organisms

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Abstract

One of the important agricultural activities that have high development potential is aquaculture. The probitics are the vital ways to increase agricultural products. There are bacteria, bacteriophages, microalgae and yeasts as probiotics. The common probiotics that are used for aquaculture practices (water, feed supplements) are showed as bacteria such as *Lactobacillus, Lactococcus, Leuconostoc, Enterococcus, Carnobacterium, Shewanella, Bacillus, Aeromonas, Vibrio, Enterobacter, Pseudomonas, Clostridium*, and yeasts such as *Saccharomyces, Debaryomyces* species. Probiotics are used as feed supplements for fish in order to increase growth performance, feed utilization, stress response, immune responses, disease resistance, general vigor, and alternatives to antibiotics. There are present lots of currently available mono or multi strains of probiotics,. The probiotics (*Vibrio harveyi*) release some beneficial effects on the fish gut defenses. They protect digestive tract agaist to inflammation. Some lactic acid bacteria (*Brevibacillus brevis, Vagococcus fluvialis*) help digestion of art fish by sticking to mucosal epithelium of the gastrointestinal tract. The probiotics increase feed digestibility by segregation of different digestive enzymes. Probiotics are commercially used to produce organic acids, fatty acids, biotin,vitamin B_{12}, hydrogen peroxide, antibiotics, bacteriocins, siderophores, and lysozyme. Some previous studies are indicated that the probiotics have important health benefits of some aquatic animals (Japanese flounder, black tiger prawns, *Penaeus monodon*, white leg prawns, *Litopeneus vannamei* and western king prawns, *Peneus latisulcatus*). In this study, it is going to be given more detail information about the definition, mechanism, functions of probiotics, and indicating the previous studies being done on the using of probiotics for aquatic organisms.

Key Words: *Aquatic organisms, Probiotics, Aquaculture*.

Probiyotiklerin Akuatik Orgnizmalarda Kullanımı

Özet

Yüksek gelişim potansiyeline sahip tarım aktivitelerinden biri akuakültürdür. Tarım ürünlerini artırmak için en önemli yollardan biri probiyotiklerdir. Probiyotik olarak bakteriler, bakteriofajlar, mikroalgler ve mantralar vardır. Akuakültür uygulamalarında (su, yem katkıları) kullanılan yaygın probiyotikler bakteri olarak örneğin, *Lactobacillus, Lactococcus, Leuconostoc, Enterococcus, Carnobacterium, Shewanella, Bacillus, Aeromonas, Vibrio, Enterobacter, Pseudomonas, Clostridium sp*, ve maya olarak örneğin, *Saccharomyces, Debaryomyces sp*. gösterilebilir. Balıklarda büyüme performansı, yem kullanımı, strese yanıt, bağışıklık yanıtı, hastalıklara karşı dayanıklılık, genel dayanıklılık ve antibiyotiklere karşı alternatif olma gibi özellikleri artırmak için probiyotikler yem katkı maddesi olarak kullanılmaktadır. Güncel olarak birçok mono veya çoklu probiyotikler mevcuttur. Probiyotikler (*Vibrio harveyi*) balık bağırsağının savunmasına bazı yararlı etkiler bırakmaktadır ve bunlar sindirim sistemini inflamasyona karşı korurlar. Bazı laktik asit bakterileri (*Brevibacillus brevis, Vagococcus fluvialis*) sindirim sisteminde mukosal epiteliuma yapışarak balığın sindirime yardım ederler. Probiyotikler yemlerin sindirilebilirliliğini farklı sindirim enzimlerini salgılayarak artırırlar. Probiyotikler ticari olarak organik asitler, yağ asitleri, biyotin ve vitamin B_{12} üretimine yardımcı olurken hidrojen peroksit, antibiyotik, bakteriyosin, siderofor, lizozom üretiminde kullanılmaktadır. Önceki çalışmalar bazı akuatik hayvanların (Japanese flounder, black tiger prawns, *Penaeus monodon*, white leg prawns, *Litopeneus vannamei* and western king prawns, *Peneus latisulcatus*) sağlıklı olmaları üzerine önemli faydalara sahip olduğunu göstermiştir. Bu çalışmada, probiyotiklerin tanımı, mekanizması ve fonksiyonları ve akuatik organizmalar için probiyotik kullanımı üzerine şimdiye kadar yapılmış çalışmalar hakkında detaylı bilgiler verilmiştir.

Anahtar Kelimeler: *Probiyotikler, Akuatik organizmalar, Akuakültür*

ID: 697

Effects of Light and Dark Conditions on Root Development of Black Mulberry (*Morus Nigra* L.) Hardwood Cuttings

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Abstract

This study was carried out to determine the root development of black mulberry hardwood cuttings kept in light and dark conditions. The experiment was carried out in the polyethylene greenhouse of Tokat Gaziosmanpaşa University Research and Application Center, in 2021. As material, hardwood cuttings prepared from one-year-old branches of black mulberry trees were used. The cuttings were divided into 3 different groups and planted in rooting beds containing perlite with bottom heating (22±2 °C). First group of cuttings were planted into beds as soon as taken from tree (control), the second group of cuttings were plantend after the cuttings were kept under daylight conditions for 5 days (in the open) and third group cuttings were planted after the cuttings were kept in the dark conditions (in the dark) for 5 days in both conditions soaked in water. All cuttings were dipped in 6000 ppm IBA (indole-3-butyric acid) hormone for 5 seconds just before planting. The experiment is with 3 replications and there are 15 cuttings in each replication. After keeping 90 days in the rooting environment, the cuttings were removed; root number (root/stem), root length (cm), root diameter (mm), decay rate (%), rooting rate (%) and callus formation rate (%) parameters were investigated. As a result of the study, there was no statistical difference between the different conditions in the investigated parameters. The data obtained varied between the following values; rooting rate between 68.89% - 93.33%, decay rate between 24.4% - 55.5%, callus formation rate between 68.8% - 88.8%, number of roots 8.8 - 13.5 root/stem, root length 6.5 - 7.4 cm and root diameter between 1.02 - 1.16 mm.

Key Words: *Morus nigra, IBA, Rooting, Callus, Decay*

Açık ve Karanlık Koşulların Karadut (*Morus Nigra* L.) Odun Çeliklerinin Kök Gelişimi Üzerine Etkileri

Özet

Bu çalışma, karadut odun çeliklerinin aydınlık ve karanlık koşullarda bekletilerek kök gelişiminin belirlenmesi amacıyla yapılmıştır. Deneme, 2021 yılında Tokat Gaziosmanpaşa Üniversitesi Araştırma ve Uygulama Merkezine ait karadut yetiştiriciliği yapılan polietilen serada yürütülmüştür. Materyal olarak, damızlık karadut ağaçlarının bir yaşlı dallarından hazırlanan odun çelikleri kullanılmıştır. Seradan alınan çelikler 3 farklı gruba ayrılarak alttan ısıtmalı (22±2 °C) perlit ortamına dikilmiştir. Birinci grup çelikler hiç bekletilmeden (kontrol), ikinci grup çelikler 5 gün açıkta bekletildikten sonra (açıkta) ve üçüncü grup çelikler 5 gün karanlıkta bekletildikten (karanlıkta) sonra dikilmiştir. Tüm çelikler dikimden hemen önce 6000 ppm IBA (indol-3-bütirik asit) hormonuna 5 saniye süreyle daldırılmıştır. Deneme 3 tekerrürlü olup, her bir tekerrürde 15 çelik bulunmaktadır. Köklenme ortamında 90 gün bekletildikten sonra çelikler sökülerek; kök sayısı (kök/çelik), kök uzunluğu (cm), kök çapı (mm), çürüme oranı (%), köklenme oranı (%) ve kallus oluşum oranı (%) parametreleri incelenmiştir. Çalışma sonucunda, incelenen parametrelerde farklı koşullar arasında istatistiki açıdan önemli bir farklılık oluşmamıştır. Elde edilen verilere göre; köklenme oranı %68.89 - %93.33 arasında, çürüme oranı %24.4 - %55.5 arasında, kallus oluşum oranı %68.8 - %88.8 arasında, kök sayısı 8.8 - 13.5 kök/çelik, kök uzunluğu 6.5 - 7.4 cm ve kök çapı 1.02 - 1.16 mm arasında değerler almıştır.

Anahtar Kelimeler: *Morus nigra, IBA, Köklenme, Kallus, Çürüme*

Giriş

Dut *(Morus spp.), Urticales* takımı *Moraceae* familyasının *Morus* cinsinde yer alan, değişik iklim ve toprak koşullarına adaptasyon yeteneğinin yüksek oluşu (Özgen, 2010) ve özellikle kuşların meyvelerini yiyerek tohumlarını uzak yerlere taşımasıyla dünyanın pek çok yerinde yetişebilen bir meyve türüdür (Machii ve ark., 2002). Bu nedenle *Morus* cinsinin orijininin neresi olduğu konusunda araştırmacılar arasında fikir birliği sağlanamamıştır. *Morus* cinsine ait bazı türler ülkemizde de geniş yayılma alanı oluşturmuştur. Ülkemizde bilinen ve meyvesinden yararlanılarak en çok yetiştirilen *Morus alba* L. (beyaz dut), *Morus nigra* L. (karadut), *Morus rubra* L. (kırmızı dut), *Morus laevigata* (parmak dut) türleridir (Özbek, 1977). Bunlardan biri olan Karadut (Morus nigra L.), Dutgiller (*Moraceae*) familyasına ait olup anavatanı Türkiye, İran, Arabistan, Rusya ve Suriye olarak bilinmektedir (Bellini ve ark., 2000; Roger 2002). Meyveleri kuru-taze tüketimin yanı sıra pekmez, reçel, marmelat, pestil, dut ezmesi, meyveli dondurma, pasta, çörek, puding, cevizli sucuk, sirke, meyve suyu konsantresi yapımında kullanılmaktadır (Erdoğan ve Pırlak, 2005). Dutun daha çok meyvelerinden faydalanıldığı bilinse de yaprak, gövde ve kök kabukları da farklı alanlarda kullanılmaktadır. Yaprakları çay ve bazı yörelerde yemek

yapımında ayrıca ipek böceği yetiştiriciliğinde fayda sağlamaktadır. Gövdesi kâğıt, çuval, mobilya ve müzik aleti yapımında kullanılmaktadır (Lale ve Özçağıran, 1996; Moore, 2002; Suttie, 2002). Ancak hem birçok alanda faydalanılan hem de besin değeri yüksek olan dut bitkisi için ticari anlamda yetiştiricilik istenilen seviyelerde değildir. Dut bitkisinin tohum, çelik, aşı, daldırma ve doku kültürü ile üretimi yapılmaktadır. Bunlardan en çok tercih edilen çelik ile çoğaltma yöntemidir. Çünkü çelikle çoğaltma yöntemi diğer çoğaltma yöntemlerine göre daha pratik bir uygulamadır. Fakat karadut adventif köklenme kabiliyeti zayıf olan türlerden biridir. Bu nedenle karadutta çelikle çoğaltma çalışmalarında IBA ve NAA gibi bitki hormonları kullanılarak, çelikle çoğaltması zor olan türlerde köklenme oranını artırmaya yönelik çalışmalar yapılmaktadır (Ünal ve ark., 1992; Şenel, 2002; Karadeniz ve Şişman, 2003; Koyuncu ve ark., 2003; Erdoğan ve Aygün, 2006; Yıldız ve ark., 2009; Ekizoğlu, 2010; Yağlıoğlu, 2015; Edizer ve ark., 2016). Yapılan çalışmaların sonuçları incelendiğinde, IBA uygulamalarının 1000 ila 8000 ppm aralığında değişen dozlarının köklenme oranlarına farklı etkiler gösterdiği görülmektedir. Bu çalışmanın amacı, Karadut odun çeliklerinin açıkta ve karanlık koşullarda bekletildikten sonra dikim öncesi 6000 ppm IBA uygulamasının kök gelişimi üzerine ne tür etkilerinin olacağını belirlemektir.

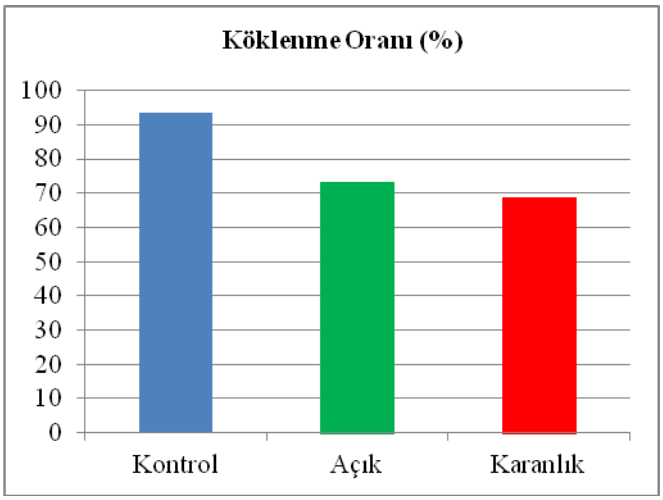
Materyal ve Yöntem

Deneme, Tokat Gaziosmanpaşa Üniversitesi Araştırma ve Uygulama Merkezine ait polietilen serada kurulmuştur. 1 Ocak 2020 tarihinde alınan karadut odun çelikleri üç gruba ayrılmıştır: Birinci grup çelikler hiç bekletilmeden (kontrol), ikinci grup çelikler oda koşullarında 5 gün açıkta bekletildikten sonra (açıkta) ve üçüncü grup çelikler oda koşullarında 5 gün karanlıkta bekletildikten (karanlıkta) sonra dikilmiştir. Tüm çelikler dikimden hemen önce 6000 ppm IBA (indol-3-bütirik asit) hormonuna 5 saniye süreyle daldırılmıştır. Çelikler, içinde saf perlit bulunan alttan ısıtmalı (22±2 °C) bentlere dikilmiştir. Çeliklerin sulanması düzenli aralıklarla gerçekleştirilmiştir. Çelikler dikimden 90 gün sonra köklendirme ortamından sökülerek kök sayısı (adet/çelik), kök uzunluğu (cm), kök çapı (mm), çürüme oranı (%), köklenme oranı (%) ve kallüs oluşum oranı (%) belirlenmiştir. Deneme, tesadüf parselleri deneme desenine göre 3 tekerrürlü ve her bir tekerrürde 15 çelik olacak şekilde kurulmuştur. Araştırma sonucunda elde edilen veriler varyans analizine tabi tutulduktan sonra uygulama ortalamaları arasındaki farklar önemlilik derecesine ($p<0.05$) göre Duncan çoklu karşılaştırma testine tabi tutulmuştur.

Bulgular ve Tartışma

Köklenme Oranı (%)

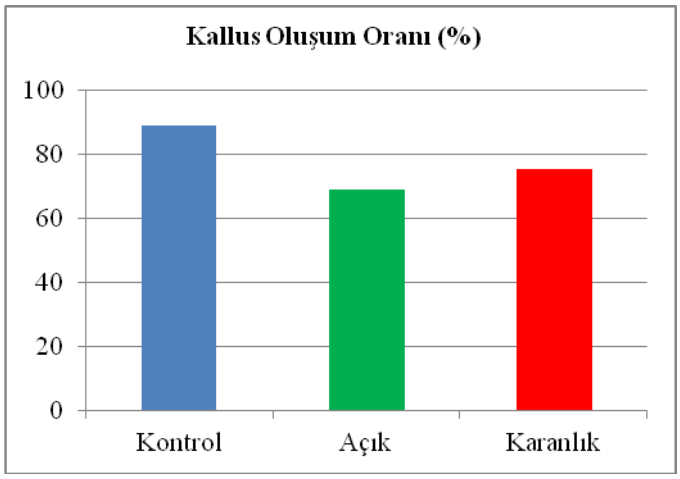
Şekil 1. incelendiğinde farklı koşullar arasında oluşan farklılıklar istatistiki açıdan önemsiz bulunmuştur. Karadut çeliklerinde köklenme oranı; kontrol uygulamasında %93.33, açıkta bekletilenlerde %73.3 ve karanlıkta bekletilenlerde %68.89 olarak belirlenmiştir. Literatürde yapılan çalışmalarda: Ünal ve ark. (1992) en yüksek köklenme oranını %14.4 bulurken, Karadeniz ve Şişman (2004) 2000 ppm IBA dozu ile %23.4, Koyuncu ve ark., (2003) 5000 ppm IBA dozu ile %33.3, Erdoğan ve Aygün (2006) 6000 ppm IBA dozu ile %60 olarak bulmuştur. Bu sonuçlara bakıldığında IBA dozunun artması ile birlikte köklenme oranının da arttığı görülmektedir. Ayrıca 2000 ppm IBA uygulamasının köklenme oranına etkisinin incelendiği diğer çalışmalarda %85 (Roussos ve ark., 2020) ve %70 (Zenginbal ve Demir 2018) gibi daha yüksek köklenme oranlarına ulaşılmıştır.



Şekil 1. Karadut (*Morus nigra L.*) odun çeliklerinin farklı koşullarda bekletilmesinin köklenme oranı (%) üzerine etkisi

Kallus Oluşum Oranı (%)

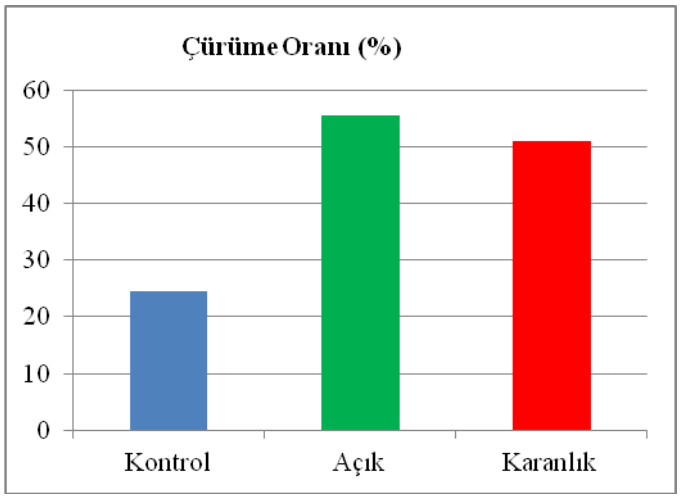
Bitkiler, yaralanmaya tepki olarak kallus (yara) dokusu oluşturur. Bu yara dokusu köklenme ortamındaki çürümeyi önleyerek çeliklerin hayatta kalma süresini artırabilir. Yaptığımız çalışmada, kallus oluşum oranları açısından koşullar arasında belirgin bir farklılık oluşmamıştır (Şekil 2.). Kallus oluşum oranları; kontrol uygulamasında %88.89, açıkta %68.89 ve karanlıkta %75.56 olarak bulunmuştur. Literatür incelendiğinde kallus oluşum oranı 4000 ppm IBA uygulaması sonucunda %70 (Koyuncu ve ark., 2003), 8000 ppm IBA uygulaması sonucunda ise %100 (Edizer ve ark., 2016) bulunduğu bildirilmiştir.



Şekil 2. Karadut (*Morus nigra L.*) odun çeliklerinin farklı koşullarda bekletilmesinin kallus oluşum oranı (%) üzerine etkisi

Çürüme Oranı (%)

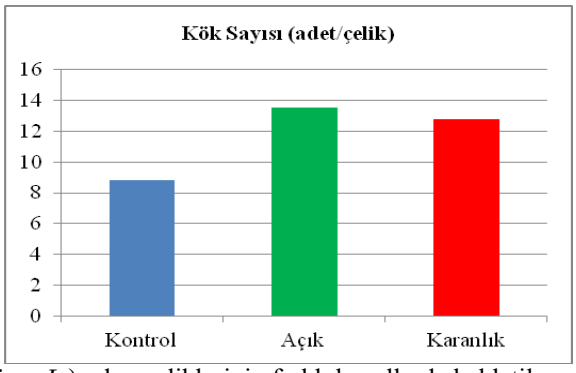
Çürüme oranları açısından koşullar arasında belirgin bir farklılık bulunmamıştır (Şekil 3.) 6000 ppm IBA uygulaması yapılarak farklı koşullarda bekletilen karadut odun çeliklerinin çürüme oranı kontrol uygulamasında %24.44, açıkta bekletilen çeliklerde %55.55 ve karanlıkta bekletilen çeliklerde ise %51.11 olarak belirlenmiştir.



Şekil 3. Karadut (*Morus nigra L.*) odun çeliklerinin farklı koşullarda bekletilmesinin çürüme oranı (%) üzerine etkisi

Kök Sayısı (adet/çelik)

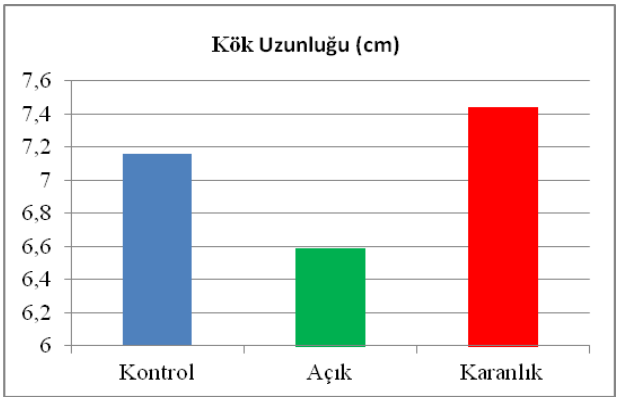
Şekil 4. incelendiğinde koşullar arasında istatistiki açıdan önemli bir fark çıkmamıştır. Kök sayısı kontrol uygulamasında 8.84 adet/çelik, açıkta ve karanlıkta bekletilen çeliklerde sırasıyla 13.51 ve 12.76 adet/çelik olarak tespit edilmiştir. Literatürde yapılan çalışmalara bakıldığında; Koyuncu ve Şenel (2003) ve Yıldız ve ark., (2009)'nın yaptığı çalışmalar sonucunda kök sayıları sırasıyla 2.2 adet/çelik ve 3.5 adet/çelik olarak belirtilmiştir. Bizim bulduğumuz değerlere kıyasla ifade edilen bu değerler düşük bulunmuştur. Diğer çalışmalarda ise Koyuncu ve ark., (2004) 8.0 adet/çelik, Zenginbal ve Demir, (2018) 9.64 adet/çelik, Singh (2018) 8.55 adet/çelik, Roussos ve ark., (2020) ise 14.8 adet/çelik kök sayısı elde ederek yaptığımız çalışma ile benzer sonuçlar görülmüştür.



Şekil 4. Karadut (*Morus nigra L.*) odun çeliklerinin farklı koşullarda bekletilmesinin kök sayısı (adet/çelik) üzerine etkisi

Kök Uzunluğu (cm)

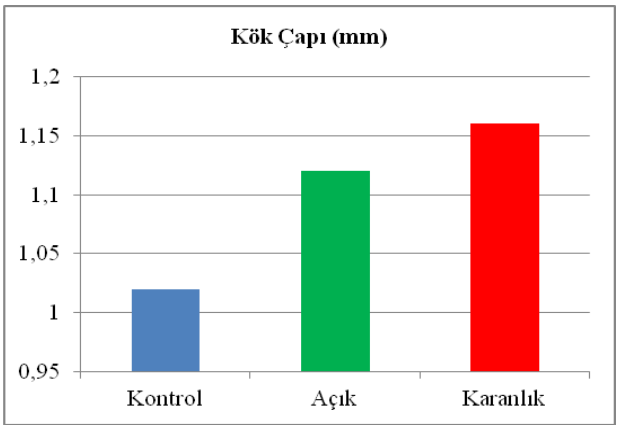
Kök uzunluğu parametresinde istatistiksel açıdan bir farklılık oluşmadığı görülmüştür (Şekil 5.). Elde edilen sonuçlara göre kök uzunluğu kontrol uygulamasında 7.16 cm, açıkta bekletilen çeliklerde 6.59 cm, karanlıkta bekletilenlerde ise 7.44 cm olduğu tespit edilmiştir. Elde ettiğimiz bu değerler, diğer araştırmacılar tarafından elde dilen kök uzunluğu değerleri ile karşılaştırılacak olursa, Yıldız ve ark., (2009)'nın 6.66 cm, Zenginbal ve Demir, (2018)'in 8.23 cm, Singh (2018)'in 9.11cm ve Roussos ve ark., (2020)'nın 8 cm olarak bildirdiğiyle uyum içerisinde olduğu görülmüştür.



Şekil 5. Karadut (*Morus nigra L.*) odun çeliklerinin farklı koşullarda bekletilmesinin kök uzunluğu (cm) üzerine etkisi

Kök Çapı (mm)

Şekil 6. incelendiğinde kök çapları bakımından koşullar arasında istatistiksel açıdan bir farklılık bulunamamıştır. Çeliklerin kök çapları kontrol uygulamasında 1.02 mm, açıkta bekletilenlerde 1.12 mm, ve karanlıkta bekletilenlerde 1.16 mm olarak tespit edilmiştir. Bulduğumuz bu değer Yıldız ve ark., (2009)'nın 2.03 mm ve Zenginbal ve Demir, (2018)'in 2.31 mm olarak bulduğu değerden düşük çıkmıştır. Bu farklılığın sebebi farklı koşullar ve ortam sıcaklıklarından kaynaklanmış olabilir.



Şekil 6. Karadut (*Morus nigra L.*) odun çeliklerinin farklı koşullarda bekletilmesinin kök çapı (mm) üzerine etkisi

Sonuç

Yapılan çalışma sonucunda, karadut odun çeliklerinin dikim öncesinde 5 gün açıkta ve karanlıkta bekletilmesinin köklenme kabiliyetlerine olumlu etkisinin olmadığı, kontrol ile benzer etki gösterdiği saptanmıştır. Deneme sonucunda incelenen parametrelerde; köklenme oranı %68.89 - %93.33 arasında, çürüme oranı %24.4 - %55.5 arasında, kallus oluşum oranı %68.8 - %88.8 arasında, kök sayısı 8.8 - 13.5 kök/çelik, kök uzunluğu 6.5 - 7.4 cm ve kök çapı 1.02 - 1.16 mm arasında değerler almıştır.

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Comparison of Some Quality Parameters in Fresh and Dry Samples of *Morus Rubra* Fruits

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Abstract
In Turkey, three species of mulberries, white (*M. Alba*), black (*M. Nigra*), and red-purple (*M. Rubra*) are grown commonly. These widely can be consumed fresh as well as dry. However, its rapid post-harvest decay raises major concerns about the sustainability of the fruit for both food and economic purposes. In this regard, besides the fresh consumption of black mulberry fruit, it can consume as dried it also offers an alternative way. In this study, it was aimed to compare some quality parameters in fresh and dry samples of *Morus rubra* fruits grown in TOKAT. It was applied different temperatures to Morus rubra fruits that at collected in two different maturity levels (semi-ripe and full-ripe). In the drying process, mulberry fruits were dried in a hot air dryer at 40, 50, 60, and 70 °C. Total phenol, total monomeric anthocyanin, total antioxidant capacity, colour values (L, a, b) chroma, hue (h°), and browning indices values will be measured in fresh and dried products. In addition, different mathematical models will be tried by constantly noting the weight drops of the products at certain time intervals and determining which mathematical model will best predict the drying kinetics.
Key Words: *Antioxidant, Phenol, Anthocyanin, Drying, Mulberry*

Introduction

Mulberry is a member of the family *Moraceae* and genus *Morus* and is found all over the world in a variety of climatic settings ranging from tropical to temperate Morera or mora in Spanish, Moreira in Portuguese, Murier in French, Tut in Urdu, and Sahtut in Hindi are some of the names given to it. There are over a thousand mulberry cultivars available for sericulture in China, the world's leading sericulture nation. *Morus alba* L. is the most dominant species among the 24 species and 1 subspecies (Herman et al. 2022). Mulberry is a fast-growing deciduous plant and it grows under different climatic conditions such as tropical, subtropical, and temperate throughout the world. It has been cultivated in the Northern hemisphere for centuries. In Türkiye, mulberry fruits are as important as the other temperate fruit species such as apricot, walnut, sour cherry, etc. Mulberry trees are extensively grown in southern Europe, India, and China for their foliage as foods for silkworms. However, in Türkiye and Greece mulberries are grown for fruit production rather than foliage. In Türkiye, growing conditions in the most agroecological region are very suitable for cultivating high-quality mulberry fruits, mainly from *Morus alba, Morus nigra,* and *Morus rubra* (Güngör ve Şengül., 2008). Mulberry production number of 69,475 tonnes in the year of 2021 (Turkish Statistical Institute- TUIK, 2018). Mulberry, because of the short harvesting season and their sensitivity to storage, fresh mulberry fruits should be preserved in some form. Unwashed berries can be kept in a container for several days in a refrigerator. Another preservation method is drying. Also, it is used in mulberry pekmez (a concentrated mulberry juice product), juices, paste, and marmalade (Doymaz, 2004). Drying is one of the oldest and most common methods used to preserve foods and it can be carried out either traditionally, by sun drying, or industrially by solar, hot air, infrared, and other drying methods (Golpour et al., 2020). The fruits are easily spoiled after harvest due to their high moisture content. For this reason, fruits are subjected to either drying processes or cold storage processes so that they can be preserved for a long time without spoiling (Doymaz, 2011). Drying agricultural products; ensures that the moisture in their content can be removed and stored for a long time. With the drying process, the physical structure of the products is reduced, making them much easier to transport. It ensures that products that need to be consumed quickly after harvesting have a longer shelf life. In our country, the drying process is mostly done in an open environment. Although the cost of this drying method is low, it negatively affects the quality of the dried product, prolongs the drying time, and does not provide a hygienic drying environment. In order to eliminate these disadvantages, drying methods have been developed in which drying is done in a closed environment and product-specific drying conditions are controlled. In the drying process, which is one of these methods, the air temperature can be controlled, the drying process can be carried out in a shorter time and a high-quality final product can be obtained (Figiel,2010).

Materials and Methods

Materials

Fruits to be Dried and Ripening Levels Semi and full-ripe purple mulberry fruits to be used as the drying material were harvested from a grower orchard in Kemalpaşa village of Tokat province on 11th of July, 2022.

1. Moisture determination process

In order to determine the moisture content, an average of 50±1.5 g of fresh fruit was used and dried at 70 ºC with 5 replications until the weight change was stabilized in both maturity stages (Abuska ve Doğan, 2010).

2. Drying process

The products to be subjected to the drying process within the scope of the experiment were first sorted and placed in aluminium containers in equal amounts and dimensions in a thin layer drying model as 4 replications and weighed with a precision balance with 0.01 g sensitivity. The products prepared for the drying process were weighed in an oven dryer at 40, 50, 60, and 70 °C at regular intervals until the moisture content decreased to 10% humidity and the drying process was carried out. Colour measurements of the products falling to the determined moisture level were made (Polatcı ve Taşova, 2017).

3. Oven

The oven used in the study is Şimşek Laborteknik brand and model ST-120. The cabin temperature is measured with the sensors in the oven and transmitted to the control unit. The drying air temperature is adjusted via the control unit on the oven.

4. Drying Models

During the drying process of the products, the available moisture content (ANO) values were calculated in accordance with the given equation.

$$ANO = \frac{M-M_e}{M_0-M_e}$$

ANO: Separable humidity
M: Instant moisture content of the product
Me: Equilibrium moisture of the product
Mo: Initial moisture content of the product

Equations of the models used

Model name	**Equality**	**Source**
Page	MR= exp (-h.(t^j))	Liu et al. (2009)
Modifiye Page	MR=exp[(-kt)^n]	Toğrul (2006)
Lewis	MR=exp(-kt)	Doymaz (2006)

In order to process the data obtained after the drying process of the products, Page, Yağcıoğlu, Midilli, et al. equations are used. As a result of drying, the moisture rates in the products were calculated with the given equations and the acceptable humidity rate was modelled with the model equations. It was determined which model predicted the available moisture content better.

5. Colour Measurements

Colour measurements of mulberry fruits after drying were made with a Minolta brand CR400 (Japan) colourimeter and L, a, b values were determined.

(L) refers to the brightness value of the product and varies between 0-100. When L gets the value of 0 (zero), it means that the colour is black, that is, there is no reflection, and when it takes the value of L 100, it means that the product colour is white, that is, the reflection is complete. The value (a) denotes red-green, and (b) denotes yellow-blue colours and takes (+, -) values, respectively. If the colour values are a = 0 and b = 0, it shows that the colour is Gray (McGuire, 1992). Other colour values to be calculated will be determined using the measured colour values.

Table of colour equations to be calculated

Colour Value	**Equality**
Croma, C	$C = (a^2 + b^2)^{1/2}$
Hue, º	$h^\circ = \tan^{-1}(\frac{b}{a})$
colour change, ΔE	$\Delta E = \sqrt{(L - L*)^2 + (a - a*)^2 + (b - b*)^2}$

Here, Croma (C): hue of the colour, hue°: angle value of the colour, colour change (ΔE): indicates the colour change value after drying compared to fresh.

6. Chemical Analyses;

6.1. Total Solution Soluble TSS

After the fruits were pureed in the homogenizer, the juices were extracted by centrifugation. Then, in a digital refractometer calibrated according to pure water (Atago PAL-1, USA) readings were made and the values were expressed as %.

6.2. Total phenolic content

Total phenolic content was measured according to the procedure described by Singleton and Rossi (1965). 40 ml of water was added to 10 g of dried mulberry sample and kept at +4 for 3 days. It was then extracted with a buffer containing acetone, water and acetic acid (70:29.5:0.5 v/v) for 24 hours in the dark. The extracts were combined with Folin-Ciocalteu's phenol reagent and water and incubated in the room for 8 minutes, then 7% sodium carbonate was added. After 2 hours, absorbance at 750 nm was measured in an automated UV-vis spectrophotometer (Model T60U, PG Instruments). Gallic acid was used as standard. Results were expressed as micrograms (µg) gallic acid equivalent (GAE) g-1 (Aglar et al. 2017).

6.3. Total Antioxidant Capacity (TEAC)

For the standard TEAC assay, ABTS+ was dissolved in acetate buffer and prepared with potassium persulfate. The mixture was diluted in an acidic medium of 20 mM sodium acetate buffer (pH 4.5) to an absorbance of 0.700±0.01 at 734 nm for longer stability. For the spectrophotometric assay, 2.97 mL of the ABTS+ solution and 20µL of fruit extract were mixed and incubated for 10 min and the absorbance was determined at 734 nm (Gündüz et al. 2013).

Statistical analysis

In order to determine the effects of drying temperatures on the colours, drying values, and chemical analyses of mulberry fruit in two different maturity stages, a comparison was made according to the $p<0.05$ importance level in the SPSS package program.

Result and Discussion

The first moisture contents of semi-ripe and fully ripe purple mulberries before drying are given in Table 1.

Table 1 initial moisture content of semi-ripe and full-ripe purple mulberries

FIRST MOISTURE CONTENT	
Full- Ripe	SEMI- RIPE
73.10	79.72

The final moisture values and drying times of the dried products are given in Table 2.
According to the table, the shortest drying time was observed in the semi-mature product at a drying temperature of 870 minutes and 70 °C, while the longest drying time was observed in the semi-mature product at a temperature of 7590 minutes and 40 °C. It was determined that the increase in drying temperature decreased the drying time for all products.

Table 2 final moisture values and drying times of dried products

Product	*DRYING TEMPERATURE*	*AVERAGE FINAL MOISTURE (%)*	*DRYING TIME(MIN)*
Full- Ripe	40	10.63	6810
	50	9.93	3150
	60	9.67	2070
	70	9.83	1350
Semi- Ripe	40	10.04	7590
	50	10.59	2970
	60	10.00	1530
	70	10.31	870

The R2 values calculated in the thin layer drying model of the dried products are given in Table 3.
According to the table, the model that best predicts drying was determined as 0.9999 in fully mature product and Wang Singh at 40 °C drying temperature.

Table 3. R^2 values calculated in the thin layer drying model of the dried products

DRYING TEMPERATURE					
Product	Drying Model	40	50	60	70
Full- Ripe	PAGE	0.9945	0.9983	0.9976	0.9936
	LEWIS	0.9769	0.9887	0.9912	0.9664
	WANG SINGH	0.9999	0.9897	0.9993	0.9960
	Midilli Küçük	0.9998	0.9989	0.9984	0.9967
Semi- Ripe	PAGE	0.9950	0.9956	0.9953	0.9936
	LEWIS	0.9740	0.9793	0.9723	0.9664
	WANG SINGH	0.9996	0.9994	0.9994	0.9960
	Midilli Küçük	0.9995	0.9991	0.9994	0.9967

When Table 4 is examined, L, a, and b values were statistically different from fresh at a 5% significance level. However, when the L value was examined, there was no statistical difference between 40 and 70 C drying temperatures in semi-ripe fruit and 40 and 60 C in fully mature fruit. In the study, when the a value was examined, it was determined that there was no statistical difference at 40, 50, and 70 C drying temperatures in semi-ripe fruit, and at 40, 60, and 70 C drying temperatures in fully mature fruit. Looking at the b value; It was determined that there was no statistical difference in the drying temperatures of 40 and 50 C in semi-ripe fruit, and in 40, 60, and 70 C in fully ripe fruit.

Table 4. Fresh and dried L, a, b, values of semi-ripe and fully ripe purple mulberries

Semi- Ripe			
Drying Temperatures(C°)	L	a	B
FRESH	51.46^{a}	2.11^{c}	13.35^{a}
40 **C°**	33.55^{b}	5.58^{a}	5.70^{c}
50 **C°**	30.11^{c}	5.04^{a}	5.54^{c}
60 **C°**	18.99^{d}	3.36^{b}	-1.18^{d}
70 **C°**	32.51^{b}	5.07^{a}	8.34^{b}

Full- Ripe			
Drying temperatures(C°)	L	a	B
FRESH	21.94^{c}	10.45^{a}	0.22^{b}
40 **C°**	28.92^{ab}	5.12^{b}	2.36^{a}
50 **C°**	27.74^{b}	3.39^{c}	-0.62^{b}
60 **C°**	28.80^{ab}	4.80^{b}	2.00^{a}
70 **C°**	30.16^{a}	4.90^{b}	1.77^{a}

When Table 5 is examined, the chroma value, which shows the color saturation of the fresh fruit, was calculated as 10,52 in the fully ripe fruit.Taşova and Polatcı (2019), determined the color and some physical properties of finger mulberry fruit in their study. They found the chroma value between 6,16 and 10,85. In semi-ripe fruit, the chroma value was calculated as 13,74. In the fully ripe fruit, the lowest chroma value was found at 3,47 to 50 °C drying air, and the highest chroma value was found at 5,76 to 40 °C drying air temperature. In semi-ripe fruit, the lowest chroma value is 3,58, and 60 °C drying air temperature, The highest chroma value was calculated at a drying air temperature of 9,83 and 70 °C. When the total color change was examined, it was found that the highest drying temperature was 70 C in fully ripe fruit and 40 C in semi-ripe fruit. Tasova et al. (2021), in their study, determined the drying performance and color values of black mulberry fruit dried under different conditions. As a result of the study, the total color change for the black mulberry fruit was determined between 20-28 and the values show similar characteristics. When the color characteristics are examined, it is recommended to dry the semi-ripe fruit at 70 C and the fully ripe fruit at 40 C.

The phytochemical contents of semi-mature and fully mature levels of mulberry samples, regardless of temperature values, are given in Table 6. A statistically significant difference was found between semi-mature and fully mature products in the determination of total phenolic compounds. When compared at maturity levels, the phenolic content of fully mature products was 5532,90 (µg GAE/g), while it was found to be 3561,40 (µg GAE/g) in semi-ripe products.There was no statistical difference between maturity levels in the determination of total antioxidant capacity. However, as the maturity level increased, the antioxidant capacity increased , the antioxidant capacity increased. Antioxidant capacities were found as 4,58 (µmol TE/g) in semi-ripe fruits and 4,74 (µmol TE/g) in

fully ripe fruits. Although there is no statistical difference between the maturity levels in the amount of water-soluble dry matter, it increases in direct proportion with the increase in the maturity level. It was found as 63,55 (%) in semi-ripe products and 73,84 (%) in fully mature products. Many biochemical events such as the metabolization of sugars and acids, the hydrolysis of pectins, the production of carotenoids, and the exchange of phenolic compounds occur with the ripening of fruits and vegetables (Brummell, 2006; Prasanna et al. 2007; Tepe 2022).

Table 5 Chrome (C), Hue (H º), and Color Change (ΔE) of fresh and dried products

	DRYING METHOD	**DRYING CONDITION**	**C**	**H º**	**ΔE**
Full-Ripe	FRESH	-	10.52	1.94	-
	OVEN	40	5.76	21.90	23.84
		50	3.47	-9.71	24.54
		60	5.37	18.60	24.00
		70	5.29	17.94	25.35
Semi-Ripe	FRESH	-	13.74	50.24	-
	OVEN	40	8.33	39.61	26.30
		50	7.53	46.11	23.47
		60	3.58	-17.57	16.02
		70	9.83	55.49	24.21

Table 6. The effects of different maturity stages on phytochemical contents and TSS amounts in purple mulberry fruit.

Maturity Stage	**TP (µg GAE/g)**	**TEAC (µmol TE/g)**	**TSS (%)**
Semi-ripe	3561.40b	4.58	63.55
Full- Ripe	5532.90a	4.74	73.84
Materiality Level	0.013*	0.765^{NS}	0.260^{NS}

NS: Non Significant (p>0.05). ***:** p <0.05.

Regardless of their maturity level, different drying temperatures applied to the products and the phytochemical contents of fresh products are given in table 7. When all drying temperatures were compared with the fresh sample in the determination of total phenolic compounds, the difference between them was found to be statistically significant. The lowest phenolic content was found at 1253,06 (µg GAE/g) in fresh samples, while the highest phenolic content was 6607,65 (µg GAE/g) at 70 C˚ drying temperature. In addition, it was found that the total phenolic content showed an increasing trend with increasing drying temperatures. A statistical difference was found between fresh samples and drying temperatures in total antioxidant content. The lowest value was found as 2,13 (µmol TE/g) in fresh samples, and the highest value was 5,58 (µmol TE/g) at 40 °C.

Meral (2017) examined the effects of different drying temperatures on the antioxidant capacity in study on uskun fruit and found that the antioxidant value decreased with the increase in temperature and shortening of the time.

A similar result of this judgment was found in our study at 40°C. It was observed that the dried purple mulberry products preserved their antioxidant capacity more with the long drying time and low temperature. The difference between fresh samples and drying temperatures in the amount of water-soluble substances was found to be statistically significant. The highest value was found at 70 C˚ with 82,75%, while the lowest value was found at 21,80% in fresh samples. With the increase in temperature, the amount of water-soluble dry matter increased. The reason for this is that the amount of soluble dry matter in water is expected to increase as the volumes of the products decrease and liquid losses are experienced.

Table 7 The effect of different drying temperatures on phytochemical contents and TSS amounts in purple mulberry fruits.

Drying Temperatures(C˚)	**TP (µg GAE/g)**	**TEAC (µmol TE/g)**	**TSS (%)**
Fresh	1253.06 c	2.13 b	21.80 b
40	4432.65 b	5.58 a	75.25 a
50	5068.07 ab	4.98 a	82.17 a
60	5374.32 ab	5.04 a	81.50 a
70	6607.65 a	5.57 a	82.75 a
Materiality Level	0.001**	0.001**	0.001**

****:** p <0.01.

Phytochemical results of semi-ripe fresh and dried purple mulberry samples are given in Table 8. There was a statistical difference between the applications in the determination of total phenolic. While the highest value was 4218,07 (µg GAE/g) at 70 C°, the lowest value was 1222,23 (µg GAE/g) in the semi-ripe fresh products. Statistically, differences were found between the applications in total antioxidant values of semi-ripe products. The highest value was 6,01 (µmol TE/g) at 70°C, while the lowest value was 2,02 (µmol TE/g) in semi-ripe fresh samples. There are statistical differences between applications in the amount of water-soluble dry matter. Values were found between 19,07 – 78,67%.

Table 8 Effect of different drying temperatures on phytochemical content and TSS amount in purple (semi-ripe) mulberry fruits.

Maturity Drying Temperatures(C°)	TP (µg GAE/g)	TEAC (µmol TE/g)	TSS (%)
Semi-ripe Fresh	1222.23c	2.02c	19.07d
Semi-ripe 40	3401.40b	5.02ab	66.67c
Semi-ripe 50	4388.90a	5.16ab	78.67a
Semi-ripe 60	4576.40a	4.68b	76.67b
Semi-ripe 70	4218.07a	6.01a	76.67b
Materiality Level	0.001**	0.001**	0.001**

****:** p <0.01.

Phytochemical contents of fully ripe fresh and dried purple mulberry samples are given in Table 9. In terms of total phenolic values, statistical differences were determined between the applications. The results ranged from 1283,89 to 8997,23 (µg GAE/g). In addition, it was observed that the phenolic content increased with the increase in drying temperatures. Statistically, differences were found between applications in total antioxidant content and the highest value was 40 C° 6,14 (µmol TE/g) while the lowest value was 2,25 (µmol TE/g) when fully ripe. There were statistical differences between the applications in terms of the amount of water-soluble dry matter. Values range from 24,53% to 88,83%.

Table 9 Effect of different drying temperatures on phytochemical content and TSS amount in purple (full-ripe) mulberry fruits.

Maturity Drying Temperatures(C°)	**TP (µg GAE/g)**	**TEAC (µmol TE/g)**	**TSS (%)**
Full- Ripe Fresh	1283.89d	2.25d	24.53d
Full- Ripe 40	5463.90c	6.14a	83.83c
Full- Ripe 50	5747.23bc	4.79c	85.67b
Full- Ripe 60	6172.23b	5.39b	86.33b
Full- Ripe 70	8997.23a	5.13bc	88.83a
Materiality Level	0.001**	0.001**	0.001**

Conclusiun

There are two important criteria for phytochemicals in the drying process, temperature and time. In some products, higher losses may occur even at low temperatures due to the negative effect of time. In such studies, comments can be made about the best drying method time and temperature for different species by conducting experiments at different maturity levels and temperatures. The model that best predicted the drying curves was determined as WANG SINGH. If a semi-ripe berry is being dried and it is not desired to lose its antioxidant values, we recommend it to be dried at a high degree. If a full ripe mulberry is to be dried and its antioxidant values are to be preserved, we recommend low temperature.

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Effects of Paclobutrazol Applications on Rooting Performance of Black Mulberry (*Morus Nigra* L.) Hardwood Cuttings

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Abstract

The cutting reproduction are the cheapest and most practical method for plants capable of clonal regeneration. However, the difficulties in adventitious root formation in black mulberry cuttings create a disadvantage for mulberry growers. In this study, it was aimed to investigate the effect of IBA and Paclobutrazol applications on the rooting ability of black mulberry hardwood cuttings. The experiment was carried out in the polyethylene greenhouse of Tokat Gaziosmanpaşa University Agricultural Research and Application Center in February 2022. As material, hardwood cuttings prepared from one-year-old branches of breeding black mulberry trees within the body of the directorate were used. The study was set up in a randomized plot design with 3 replications and 15 cuttings in each replication. In the study, pure water as a control group, 6000 ppm IBA and doses of 1000 ppm, 2000 ppm and 3000 ppm Paclobutrazol respectively were applied to black mulberry wood cuttings separately and together. After the application, the cuttings were planted in perlite medium. The cuttings were kept in the rooting medium for 90 days and then by removed; rooting rate, root number, root length and root diameter values have been recorded. As a result of the study, the effect of the applications on the root number of the cuttings was not observed while on the rooting rate, root length and root diameter parameters was observed. In terms of rooting rate, the best result was obtained from IBA+PBZ 1000 application (40.00%) compared to the control group (0.0%). The highest root length was determined in IBA 6000 application, and the thickest root diameter values were determined in PBZ 1000 application.

Key Words: *Morus nigra, Callus, Rooting, Paclobutrazol, IBA*

Paclobutrazol Uygulamalarının Karadut (*Morus Nigra* L.) Odun Çeliklerinin Köklenme Performansı Üzerine Etkileri

Özet

Çelikle çoğaltma, klonal rejenerasyon yeteneği olan bitkiler için en ucuz ve en pratik yöntemdir. Fakat kara dut çeliklerinde adventif kök oluşumunda yaşanan zorluklar, dut yetiştiricileri için dezavantaj oluşturmaktadır. Bu çalışmada, karadut odun çeliklerinin köklenme kabiliyetleri üzerine IBA ve Paclobutrazol (PBZ) uygulamalarının etkisinin incelenmesi amaçlanmıştır. Deneme, 2022 yılının şubat ayında Tokat Gaziosmanpaşa Üniversitesi Tarımsal Araştırma ve Uygulama Merkez Müdürlüğü'ne ait polietilen serada yürütülmüştür. Materyal olarak müdürlük bünyesinde bulunan damızlık karadut ağaçlarının bir yaşlı dallarından hazırlanan odun çelikleri kullanılmıştır. Çalışma, tesadüf parselleri deneme desenine göre 3 tekerrürlü ve her tekerrürde 15 çelik olacak şekilde kurulmuştur. Çalışmada kontrol grubu olarak saf su, 6000 ppm IBA ve sırasıyla 1000 ppm, 2000 ppm, 3000 ppm PBZ dozları ayrı ayrı ve bir arada kara dut odun çeliklerine uygulanmıştır. Uygulama sonrasında çeliklerin perlit ortamına dikimi yapılmıştır. Köklenme ortamında 90 gün bekletilen çelikler bu süre sonunda sökülerek; köklenme oranı, kök sayısı, kök uzunluğu ve kök çapı değerleri kaydedilmiştir. Çalışma sonucunda, çeliklerin kök sayılarında uygulamaların etkisi görülmezken köklenme oranı, kök uzunluğu ve kök çapı parametrelerinde uygulamaların etkisi gözlemlenmiştir. Köklenme oranı bakımından en iyi sonuç kontrol grubuna (%0,0) kıyasla IBA+PBZ 1000 uygulamasından (%40,00) elde edilmiştir. En yüksek kök uzunluğu IBA 6000 uygulamasında, en kalın kök çapı değerleri ise PBZ 1000 uygulamasında tespit edilmiştir.

Anahtar Kelimeler: *Morus nigra, Kallus, Köklenme, Paclobutrazol, IBA*

Giriş

Dut (*Morus Nigra* L.), yüksek adaptasyon yeteneğine sahip, farklı iklim şartlarına ve toprak koşullarına uyum sağlayabilen kuzey yarım kürenin ılıman, tropik ve subtropik iklimlerinde yetişebilen bir meyve türüdür (Yağlioğlu, 2015). Yıllık yağış miktarı 600-2500 mm arasında olan yerlerde sulamaya ihtiyaç duyulmadan yetiştirilebilir (Saraçoğlu ve ark., 2016). Dut, dünyanın birçok bölgesinde yayılım göstermiştir ve Türkiye dutun anavatanı ve doğal yayılış alanları içerisinde yer almaktadır. Ülkemizde yaygın olarak yetiştiriciliği yapılan dut türleri Morus alba (beyaz dut), Morus nigra (karadut) ve Morus rubra (kırmızı veya mor dut)'dır (Yağlioğlu, 2015). Dut bitkisinin hem yaprağı hem de meyvesi farklı alanlarda kullanılmaktadır. Yaprağı yaygın olarak ipekböceği yetiştiriciliğinde ve farmakoloji alanında değerlendirilmektedir. Ayrıca dut bitkisinin yaprakları halk arasında alternatif tedavi yöntemi olarak da tüketilmektedir. Meyveleri ise taze tüketiminin yanı sıra, kurutularak, meyve suyu olarak, şurup, pekmez veya pestil yapılarak kullanılmaktadır (Dinçer, 2020) Ülkemizde dutun genetik potansiyeli ve tüketim imkanları fazladır. Fakat bu potansiyel yeterince kullanılmamaktadır (Yağlioğlu, 2015). Bu

potansiyelin değerlendirilmesi için karadut bitkisinin çeşitli yöntemlerle çoğaltılması ve üretiminin arttırılması gerekmektedir. Meyvecilikte modern üretimin ön koşulu kaliteli ve stadart fidan üretimi yapmaktır. Fidan üretiminde vejetatif olarak aşı, daldırma, doku kültürü ve çelikle çoğaltma yöntemleri kullanılmaktadır (Yıldız ve ark., 2009). Bu yöntemlerin birbirlerine göre avantaj ve dezavantajları bulunmaktadır. Aşı ile çoğaltma yöntemi belli anaçların üstün özelliklerinden yararlanmak için tercih edilir (Altuncu, 2019) fakat, karadutta aşı ile üretimde bazı zorluklar yaşanmaktadır. Aşı yapılırken meydana gelen süt salgısı ve aşı gözünün altında boşluk bulunması aşı tutmasını engellemektedir (Çekiç ve ark., 2013). Daldırma ile çoğaltma yöntemi, çoğaltılması zor olan meyve türlerinde kullanılmaktadır. Fakat bu yöntem iş gücü gereksinimi ve üretilen bitki sayısının sınırlı olması sebebi ile ticari fidan üretiminde tercih edilmemektedir (Altuncu, 2019). Doku kültürü ile üretim yöntemi ise kalifiye eleman eksikliği ve pahalı donanım gereksinimi nedeni ile henüz pratik bir yöntem değildir (Yağlioğlu, 2015). Çelikle çoğaltma yöntemi klonal rejenerasyon yeteneği gösteren bitkilerde kullanılabilecek en ucuz ve en pratik yöntem olarak kabul edilir (Yıldız ve ark., 2009). Karadutta çelikle çoğaltma en pratik yöntem olmasına rağmen adventif kök oluşturma kabiliyetinin zayıf olması sebebi ile istenen başarı elde edilememektedir (Yildiz ve ark., 2009). Karadut gibi köklenmesi zor olan bitki türlerinde, çelikle çoğaltımda çeşitli bitki büyüme düzenleyicilerin kullanımı ile köklenme oranı artırabilmektedir (Saraçoğlu ve ark., 2016). Köklendirme amacıyla kullanılan büyüme düzenleycilerin en yaygın kullanılanı oksin grubunda yer alan IBA (Indol bütirik asit)'dır. IBA, köklenmeyi teşvik etmektedir (Zenginbal ve ark., 2006). Yapılan çalışmalarda, çelikle çoğaltmada IBA'nın farklı dozları kullanılmış ve farklı sonuçlar elde edilmiştir (Yıldız ve ark., 2009; Çekiç ve ark., 2013). Köklenmeyi arttırmak amacı ile IBA dışında farklı bileşikler de kullanılmaktadır. Bu bileşikler arasında yer alan Paclobutrazol (PBZ) bir triazol türevi bileşik olup, düşük dozlarda bile etkisini gösterebilmektedir (Çekiç ve ark., 2013). PBZ, genellikle fide yetiştiriciliğinde durdurucu olarak kullanılmaktadır (Geboloğlu ve ark., 2015; Geboloğlu ve ark., 2016). Bir giberellin biyosentez inhibitörü olarak PBZ'nin düşük konsantrasyonlarda kullanıldığında çeliklerde kök oluşumunu uyardığı bildirilmiştir (Bueno ve ark., 2021). Bu çalışmada, karadut odun çeliklerinin köklenme kabiliyetleri üzerine IBA ve PBZ uygulamalarının etkisinin incelenmesi amaçlanmıştır.

Materyal ve Yöntem

Yapılan bu çalışma Tokat Gaziosmanpaşa Üniversitesi Tarımsal Araştırma ve Uygulama Merkez Müdürlüğü bünyesinde bulunan çelikle çoğaltma ünitesinde yürütülmüştür. Materyal olarak müdürlük bünyesinde bulunan damızlık karadut ağaçlarının bir yaşlı dallarından hazırlanan odun çelikleri kullanılmıştır. Odun çelikleri 2022 yılının şubat ayında alınarak perlit ortamına dikilmiştir. Köklenme ortamında 90 gün bekletilen çelikler bu süre sonunda sökülerek; köklenme oranı, kök sayısı, kök uzunluğu ve kök çapı değerleri kaydedilmiştir. Çalışma, tesadüf parselleri deneme desenine göre 3 tekerrürlü ve her tekerrürde 15 çelik olacak şekilde kurulmuştur. Dikimden önce odun çeliklerinin üçte birlik kısımları 6000 ppm IBA, 1000 ppm PBZ, 2000 ppm PBZ ve 3000 ppm PBZ çözltilerine ayrı ayrı ve bir arada olacak şekilde daldırılmıştır (Çekiç ve ark., 2013). Sadece IBA uygulanan çelikler, etanol içerisinde çözünen IBA solüsyonunda 5 saniye, sadece PBZ uygulanan çelikler ise PBZ çözeltisinde 15 dakika bekletildikten sonra dikimi yapılmıştır. IBA ve PBZ'nin birlikte kullanıldığı uygulamalarda çelikler, önce PBZ çözeltisine ardından IBA çözeltisine daldırılıp dikimi yapılmıştır. Deneme sonunda çelikler sökülerek; köklenme oranı, kök sayısı, kök uzunluğu ve kök çapı paremetreleri tespit edilmiştir. Elde edilen veriler SAS paket programı kullanılarak varyans analizine tabi tutulduktan sonra ortalamaların karşılaştırılmasında Duncan çoklu karşılaştırma testi ($P<0.05$) kullanılmıştır.

Bulgular ve Tartışma

Karadut odun çeliklerinden elde edilen köklenme oranı, kök sayısı, kök uzunluğu ve kök çapı verileri Tablo 1'de verilmiştir. Kontrol ve PBZ 3000 ppm uygulamalarında köklenme olmadığı için kök sayısı, kök uzunluğu ve kök çapı verileri elde edilememiştir.

Tablo 1. Farklı IBA ve PBZ uygulamalarının karadut odun çeliklerinin köklenme parametreleri üzerine etkisi

UYGULAMALAR (ppm)	KÖKLENME ORANI (%)	KÖK SAYISI (Kök Sayısı/Çelik)$^{Ö.D.}$	KÖK UZUNLUĞU (cm)	KÖK ÇAPI (mm)
KONTROL	0.00 C	-	-	-
IBA 6000	31.11 AB	9.07	36.60 A	1.58 CD
PBZ 1000	2.22 C	1.00	5.00 B	2.90 A
PBZ 2000	2.22 C	7.00	5.40 B	1.94 BC
PBZ 3000	0.00 C	-	-	-
IBA + PBZ 1000	40.00 A	23.22	27.30 AB	1.45 D
IBA +PBZ 2000	33.33 AB	13.64	20.00 AB	2.02 B
IBA+PBZ 3000	22.20 B	27.87	18.00 AB	1.84 BC

Aynı sütunda aynı harfle gösterilen ortalamalar arasındaki fark önemli değildir ($p<0.05$). Ö.D.: Önemli değil.

Köklenme oranı verilerine baktığımızda kontrol grubu ve PBZ 3000 ppm uygulamasında hiç köklenme görülmemiştir. En iyi köklenme oranı ise IBA+PBZ 1000 ppm uygulamasında görülmüştür. Çeliklerin köklenme kabiliyeti üzerine tek başına uygulanan PBZ'nin etkisi zayıf kalmıştır. Fakat, IBA ile birlikte kullanıldığında, PBZ sinerjik etkileşime girerek köklenme oranını artırmıştır. Ayrıca IBA+PBZ uygulamalarında, PBZ dozları düştükçe köklenme oranı artmıştır. Çalışmamıza benzer şekilde, Çekiç ve ark., (2013) yaptığı çalışmada, PBZ'nin IBA ile birlikte uygulandığında karadut odun çeliklerinin köklenme oranını artırdığını ifade etmiştir. Kivi bitkisinin çelikle çoğaltılmasının incelendiği bir çalışmada, IBA+ PBZ uygulamalarında, PBZ'nin sabit (500 ppm) IBA dozlarının (1.500, 2.500 ve 3.500 ppm) ise artmasıyla köklenme oranının artma eğiliminde olduğu görülmüştür (Ali ve ark., 2017).

Tablo 1. de çelik başına kök sayısı verilerine bakıldığında, uygulamalar arasında istatistiksel açıdan herhangi bir farklılık oluşmamıştır. Kök uzunluğu verileri incelendiğinde ise, en yüksek kök uzunluğu IBA uygulamasından elde edilmiştir. En düşük kök uzunluğuna ise PBZ'nin tek başına kullanıldığı uygulamalarda ulaşılmıştır. PBZ'nin IBA ile birlikte kullanıldığında tek başına kullanımına kıyasla kök uzunluğuna etkisi daha çok olmuştur. Ali ve ark., (2017) yaptıkları çalışmada, 3500 ppm IBA + 500 ppm PBZ uygulaması sonucunda en yüksek kök uzunluğunu (13.53 cm) elde etmiştir. Çekiç ve ark., (2013)'nın yaptığı çalışmada ise 6000 ppm IBA uygulaması sonucunda en yüksek kök uzunluğuna (20 cm) ulaşıldığı rapor edilmiştir.

Kök çapı verilerine bakıldığında en iyi sonuç PBZ 1000 uygulamasından (2.90 mm) elde edilmiştir. Burada IBA 6000 uygulamasına kıyasla PBZ'nin kullanıldığı uygulamalar (IBA + PBZ 1000 uygulaması hariç) kök çaplarını artırmıştır. PBZ'nin bu etkisi, bitki büyümesini durdurucu özelliğinden kaynaklanmış olabilir. Çekiç ve ark., (2013)'nın yaptığı çalışmaya göre en kalın kök çapı 1.3 mm ile 6000 ppm IBA + 2000 ppm PBZ uygulaması sonucunda elde edilmiştir. Ali ve ark., (2017)'nın kivide yaptıkları çalışmaya göre en kalın kök çapına (1.18 mm) IBA 2500 ppm + Paclobutrazol 500 ppm uygulamasından ulaşılmıştır.

Sonuç

Çalışma sonucunda, en yüksek köklenme oranı IBA + PBZ 1000 uygulamasında tespit edilmiş ve bunu IBA + PBZ 2000 ve IBA 6000 uygulamaları izlemiştir. Aynı zamanda IBA + PBZ 1000 uygulamasında en düşük kök çapı değerleri gözlemlenmiştir. En yüksek kök çapı değerleri ise PBZ 1000 uygulamasında belirlenmiştir. Kök uzunluğu parametresinde en yüksek değer IBA 6000 uygulamasında görülmüş ve bunu IBA'nın PBZ ile birlikte kullanıldığı uygulamalar takip etmiştir. Elde edilen bulgular ışığında, PBZ'nin IBA ile birlikte kullanıldığında karadut odun çeliklerinin köklenme performansını artırdığı saptanmıştır.

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Bioremediation in Forest Ecosystem

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Abstract
The most important environmental problems in today's world arise from uncontrolled increase of the population, rapidly decreasing forests and green fields, incorrect use of fields, unplanned urbanization, harmful wastes, unconscious production and consumption of energy, traffic, heavy metal loaded products of factories and mining deposits and many other human activities. Environmental pollution resulting from all these factors is an unfavorable situation in the modern world. In order to solve these problems and restore the ecosystems, fighting with pollution efficiently with rapidly developing biotechnological methods is crucial. Bioremediation is one of such technologies.
Bioremediation is the use of microorganisms to remove pollutants from soil, water and air. This is carried out either by destroying pollutants in situ or transferring polluted material to somewhere else to remediate. Different microorganisms (bacteria, algae, fungi, and plants) are used and generally certain species are determined to be suitable for different types oıf chemicals. In other words, bioremediation is the remediation of environment by microorganisms by combining basic principles of basic sciences and engineering methodologies. The basis of this system is the disintegrating harmful compounds into either less harmful or completely harmless molecules by the use of microorganismal metabolic pathways. For instance, *Pseudomonas putida* species were employed to remediate forest soil after fire together with a microbial consortium obtained from the forest local soil. Besides bacteria, fungi were shown to be effective in bioremediation in different studies.
This study aimed the usability of some frequently encountered microorganisms in forest ecology to remediate the pollution and will relate them to bioremediation. Moreover, it is aimed to present the importance of microorganisms which are crucial members of the ecosystems to support the studies to be carried out in this subject.
Key Words: *Bioremediation, forest ecology, microorganisms, pollution*

Orman Ekosisteminde Biyoremediasyon

Özet
Günümüzde en önemli çevresel problem nüfusun kontrolsüz artışı, ormanların ve yeşil alanların hızlı azalması, alanların yanlış kullanımı, plansız şehirleşme, tehlikeli atıklar, enerjinin bilinçsiz üretim ve tüketimi, trafik, üretilen ürünlerdeki ağır metal yükleri, maden birikintileri ve diğer insan aktiviteleridir. Modern dünyada tüm bu faktörlerden kaynaklanan olumsuz koşullar çevre kirliliğine sebep olmaktadır. Bu tür problemleri çözmek ve ekosistemleri iyileştirmek, kirlilikle etkili mücadele edebilen gelişen biyoteknolojik yöntemlerin kullanılması elzemdir. Biyoremediasyon bu yöntemlerden biridir.
Biyoremediasyon su, toprak ve havadaki kirletenleri mikroorganizmalar kullanarak temizleme yöntemidir. Bu yöntemde ya kirleticiler bulundukları yerde yok edilirler ya da kirli materyal başka bir yere taşınarak ıslah edilir. Farklı mikroorganizmalar (bakteri, mantar, alg ve bitkiler) kullanılabilmekle beraber bazı türlerin bazı kimyasalların gideriminde daha uygun olduğu belirlenmiştir. Diğer bir deyişle, biyoremediasyon, temel bilim ve mühendislik uygulamamalarının birleştirilmesi ile çevrenin mikroorganizmalar ile temizlenmesidir. Bu sistemin temelini mikroorganizmaların metabolik yolakları ile zararlı bileşiklerin daha az zararlı ya da tamamen zararsız hale getirilmesi oluşturur. Örneğin, *Pseudomonas putida* türü lokal orman toprağından elde edilen bir mikrobiyal konsorsiyum içerisinde yangın sonrası toprağı ıslah etmek için kullanılmıştır. Bakteriler yanında, mantarında biyoremediasyonda etkin biçimde kullanılabileceği gösterilmiştir.
Bu çalışmada orman ekosistemlerinde sıklıkla karşılaşılan mikroorganizmaların kirlilik giderimde ve biyoremediasyonda kullanılabilirliği incelenmiştir. Ayrıca, ekosistemlerin önemli birer üyesi olan mikroorganizmaların öneminin vurgulanması ve bu çalışmanın bu konuda yapılacak çalışmalara yol göstermesi amaçlanmıştır.
Anahtar Kelimeler: *Biyoremediasyon, orman ekolojisi, mikroorganizmalar, kirlilik*

Introduction
Forest ecosystems have a great place in all the ecosystems. The productivity and efficiency of ecosystems are controlled by natural processes, especially in terms of plant nutrition processes. Therefore, these processes should be analyzed well to evaluate the productivity of these ecosystems. The first development phase of forests is important in terms of nutrition, but in the advancing years accumulation of dead plant material on the surface serves as an alternative nutrition store for the soil. Research showed that around 6.2 tons/hectare of dead cover

formed 17 years after planting of black locust (*Robinia pseudoacacia*), however, around 13.7 tons/hectare death cover formed in nut pine (*Pinus pinea*) fields. Dead covers form again and again in time and decomposition and internal cycles form the main nutrition sources (Kimmins, 1997; Keskin and Makineci, 2009). Nitrogen fixing plants have a special place by their ability to free nitrogen form atmosphere by the *Rhizobium* bacteria in their roots. Among the ligneous plants naturally grown in our county white alder (*Alnus*), eleagnus (*Elaeagnus*), cercis (*Cercis*) and astragalus (*Astragalus*) among briers can be mentioned among the nitrogen fixing plants. On the other hand, ecological and sociological function of forests, such as recreation, can serve for the needs of societies. Therefore, the productivity of forests should not only be taken in terms of trees, but all the goods and services should be evaluated together. Naturally grown mycorrhizal fungi in forests are also important for development of trees as a result of their association with tree roots. Economically important species *Tuber*, *Boletus*, *Tricholoma*, *Lactarius* are among such fungi. Besides natural processes in forests, conserving biodiversity, soil and water sources, fighting with climate change and desertification are important subjects concerning the forests (Karaman et al., 2012).

Several bacterial and fungal antagonists isolated from forest soils have been shown to be used as biological control agents. One example is *Trichoderma* isolates. These fungal isolates were effective on above ground parts of plants (Fruit and Nicot 1999, Köhl and Molhoek 2001). *Ulocladium atrum* has been used against pathogens causing problems in green parts of plants

Bacteria, fungi and yeasts are organisms used in bioremediation. Bioremediation is also an efficient method to manage polluted areas and remediate polluted soils. The success of bioremediation depends on the use of correct microorganisms and their being in the right place with right environmental factors (Strong, 2008; Frazar, 2000; Ceyhan and Esmeray, 2012; Sharma, 2012; Gürgan and Adiloğlu, 2020). Bacteria are the main microorganisms in remediation. For example, Gram negative *Pseudomonas* bacteria play and important role in the detoxification of copper, cadmium, selenium heavy metals (Halder and Basu, 2016; Wessels and Emn, 2017). *Pseudomonas* bacteria also take attention for the remediation of contaminated areas, especially by petroleum (Ceyhan and Esmeray, 2012).

Research has shown that on zinc contaminated soil, *P. luteola* and *P. polymyxa* performed well for remediation of zinc from soil. The decrease of zinc concentration upon application of *P. luteola* was especially significant. The same bacterium was also demonstrated to be efficient in remediation of copper. The results suggested that this bacterial species could be used for the remediation of heavy metals from soil. (Vanlı and Yazgan, 2008). Similarly, P. *polymyxa* had a high potential to be used for bioremediation (Mokaddem et al., 2009). Another study, by Özbucak et al. (2018), *P. luteola* and P. *polymyxa* were efficient for remediation of especially copper when used separately, but when they applied together, they could remediate zinc more efficiently.

Soil is associated with all the ecological parameters and it forms the basis of forest ecosystem. Moreover, soil is strongly related with issues such as climate change, decrease in biological diversity water and energy safety, food safety, and hence attention on soil is increasing day by day. Bioremediation has been shown to be easy and applicable for remediation of either natural problems or pollution by contamination; and the basis of bioremediation is the use of microorganisms. The current research about soil bioremediation in forest ecosystem is still not sufficient and should be supported by projects about this subject.

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Cadmium And Zinc In The Environment

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Cadmium, zinc and copper are the most important metals in the study of pollution problems, as they are widely distributed in the world and have toxic properties. Cadmium and zinc (as well as lead and mercury) are found mainly in sulfide sediments. As a result of atmospheric processes, these elements easily enter the oceans. Soils contain approximately 4.5x10 -4%. Vegetation contains varying amounts of both elements, but the content of zinc in plant ash is relatively high – 0.14;, since this element plays an essential role in plant nutrition.

About 1 million kg of cadmium enters the atmosphere annually as a result of the activities of plants for its smelting, which is about 45% of the total pollution by this element. 52% of pollution comes from the combustion or processing of products containing cadmium. Cadmium has a relatively high volatility, so it easily diffuses into the atmosphere. The sources of air pollution with zinc are the same as with cadmium.

The entry of cadmium into natural waters occurs as a result of its use in galvanic processes and technology. The most serious sources of water pollution with zinc are zinc smelters and electroplating plants.

Fertilizers are a potential source of cadmium contamination. In this case, cadmium is introduced into plants that are used by humans for food, and at the end of the chain they pass into the human body. Cadmium and zinc readily enter seawater and the ocean through a network of surface and groundwater. Cadmium and zinc accumulate in certain organs of animals (especially in the liver and kidneys).

Zinc is the least toxic of all the heavy metals listed above. However, all elements become toxic if found in excess; zinc is no exception. The physiological effect of zinc is its action as an enzyme activator. In large quantities, it causes vomiting, this dose is approximately 150 mg for an adult.

Cadmium is much more toxic than zinc. He and his compounds belong to the I class of danger. It penetrates the human body over a long period. Breathing air for 8 hours at a cadmium concentration of 5 mg/m3 can cause death. In chronic cadmium poisoning, protein appears in the urine, and blood pressure rises.

When examining the presence of cadmium in food, it was found that human excretions rarely contain as much cadmium as was absorbed. There is currently no consensus on the acceptable safe content of cadmium in food.

One effective way to prevent cadmium and zinc from being released as pollution is to control the content of these metals in emissions from smelters and other industries.

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Soil Contamination With Protein And Vitamin Preservatives

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In the last 10 years, compound feeds (feed mixtures prepared from different feeds) obtained with the use of protein-vitamin concentrates (PVC) for cattle in the 80s of the twentieth century, which manifested themselves in animal husbandry due to environmental problems, have been widely developed.

The energy use of the human body is mainly associated with the consumption of animal meat. Proteins, fats and carbohydrates in meat, milk and eggs are absorbed by people by 90-98%, and in potatoes and vegetables by 70-95%. Accordingly, for animal nutrition, it is necessary to develop foods rich in protein and vitamins.

Such substances are found in microorganisms synthesized from carbohydrate-containing raw materials. On their basis, protein-vitamin concentrates are made. However, their end products, as it turned out later, are not harmless. First, during production, they cause allergies, dermatitis, bronchial asthma and, in some cases, cancer in workers. The second is the accumulation in the body of an animal of substances harmful to human health.

As a result of feeding protein-vitamin concentrates to animals, eosinophilia develops in the intestinal mucosa, granulomatosis in the liver.

It has also been proven that protein-vitamin concentrates contain 12-15 times more nucleic acids than feed. It is known that these biological polymers provide the transfer of genetic information. So it affects the genetic code of animals, birds and ultimately humans. The basis of nucleic acid in protein-vitamin concentrates is ribonucleic acid (RNA). RNA causes an increase in uric acid in the urine and blood in the human body. Leads to diseases that contain a lot of RNA.

Excessive feeding of animals with protein and vitamin concentrates leads to the accumulation of fat in the liver, increased cholesterol levels, and metabolic disorders. In this regard, protein-vitamin concentrates can be added to feed for cattle 20%, and poultry 15%.

Currently, science is trying to study the unknown properties of protein-vitamin concentrates. Therefore, it is very important to comply with the norm when added to animal feed, so as not to endanger human health.

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Evaluatıon Of Envıronmentally Harmful Mıneral Fertılızer Standards In Irrıgated Gray Brown Soıls In Samukh Dıstrıct

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Rye is one of the cereal plants cultivated as food and fodder in our republic. Rye grain contains 9.0-18.6% protein, 51.8-62.6% non-extractable nitrogenous substances, 1.6-1.9% fat, 2.3-2.5% depending on the characteristics of the variety and cultivation conditions. cellulose and 1.9-2.0% ash. Grain can contain up to 82% carbohydrates, most of which is starch. Starch has a positive effect on the preparation and composition of bread. Rye flour contains 3.1-4.5% gluten. The increase in gluten greatly improves its baking quality.

Ecological evaluation of lands and landscape complexes of the republic and individual regions has been studied by many authors.

In Ganja-Gazakh region, we began to study autumn rye in 2018.

If the application of agrochemical and chemical means in crop cultivation is not carried out correctly, if the given norms are not expected, it creates consequences for the environment and human health. From this point of view, optimizing the application of mineral fertilizers in crop cultivation, providing scientifically based "ecological" norms and ecological (agroecological) evaluation of soils can play an important role in preventing negative processes that may arise for the environment and human health.

The main goal of the research is to determine the ecologically harmless mineral fertilizer norms that ensure high and quality harvest from the autumn rye plant in irrigated gray-brown (chestnut) soils under the conditions of the Ganja-Gazakh region, and to determine the ecological value of these soils. It is evidence of logical evaluation.

Researches were conducted in 2018-2020 with the "Mirbashir-46" variety of winter rye on irrigated gray-brown (chestnut) soils at the Ganja Regional Agrarian Science and Innovation Center of the Ministry of Agriculture, located in the Samukh district.

The following price indicators were used during the ecological evaluation of the lands of Ganja-Gazakh region: bonity scores obtained on the basis of the internal properties of the soils (humus, nitrogen, phosphorus, potassium, UAC) during the comparative evaluation (bonitirotion) of the soils; Ecological scores obtained on the basis of special evaluation scales according to the degree of manifestation of individual characteristics of soils (pH, water-resistant aggregates, dry residue).

In the third stage of our research, the final ecological scores of dark gray-brown (chestnut), ordinary gray-brown (chestnut) and light gray-brown (chestnut) soils under ryegrass were found using "cultivation-ecological coefficients". The following formula was used for this:

$E_{m\text{-}e} = E_b \, x T_{m\text{-}e}$

Here, $E_{m\text{-}e}$ – is the final acculturation-ecological score of soils; E_b – soil ecological score and $T_{m\text{-}e}$ - culturalization - ecological correction coefficient.

As a result, the environmental scores of the lands used under rye crops were calculated by applying the main credit scores.

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Evaluation Of The Effect Of Fertilization And Drying Methods On Pre And Post Aflatoxin Infection In Maize Under Busogo Climatic Conditions

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Abstract
The study was carried out in 2020-2021 during the growing seasons which are 2021A that started from September 2020 till the end of January 2021 and 2021 B started from February till end of June 2021, the study was conducted in the Busogo sector, Musanze District, Northern Province. The purpose of this project was to assess the impact of fertilization and drying methods such as sun drying, dry shelter and kitchen drying on aflatoxin contamination in maize before and after harvesting. The area from which this project was conducted was chosen due to the availability of a lot of number of maize growers who cultivate them not only for consumption but also for trade purpose either processed or non-processed. During this study, a total of twenty-four (24) samples were collected, examined and evaluated for aflatoxin levels in both seasons. In the season 2021A and 2021B sample collection equivalent to twelve (12) in each season was done then dried them within 30 days by using different drying methods such as dry shelter, kitchen drying, sun drying. Randomized complete block design (RCBD) with four treatment of fertilizer combination in four replications was used in this study and all experimental plots were planted with one maize variety (H628) purchased from Rwanda Agriculture and Animal Resources Development Board. Except samples from maize cultivated without fertilizer, level of aflatoxin infection was found to be higher 10 Parts per billion. The East African countries community standard limit of 10Parts per billion which indicate a health risk to the consumer, when comparing the three drying methods employed in this study, the kitchen drying method produced lower levels of aflatoxin (1.6Parts per billion) than the dry shelter (3.2 Parts per billion) and sun drying methods (2.9 Parts per billion), samples taken from the control plot (T4) stands for no fertilizer application resulted greater levels of aflatoxin with an average of 25.75 Parts per billion compared to other treatments which yielded aflatoxin levels of at lower than 10 Parts per billion. The use of kitchen drying can be recommended as well as mixture of both organic and inorganic fertilizers when growing maize in order to reduce the level of aflatoxin.
Keywords: *Maize, aflatoxin, fertilizers, drying methods, Aspergillus.*

Introduction

Agriculture sector in Rwanda remains the major sector of the economy where 64.7% of the Rwandan population is involved in Agriculture and it contributed 26% in the GDP of the country as found in National institute of statistics of Rwanda (NISR) Labor Force Survey Trends, May 2021 report, September 2021 (NISR,2021). However, this sector faces challenges such as an ever-changing climate a concentrate on relatively brief initiatives to solve immediate and starting to emerge challenges including the soil infertility and reduced nutrient due to leaching caused by high density of the population and inappropriate harvesting a well as to remove all debris from the field after harvesting, poor information sharing channels of the agricultural related concerns, non-developed research due to narrow findings and limited variety of crops (MINAGRI ,2017).

Maize is a vital staple crop in most Sub-Saharan African countries producing food that is consumed by the majority of the population in different nature, the small-scale farmers focus on cultivating a lot of quantity of food crops such as wheat, sorghum and potatoes on a large quantity of land, maize is a crop which is very important not only for consumption but also for commercial purpose because Rwanda farmers use to trade them with Tanzania and Uganda (Daly *et al*,2016,)

Eastern province of Rwanda produces a half of maize produced in Rwanda where many of them (60%) are processed into other crucial products like maize flour, most of people used to trade them informally where 80 % of maize are commercialized in that way with in the neighboring countries. Aflatoxin contamination has resulted in lower nutritional qualities in Rwandan maize output due to a variety of variables that happened throughout before and after harvesting stage (Nishimwe *et al*, 2019).

For the purpose of helping small scale farmers to produce maize which complies with maximum limit of aflatoxin, the Rwandan government launched RAB to aid farmers to the ultimate goal of the Rwanda Agriculture and animal resources development Board Aflatoxin reduction relies on some of the same good agricultural methods that help increase production. Use of resistant cultivars, timely planting, effective fertilizer use, effective control of weeds, use of appropriate pest control, drought and mitigation of nutritional issues as well as harvesting on time are all examples of these agricultural practices. Aflatoxin can also be controlled by appropriate drying after harvesting with the appropriate time, insect control which may affect maize during storage after harvesting as well as

protecting stores against pests by adopting biopesticides. All of these practices can help to limit mycotoxins upon post – harvest (Niyibituronsa *et al*, 2020). In 1990, 94 % of the population eaten maize of various types within two weeks of the poll maize was consumed at a rate of 10.8% of total food consumed in Ghana in 1987 with the remaining foods consumed at a rate of 10.3 % by all groups (Wahab *et al* ,2022).

Maize can also be used to make, baked goods, silage, animal feed, adhesives, and oil, fungus that contaminate maize in storage are able to cause mycotoxins that are dangerous to human and animal health, Aspergillus flavus is found to be the essential fungus of preharvest maize which cause aflatoxin. The mentioned issues favorize to maize to get unfavorable for use and also contribute to the reduction of global economy, he also reported that in Rwanda, aflatoxin found to be the serious health issues in agricultural sector (Nishimwe *et al*, 2019).

2. Materials and Methods

Study area

Experimental fields have been carried in the farm of the College of Agriculture, Animal Sciences and Veterinary Medicine, University of Rwanda. situated in the Northern province, Musanze District, Busogo Sector at 72 km from Kigali as Capital city of Rwanda to the North-West. Latitude of 1° 33' 32" South & 29° 32' 57" of Longitude East with an elevation of 2,221 m above sea level. The annual temperature in Busogo is 17°C- 20°C. The soil is relatively productive based on the overall amount of annual rainfall obtained (Meteo Rwanda, 2020).

Experimental Design

During the research, the experiment was conducted for four treatment of fertilizer combination in four replications using a factorial arrangement in Randomized complete block design (RCBD) assigned at random in each replication. Treatments were arranged as T1 (NPK 17-17-17 + DAP), T2 (Farm yard manure), T3 (NPK 17-17-17 + DAP + Farm yard manure) and T4 (control; no fertilizer application). All experimental plots were planted with one maize variety (H628) purchased from RAB at a rate of 30 kg/ha. The 16 experimental plots were placed in the same location within two (2) agricultural seasons which are season 2021A and 2021 B; plots size was set out at 5 m × 5 m (25 m2) in size per treatment and sowing the seed was done with in one day in all plots directly after field preparation where in each hole 2 grains were placed. spacing of 75 cm between rows and 40 cm with 40 cm between holes. After sowing, 30 tons of organic fertilizer (cow dung) and 100 kgs of DAP were used respectively while urea was applied during weeding.

Collecting data

Data were collected at vegetative stage in the field and at the harvest Plant emergence, plant height, leaf area index, stem diameter, plant vigor, harvested plant (number), weight and yield metrics are among the data collected.

Crop emergence: Seeds were sown so that each bed possessed twenty-four (24) plant holes, during data collection of plant emergence, we counted newly emerging plants emerged at 30 days after sowing

Height of plant (cm): For measuring plant height, the interval from the surface to the collar of developed upper leaf (three months after sowing) was measured using a meter rule. Centered plants in each bed were selected to collect data three couples were selected randomly means that 6 plants per block were selected. plants in each bed

Diameter of stem (cm): Data on stem diameter were collected by measuring the circumference (c) at two thirds (2/3) of plant height during tasseling (2.5 months after planting) and approximated diameter of stem (d) by means of the formula herewith below

$$d = \frac{c}{\pi}$$

Note that $\pi \approx 3.14$ and c = relates to the diameter of the maize stem; the technique for selecting plants to measure stem diameter was the same as for plant height sampling(Longfei *et al* 2020),

Leaf Area Index (LAI): During calculation of leaf area index, we used to divide the plant into three equal quadrants lengthwise, using mature leaves on their middle side. $LAI = LWK$ Note that L stands for length of the leaves while **W** stands for the width of the leaves, **K** is considered as the constant which has the value of 0.75. The way LAI was done is the same way plant height selection was done. Sample selection of the plant used to calculate LAI was done on the harvestable plants by looking on their average per bed and per treatment (Rahul *et al*, 2021).

Plant vigor plant: The vigor of plants was measured by using three point-point scale where poor vigor was characterized by 1, average vigor was characterized by 2, good vigor was characterized by 3. Stem size, the number of stems bore without holes I considered all leaved including damaged ones when categorizing maize stems. The average weight (kg) of collected cobs was determined using a scale balance upon harvest. For the weight of the maize cobs, three samples were taken per plot. The average weight as sample was recorded for each treatment per block (Longfei et *al*, 2020).

Drying of maize grains

During this study, we examined the issues of maize grain management as well as their storage, in order to evaluate the good drying methods which can favorize small scale farmers, cooperatives or commercial farms to get high quality maize that are free from aflatoxin. During this study, we look out the natural and artificial drying method that are currently used. Finally, different structure of storage and drying methods fluctuating from modest family units to huge commercial units are examined as well as management suggestions for minimizing harm while storing.

During this study, we evaluated the impact of various drying processes on aflatoxin attack levels after various treatments were applied during the tests.

***A.* Natural drying**

Sun Drying

While conducting this research, we adopted well known but old drying method which is putting maize on natural sun (sun drying). The maize grains produced from the treatments T1, T2, T3, T4 for all replications (4) were put directly under sun on sheeting for the prevention of moisture content from the soil ground to reach the maize grains.

B. Artificial Drying

Kitchen Drying*:*

In order for assessing the rate of aflatoxin, we used to adopt the kitchen drying as the other drying methods which is effective by putting maize grains above fire of the kitchen. Kimario (2021) reported that kitchen drying managed to reduce aflatoxin levels in maize at the rate of 78.5%.

Dry shelter:

In this study, dry shelter as one of the drying methods established by the government as post-harvest handling technology was used to evaluate its effect on aflatoxin contamination

Testing of aflatoxin

With referring to VICAM. L P (1999), we used aflatest (Watertown, MA) of OAC fluorometer. The aflatest was chosen due to its rapidity where with in only 10 min per ton test you get the results, it is also very sensitive consequently providing reading as low as 2Parts per billion to 10 Parts per billion in a sample and continues to read the results until 50 Parts per billion per sample.; it is suitable for using it in the same extract instrumentation for other mycotoxins 'test; it is easy to use thus it does not require special Those testing tools are trusted due to less toxic materials they possess in comparison with conventional methods . this method possess in numerical data in Parts per billion can be used to clean HPLC (High performance liquid chromatography).

The test was carried out by blending a crushed sample of the kernels weighing 25 g of blended maize grains mix with 5g of Na Cl and 125 ml of methanol (70%);30% of distilled water (H_2O) in a blender jar at high speed for 2 minutes in covered blender jar as it is shown in the appendix 7. Fluted filter paper was used to filter the extract and collect the filtrate in clean vessel (Neogen, 2018).

3.3. Sampling

According to Hamed (2016), we adopted the simple random sampling method by collecting and measuring the composite sample equal to the maximum of 1 kg of from each treatment in both seasons (2021A and 2021B) and dividing it into 12 sub samples of roughly 300 g each in each season. For the aflatoxin levels analysis, ground samples of roughly 25g were utilized for each sub sample and the average level was obtained, the sample collection was done with second -season maize which tend to dry out faster on the farm, the average moisture level in each treatment was 12.5%.

Within the 2 seasons of the study, total number of samples collected and tested were twenty-four (24) with combination produce of each treatment (T1, T2, T3, T4) of all replication. In accordance with the protocol used during sampling, samples were collected in polythene bags and transported them to the Rwanda standard board Laboratory for aflatoxin testing

Preparation of the sample

For avoiding the mold formation as well as aflatoxin production, maize grains were dried in order reach the moisture content of no more than 13% within 30 days, when maize are affected by aflatoxin there is a chance of getting pollution and the species causing aflatoxin causes those pollution,to address this problem, the entire 1 kg of the sample was grinded and segmented using only a Bunn and constantly fighting grinder (Mann: Bunn-o-Matic corporation Springfield, Illinois in the United States of America) in order to obtain a combined subsample for representing the overall sample characterized with codes associated with them to affiliate the items in the questionnaire (Noreddine ,2020).

Aflatoxin's extraction

During the extraction of aflatoxin,50 mg of crushed samples was mixed with 250 ml of 65% ethanol(v/v) in a laboratory mixer (IKA.Werker, Germany) and rapidly shaken for 3 min material was filtering using Whatman No.1 filter paper once it had settled (Whatman international Ltd, Maidstone, Uk) (Neogen , 2018).

Quantification of aflatoxin

The samples were analyzed by using an enzyme-linked immunosorbent assay (ELISA) to quantify the total of aflatoxin as indicated by the company's procedures using a Reveal accuscan (Neogen, USA), the ELISA has a quantitative range of 2-150 g total aflatoxins/kg and a lower of detection (LOD) OF 2G/KG (Neogen ,2018).

Statistical analysis

The levels of aflatoxin of four treatments were analyzed in the years of research from 2020-2021,simple descriptive statistics and the SPSS statistical package from 1993 at p=0.005 was used to evaluate data such as mean, range, variance, coefficient of variation and least significant difference. The test statistic was the variance ratio test, the 'F' distribution was used to compare two growth seasons at the same time for significant variations, the selection of it had the advantages of comparing two environments in one period (Mohd ,2017)

Results and Discussion

Impact for methods of drying on aflatoxin infection for the Cropping season 2021A & 2021B

The results of aflatoxin levels following the drying methods have shown the great impact on aflatoxin contamination, Nethertheless, the level of aflatoxin was found to have significant difference contamination in sun drying methods, kitchen drying and drying shelter methods as it is shown in table 3.the lower aflatoxin infection levels were seen when using kitchen drying (1.6Parts per billion) when the maize is grown with fertilization of mixture of organic and inorganic fertilizers compared to sun drying (1.6Parts per billion) and dry shelter drying method (2.2Parts per billion).

The inconsistency ratio test demonstrated a significant difference in the influence of methods of drying all treatments (T1, T2, T3, T4) on aflatoxin contamination in the seasons 2021A and 2021B. The result shows that treatment T4 the aflatoxin levels were 26.70 Parts per billion when adopted the sun drying, whereas aflatoxin results for T3 was 1.4 when adopted the kitchen drying(Table 1).

Table 1: Aflatoxin levels measured in every treatment resulting all methods of drying within cropping season 2021A & 2021B

Results of in Parts per billion of total aflatoxin in various drying techniques for all treatments							
		kitchen drying		**Dry shelter**		**Sun drying**	
Treatment	**Treatment description**	**2021A**	**2021B**	**2021A**	**2021B**	**2021A**	**2021B**
T1	NPK +DAP	2.70^{ab}	1.60^{ab}	2.70^{ab}	3.20^{ab}	1.70^{ab}	2.90^{ab}
T2	FYM	3.70^{a}	4.90^{ab}	3.00^{ab}	5.0^{ab}	2.60^{ab}	1.80^{ab}
T3	NPK+DAP+FYM	1.40^{ab}	2.60^{ab}	2.2^{ab}	3.20^{ab}	1.60^{ab}	2.80^{ab}
T4	No fertilizer	11.0^{ab}	13.0^{b}	10.5^{b}	11.7^{b}	25.50^{b}	26.7^{b}
LSD	Least sign. difference	**8.119**	**4.53**	**3.45**	**6.20**	**10.31**	**10.61**

Impact of fertilizer application on aflatoxin infection before harvesting in season 2021A and season 2021B.

The aflatoxin contamination shown a significant difference between four treatments which are Growing maize with only inorganic fertilizer application(T1), Organic fertilizer (T2), mixture of organic and inorganic (T3) and growing maize without fertilizer application (T4).

The lower level of aflatoxin infection was found in the treatment (T3) stands for mixing the inorganic and organic fertilizer application by 5.2 Parts per billion compared with non-fertilizer application (T4) by 13.4Parts per billion, organic fertilizer application(T2) by 8 Parts per billion, inorganic fertilizer application (T1) by 5.7 Parts per billion of the maize grown in season 2021A.

The lower-level aflatoxin infection was found in the mixture of organic and inorganic fertilizer application (T3) by 6.1 Parts per billion compared with non-fertilizer application(T4) by 14.7, organic fertilizer application(T2) by 8 Parts per billion, inorganic fertilizer application(T1) by 6.2 Parts per billion, of the maize grown in season 2021B.

Aflatoxin levels was found to be influenced by fertilizer application across the seasons of study, maize grown in T4 (Control) increased aflatoxin levels at the higher than standard limit 10 Parts per billion, whereas maize grown with a combination of organic and inorganic fertilizers (T3) reduced the level of aflatoxin contamination before harvesting at 5.2 Parts per billion, fertilizers application while growing maize have great impact on aflatoxin levels on maize. According to Gary *et al* (2018) aflatoxin levels in the farms where fertilizers were not applied raised the aflatoxin levels at the range between 34.19-62.05% after storage. again, fertilizer called yaralegum combined with green Ok influenced the reduction of aflatoxin contamination at the range of 37.40%-18.72% in the field before harvesting. The research was done following the findings from the authors mentioned above by assessing the effects that can be caused by Application of only organic fertilizers, inorganic fertilizers or mixture of organic and inorganic fertilizers as well as growing the without any fertilizer application. (Table 2)

Table 2: Impact of fertilizer application on aflatoxin infection before harvesting in cropping season 2021A & 2021B

	Aflatoxin results (Parts per billion)				
Season	**Treatments**				
	T1	**T2**	**T3**	**T4**	**LSD**
2021A	5.70[a]	8.0[a]	5.20[a]	13.40[a]	39.8
2021B	6.20[ab]	8.0[ab]	6.10[ab]	14.70[b]	3.54
Mean	5.95	8	5.65	14.5	21.67

T1:NPK + DAP,**T2:**Farm yard manure,**T3:**NPK +DAP+FYM,**T4:**Control
LSD: Least significance difference

Conclusion

Application of fertilizer to combat aflatoxin attack in maize

Aflatoxin was identified in detectable concentrations in maize plots grown without fertilizer. There had been a significant difference in aflatoxin levels as a result of fertilizer between T4(control) and other treatments, growing maize without fertilization resulted the significant increase in aflatoxin levels. As a result, from soil nutrient, the usage of a mix of organic and inorganic fertilizers was found to be helpful in lowering pre-harvest aflatoxin contamination. Combination of both organic and inorganic fertilizers during maize cultivation demonstrated to reduce aflatoxin in the field before harvesting compared to other treatments used during the study.

Effects of fertilizer and farm management on aflatoxin contamination development and yield metrics.

Aflasafe is achieved through the use of toxigenic strains of *Aspergillus spp*, which work by competitively excluding toxigenic strains from the substrate, only aflatoxins produced on the farm can be avoided by employing strategies such as effective farming systems and the use of aflasafe. Natural infection can only be regulated after the fact by using post-harvest application processing procedures that limit further infiltration into grains.

The results also shown that fertilizing maize with both organic and inorganic fertilizers is helpful to the plant maize to enhance growth and development which lead to the reduction of aflatoxin contamination in maize.

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Hay Yield and Quality of Berseem Clover (*Trifolium alexandrinum* L.) and Ryegrass (*Lolium multiflorum* L.) Mixtures

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Abstract
The cultivation of two or more plant species at the same time in the same field during a growing period is called intercropping. Intercropping system is frequently applied to increase the yield and quality of hay, especially in forage crop cultivation. The aim of current study was to determine hay yield and quality traits of of Berseem clover "C" (*Trifolium alexandrinum* L.) annual ryegrass "R" (*Lolium multiflorum* L.) mixtures (100+0%, 80+20%, 60+40%, and 20+80%) in Bilecik ecological condition during 2021-2022 vegetation period. The experiment was arranged in randomized blocks design with three replications. In the study, hay yield, crude protein radio (CP) protein yield, acid detergent fiber (ADF), neutral detergent fiber (NDF), potassium (K), phosphorus (P), calcium (Ca) and magnesium (Mg) contents were determined. The highest hay and crude protein yields were determined in 60%C+40R (670.83 and 105.87 kg/da), 40%C+60R (780.53 and 112.87 kg/da), and 20%C+80R (721.17 and 109.03 kg/da) mixtures. CP, ADF, and NDF contents of the mixtures ranged from 14.27-17.73%, 33.89-37.59%, and 46.39-65.30%. Macronutrients, which are important for animal nutrition and health, were high in all processes. As a result, it was concluded that the ratio of Beersem clover in mixtures annual ryegrass should be between 20-60% in terms of forage yield and quality in Bilecik ecological conditions.
Key Words: *Beersem clover, Annual ryegrass, intercropping, yield, quality.*

İskenderiye Üçgülü (*Trifolium alexandrinum* L.) Tek Yıllık Çim (*Lolium multiflorum* L.) Karışımlarının Ot Verimi ve Kalitesi

Özet
Bir yetiştirme dönemi içerisinde aynı tarlada, aynı anda iki ya da daha fazla bitki türünün birlikte yetiştirilmesi karışık ekim olarak adlandırılmaktadır. Özellikle yem bitkileri tarımında otun verim ve kalitesini arttırmak amacıyla karışık ekim sistemi sıklıkla uygulanmaktadır. Bu çalışmada, Bilecik ekolojik koşullarında İskenderiye üçgülü (*Trifolium alexandrinum* L.) "Ü" ile tek yıllık çim (*Lolium multiflorum* L.) "Ç" karışımlarının (%100+0, %80+20, %60+40 ve %20+80) ot verimi ve kalitesinin belirlenmesi amaçlanmıştır. Çalışma 2021-2022 yılı vejetasyon dönemimde ve Tesadüf Blokları Deneme Desenine göre yürütülmüştür. Çalışmada karışımların kuru ot verimi, ham protein oranı (HPO), protein verimi, asit deterjanda çözünmeyen lif (ADF), nötr deterjanda çözünmeyen lif (NDF), potasyum (K), fosfor (P), kalsiyum (Ca) ve magnezyum (Mg) içerikleri belirlenmiştir. En yüksek kuru ot ve ham protein verimi %60Ü+40Ç (670.83 ve 105.87 kg/da), %40Ü+60Ç (780.53 ve 112.87 kg/da) ve %20Ü+80Ç (721.17 ve 109.03 kg/da) karışımlarında belirlenmiştir. İşlemlerin HPO, ADF ve NDF içerikleri %14.27-17.73, %33.89-37.59 ve %46.39-60.30 arasında değişmiştir. Hayvan besleme ve sağlığı açısından önem teşkil eden makro besin elementleri ise tüm işlemlerde yüksek olmuştur. Sonuç olarak Bilecik ekolojik koşullarında yem verimi ve kalitesi açısından İskenderiye üçgülünün tek yıllık çim ile oluşturulan karışımlarında oranının %20-60 arasında olması gerektiği sonucuna varılmıştır.
Anahtar Kelimeler: *İskenderiye üçgülü, tek yıllık çim, karışık ekim, verim, kalite.*

Giriş

Dünyada ve ülkemizde ekilebilir tarım alanlarını artırma imkânlarının azalması ve nüfusun sürekli artması, bitkisel üretimle uğraşanları mevcut tarım alanlarından azami derecede yararlanma yollarını aramaya yöneltmiştir. Bu yollardan biri de karışık ekim sistemidir (Acar ve ark., 2006). Özellikle yem bitkileri tarımında uygulanan karışık ekim sistemleri ile hem arazi kullanım verimliliği artmakta hem de çevresel kaynaklar en ekonomik şekilde değerlendirilmektedir (Awaad ve ark., 2018). Ülkemizde üretim için gerekli mazot, kimyasal gübre ve pestisit fiyatlarındaki artış, her geçen gün artan erozyon ve çevre kirliliği nedeniyle tarım sistemlerinde özellikle tek yıllık baklagillerin kullanımı daha da önem kazanmıştır (McCartney ve Fraser, 2010).

Son yıllarda yem bitkileri tarımında otun verim ve kalitesini arttırmak amacıyla baklagiller ile buğdaygil ya da diğer familyalara ait bitkilerin birlikte karışım halinde yetiştiriciliği yaygın hale gelmiştir (Kavut ve Geren, 2017). Böylece hayvanlar için de daha dengeli bir yem sağlamaktadır.

Karışım halinde yetiştirilen bitkiler aynı ya da farklı familyalarda olabilmektedir. Karışık ekimlerde türlerin belirlenmesi çok önemlidir. Nitekim bitkilerin birbirleri arasında doğacak olan rekabetler bir takım sorunları ortaya çıkarabilir. Dolayısıyla sahip olduğu farklı morfolojik özellikleri sayesinde ışık, su ve besin maddesi alımında birbirleri ile rekabet halinde olacaklardır. Karışımlarda türler kadar tohum oranları da rekabeti arttırmaktadır. Öyle

ki, karışım içerisinde tahıl oranı fazla olursa; erken ilkbaharda daha hızlı gelişen tahıllar kardeşlenerek diğer türün gelişimini engelleyecektir. Bu nedenle karışımdaki türler arasında dengeyi sağlamak için hem karışıma girecek tür/türlerin hem de tohum oranlarının iyi ayarlanması gerekmektedir.

Türkiye'de Akdeniz bölgelerinin meralarında doğal bir şekilde yetişen İskenderiye üçgülü (*Trifolium alexandrinum* L.) tek yıllık olup, yarı kurak koşullara iyi uyum sağlayan, serin mevsim baklagil yem bitkisidir. Bitki ana ve ara ürün olarak yetiştirilebilmekte olup karışıma girdiğinde ise otun hem verimini hem de kalitesini yükseltmektedir. Gençkan (1983) İskenderiye üçgülünün besleme değerinin yüksek olduğunu ve özellikle de sığır ve domuzların çok istekli tükketiğini bildirmiştir.

Buğdaygiller familyasında yer alan tek yıllık çim (*Lolium multiflorum* L.) lezzetli, sinidirmi kolay, enerji ve protein değeri bakımından zengin olan bir yem bitkisidir. Bitki yeşil ot, kuru ot ve silaj olarak da değerlendirilebilmektedir. Yüksek besin içeriği ve kuru madde oranı sayesinde hayvanlarda hem süt hem de et kalitesinde artışı sağlar. Ayrıca uygun ekolojik koşullarda 20 günde bir biçime gelmektedir (Anonim, 2021).

Bu çalışmada İskenderiye üçgülü (*Trifolium alexandrinum* L.) ile tek yıllık çim (*Lolium multiflorum* L.) karışımlarının ot verimi ve kalitesinin belirlenmesi amaçlanmıştır.

Materyal ve Yöntem

Bu çalışma Bilecik Şeyh Edebali Üniversitesi, Tarımsal Uygulama ve Araştırma Arazisinde 2021-2022 vejetasyon döneminde yürütülmüştür. Deneme alanının toprak yapısı killi tınlı olup, hafif alkalidir (7.70). Toprağın kireç içeriği %7.98 (orta), fosfor içeriği 222.21 kg/da (yüksek), potasyum içeriği 151.15 kg/da (yüksek) ve organik maddesi ise %1.22 (az) olarak belirlenmiştir. Deneme alanının yürütüldüğü yerin yağış toplamı uzun yıllar ortalamasında 364.6 mm iken, 2021-2022 vejetasyon döneminde 347.3 mm olmuştur. Sıcaklık ortalaması uzun yıllar ve 2021-2022 deneme yılında sırasıya 9.2 °C ve 14.4 °C olmuştur (Tablo 1).

Tablo 1. Deneme alanının uzun yıllar ile çalışmanın yürütüldüğü yıla ait iklim verileri*

Aylar	Sıcaklık (°C)		Yağış (mm)	
	Uzun yıllar	2021-2022	Uzun yıllar	2021-2022
Kasım	9.1	15.7	36.7	35.0
Aralık	4.6	9.8	55.7	39.6
Ocak	2.5	5.3	50.4	54.6
Şubat	3.7	9.3	42.6	63.5
Mart	6.4	6.6	47.3	23.1
Nisan	11.5	19.6	42.1	22.7
Mayıs	16.2	23.5	47.5	18.1
Haziran	19.9	26.1	42.3	90.7
Top/Ort	**9.2**	**14.4**	**364.6**	**347.3**

*Bilecik Meteoroloji İl Müdürlüğü

Çalışma Tesadüf Blokları Deneme Desenine göre 3 tekrarlamalı olarak kurulmuş olup, ekim işlemi elle gerçekleştirilmiştir. Parsel uzunluğu 4 m olup, parseller ise 6 adet sıradan oluşmuştur. Bitkilerin sıra arası mesafesi ise 20 cm olarak ayarlanmıştır. Tohumluk miktarı (Yalın olarak) İskenderiye üçgülünde (Efsane) 1 kg/da, tek yıllık çimde (İlkadım) 2 kg/da olarak hesaplanmıştır. İskenderiye üçgülü ile tek yıllık çim 5 farklı karışım oranında (%100+0, 80+20, 60+40, 40+60 ve 20+80) ekilmiştir. Deneme yerinde yapılan toprak analizleri sonucuna göre bitkilere ekimle birlikte dekara 8 kg P ve 5 kg N gelecek şekilde taban gübresi verilmiştir. Hasat işlemi İskenderiye üçgülünde ve karışımlarda İskenderiye üçgülünün %50 çiçeklenme döneminde, tek yıllık çimde ise süt olum döneminde gerçekleştirilmiştir. Bitkiler hasat edildikten sonra sabit ağırlığa gelinceye kadar etüvde 60 °C de kurutulmuştur. Daha sonra bu örnekler analize hazır hale getirilmek için 1 mm elek çapındaki değirmende öğütülmüştür. Öğütülen örneklerin ham protein oranı, asit deterjanda çözünmeyen lif (ADF), nötr deterjanda çözünmeyen lif (NDF) ile besin madde içerikleri (Potasyum (K), fosfor (P), kalsiyum (Ca) ve magnezyum (Mg)) Near Infrared Reflectance Spectroscopy (NIRS) (Foss 6500) cihazı ile IC-0904FE paket programı kullanılarak belirlenmiştir. İskenderiye üçgülü ile tek yıllık çim karışımlarında ortalama ham protein oranı, ADF, NDF ve makro besin elementleri, bitkilerin botanik kompozisyondaki oranları ile söz konusu özelliklerin çarpılmasıyla hesaplanmıştır. Verilerin değerlendirilmesi (SPSS 22.0 istatistik paket programı) Tesadüf Blokları Deneme Desenine göre gerçekleştirilmiş olup, işlemlerin karşılaştırılmasında ise Duncan testi kullanılmıştır.

Bulgular ve tartışma

İskenderiye üçgülü ile tek yıllık çim karışımlarının kuru ot verimi, ham protein oranı (HPO), ham protein verimi (HPV), asit deterjanda çöüznmeyen lif (ADF) ve nötr deterjanda çözünmeyen lif (NDF) içerikleri Tablo 2'de verilmiştir. Buna göre tüm özellikler üzerinde karışımların etkisi çok önemli ($P<0.01$) olmuştur.

En yüksek kuru ot ve protein verimi istatsitiksel olarak aynı grupta yer alan %60Ü+40Ç (670.83 ve 105.87 kg/da), %40Ü+60Ç (780.53 ve 112.87 kg/da) ve %20Ü+80Ç (721.17 ve 109.03 kg/da) karışımlarından, en düşük ise yalın

İskenderiye üçgülünden (213.53 ve 37.90 kg/da) elde edilmiştir (Tablo 2). Karadeniz ve Kökten (2022) Elazığ koşullarında yaptıkları çalışmada İskenderiye üçgülü ile tek yıllık çim karışımlarının kuru ot ve protein verimini sırasıyla 670.2-1659.2 kg/da ve 76.3-205.5 kg/da arasında değiştiğini bildirmişler. Sever (2021) Aydın koşullarında İskenderiye üçgülü ile İtalyan çimi karışımlarının kuru ot ve ham protein veriminin sırasıyla 769.3-1038.8 kg/da ve 114.11-190.76 kg/da, Polat ve ark. (2021) ise Şanlıurfa koşullarında 680-1317 kg/da ve 132.4-234.3 kg/da arasında olduğunu bildirmişlerdir.

ADF ve NDF ruminant rasyonlarınının enerji göstergesi olarak kabul edilmektedir. Söz konusu özellikler yemin alınabilirliği ve sindirimi açısından önem teşkil etmektedir. Çalışmada işlemlerin ADF ve NDF oranı %33.89-37.59 ve %46.39-60.30 arasında olmuştur. Ghanbari–Bonjar ve Lee (2003) ile Gülümser, (2016) yaptıkları çalışmalarda baklagil ile buğdaygil karışımlarında baklagillerin buğdaygillere oranla daha düşük ADF ve NDF oranına sahip olduğunu bildirmişlerdir. Çalışmadan elde edilen ADF ve NDF oranı söz konusu araştırıcıların bulguları ile benzerlik göstermektedir.

Tablo 2. Karışımların KOV, HPO, PV, ADF ve NDF özelliklerine ait veriler

İşlemler	**KOV (kg/da)****	**HPO (%)****	**PV (kg/da)****	**ADF (%)****	**NDF (%)****
%100 İskenderiye üçgülü (Ü)	213.53 d	17.73 a	37.90 c	33.89 d	46.39 d
%100 İtalyan çimi (Ç)	572.23 c	14.35 d	82.03 b	36.76 ab	60.30 a
%80Ü+20Ç	615.63 bc	14.27 d	87.63 b	37.59 a	56.50 b
%60Ü+40Ç	670.83 ab	15.78 b	105.87 a	34.34 d	54.99 c
%40Ü+60Ç	780.53 a	14.46 d	112.87 a	35.94 bc	57.17 b
%20Ü+80Ç	721.17 ab	15.12 c	109.03 a	35.48 c	56.26 bc
Ortalama	***595.66***	***15.28***	***89.22***	***35.67***	***55.26***

(**) 0.01 düzeyinde önemli. Aynı sütun içerisinde aynı harfte gösterilen ortlamalar arasında farklılık yoktur. KOV: Kuru ot verimi; HPO: Ham protein oranı; PV: Protein verimi; ADF: Asit deterjanda çözünmeyen lif; NDF: Nötr deterjanda çözünmeyen lif.

İskenderiye üçgülü ile tek yıllık çim karışımlarının potasyum (K), fosfor (P), kalsiyum (Ca) ve magnezyum (Mg) içerikkerine veriler Tablo 3'de verilmiştir. Buna göre tüm özellikler üzerinde karışımların etkisi çok önemli ($P<0.01$) olmuştur.

Çalışmada işlemlerin K, P, Ca ve Mg içerikleri sırasıyla, %2.59-2.94, %0.31-0.39, %0.31-1.28 ve %0.15-0.20 arasında değişmiştir (Tablo 3). Hayvanlar için gerekli olan makro besin elementlerinin başında gelen K, P, Ca ve Mg hem hayvanların hem de hayvansal ürünlerin verim ve kalitesi açsından çok önemlidir. (Başbağ ve ark., 2011; Gürsoy ve Macit, 2017). Hayvanların makro besin elementi ihtiyacının karşılanması için kaba yemlerde K oranının en az %0.8, P oranının %0.21, Ca içeriğinin %0.18-0.44 ve Mg içeriğinin ise %0.04-0.10 arasında olması gerekmektedir (Yozgatlı, 2017). Karışımlarda belirlenen besin elementleri hayvanların ihtiyaçlarını karşılayacak düzeydedir (Tablo 3).

Tablo 3. Karışımların makro besin içeriklerine ait veriler

İşlemler	**K (%)****	**P (%)****	**Ca (%)****	**Mg (%)****
% 100 İskenderiye üçgülü (Ü)	2.59 f	0.31 d	1.28 a	0.20 a
% 100 İtalyan çimi (Ç)	2.94 a	0.39 a	0.31 d	0.16 c
% 80Ü+20Ç	2.82 c	0.36 c	0.59 bc	0.15 c
% 60Ü+40Ç	2.74 e	0.38 b	0.62 b	0.16 bc
% 40Ü+60Ç	2.78 d	0.37 c	0.54 c	0.18 b
% 20Ü+80Ç	2.90 b	0.38 b	0.53 c	0.18 b
Ortalama	***2.79***	***0.37***	***0.65***	***0.17***

(**) 0.01 düzeyinde önemli. Aynı sütun içerisinde aynı harfte gösterilen ortlamalar arasında farklılık yoktur. K: Potasyum, P: Fosfor; Ca: Kalsiyum, Mg: Magnezyum.

Sonuç

Bilecik ekolojik koşullarında İskenderiye üçgülü ile tek yıllık çimin farklı tohum oranlarında birlikte ekiminin ot verimi ve kalitesine etkilerinin araştırıldığı çalışma sonucunda; yem verimi ve kalitesi açısından İskenderiye üçgülünün tek yıllık çim ile oluşturulan karışımlarında oranının %20-60 arasında uygun olabileceği, ayrıca çalışmanın 1 yıl daha yürütülmesi gerektiği kanısına varılmıştır.

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Bees In Polınatıon And The Effect Of Global Warmıng On Bees

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Abstract
Beekeeping, which is a livestock branch made depending on nature, is to collect nectar from many vegetable sources from various regions, and to transform them into different bee products in the most economical and appropriate seasonal periods. Many products are obtained with beekeeping. The contribution of these products to the economy is very high. The use of bee products on human health has also increased in recent years. Apart from these, bees also make important contributions to the ecosystem. They are pollinators of many plant species existing in the world and they also serve as pollinators of many fruits and vegetables produced in greenhouses. Thanks to the pollinatorship of bees, the quality of the products obtained is increasing. Again, with its pollinator function, bees ensure the continuity of many endangered plants, and play an important role in ecosystem balance by increasing plant and animal diversity. Bees are not only involved in the pollination of plants that need an external pollinator, but also the product quality and quantity are increased in many plants that perform their own pollination. In this review, the importance of bees in pollination and the effect of global warming on bees are mentioned.
Key words: *Bee, beekeeping, pollination,global warming*

Polinasyonda Arılar Ve Küresel Isınmanın Arılara Etkisi

Özet
Doğaya bağlı olarak yapılan bir hayvancılık kolu olan arıcılık, aslında var olan arı kolonilerinin, çeşitli bölgelerden birçok bitkisel kaynaklardan nektar toplayarak bunları en ekonomik şekilde ve uygun mevsimsel dönemlerde değişik arı ürünlerine dönüştürülmesini sağlamaktır. Arıcılık ile birçok ürün elde edilmektedir. Elde edilen bu ürünlerin ekonomiye olan katkısı oldukça fazladır. Arı ürünlerinin insan sağlığı üzerinde kullanımı da son yıllarda giderek artmış durumdadır. Bunların dışında arıların ekosistem üzerine de önemli katkıları bulunmaktadır. Dünya üzerinde var olan birçok bitki türünün tozlayıcı durumunda olup yine seralarda üretimi gerçekleştirilen birçok meyve ve sebzenin de polinatörü olarak görev alırlar. Arıların polinatörlükleri sayesinde elde edilen ürünlerin verim ve kalitesi artmaktadır. Yine tozlayıcı görevi ile arılar nesli tükenmekte olan birçok bitkinin neslinin devamını sağlamakta, bitki ve hayvan çeşitliliğini arttırarak ekosistem dengesinde önemli rol oynamaktadır. Arılar sadece dış tozlayıcıya ihtiyaç duyan bitkilerin tozlaşmasında görev almaz, kendi polinasyonunu gerçekleştiren birçok bitkide de üreticiler tarafından kullanılarak ürün kalite ve miktarının artırılması sağlanır. Bu derlemede arıların polinasyonda ki öneminden ve küresel ısınmanın arılar üzerinde ki etkisinden bahsedilmiştir.
Anahtar Kelime: *Arı, polinasyon, arıcılık, gıda ,küresel ısınma*

1.Giriş

Dünya genelinde tarım tarihi uzun yıllar öncesine dayanmaktadır. Avrupa' ya bakıldığında endüstri devrine, Anadolu da ise Asurlar- Hitit uygarlıkları gibi uygarlıklara kadar uzanmaktadır. Osmanlı döneminde ise tarımsal faaliyetler gelişme göstermiş ve bugün hale ülkemiz önemli tarım arazileri bakımından zengin bir ülke olup, tarımsal faaliyetlerin günden güne geliştiği bir yerdir (Altan ve ark.,2000, Yavuz, 2005). Hayvancılık kollarından olan arıcılığın bitkisel üretime olan olumlu etkisi göz ardı edilemez düzeylerdedir.

Geçmiş yüzyıllardan günümüze kadar gelmiş sözlü, yazılı kaynaklar ve arkeolojik kazılara bakıldığında arıcılığın uzun yıllara dayanan bir tarihi olduğu görülmektedir. Yani arılar hem doğal varlıklar hem de kültürel varlıklar olarak kabul edilmektedir. Arılar insanoğlunda merak uyandıran bir hayvancılık kolu olmayı başarıp, ilk çalışmalar 16. yüzyılda gerçekleştirilmiştir. İlerleyen teknolojiler ve arıların hem doğaya olan faydaları hem de insan sağlığı üzerine olan faydaları ile günden güne gelişen bir hayvancılık dalı haine gelmiştir (Sancak ve ark.,2013). Arıcılıkta amaç aslında var olan arı kolonilerinin, çeşitli bölgelerden birçok bitkisel kaynaklardan nektar toplayarak bunları en ekonomik şekilde ve uygun mevsimsel dönemlerde değişik arı ürünlerine dönüştürülmesini sağlamaktır. (Erdoğan ve ark., 2004).

Dünya genelinde ülkelere bakıldığında bizim ülkemiz var olan bitki florası çeşitliliği ve 4 farklı mevsimin bir arada yaşanması ile arıcılık için elverişli ülkelerin arasında yer almaktadır. Bugün FAO'nun açıkladığı rakamlara göre dünya geneli 92.291.583 adet kovan varlığı olup bunlarda üretilen bal miktarı ise 1.851.541 tondur. Türkiye'nin bu veriler arasında yer alan kovan miktarı 7.947.687 adet , bal miktarı ise 114.113 tondur (Çizelge 1). Bu veriler ile Türkiye FAO tarafından yayınlanan listede dünya sıralamasın da üçüncü sırada yer almaktadır (Anonim,2020; Öztürk ve Erkan,2020).

Çizelge1. Dünya Arıcılık Verileri

	Ülke	Kovan Sayısı (adet)	Bal Üretimi (ton)	Bal Verimi (kg/kovan)
1.	**Hindistan**	13.048.275	67.442	5,17
2.	**Çin**	9.048.546	446.900	49,39
3.	**Türkiye**	7.947.687	114.113	14,36
4.	**İran**	6.601.394	77.567	11,75
5.	**Etiyopya**	6.018.223	50.000	8,31
6.	**Rusya**	3.182.399	65.006	20,43
7.	**Arjantin**	3.020.370	79.468	26,31
8.	**Tanzanya**	3.019.784	30.584	10,13
9.	**İspanya**	2.965.557	36.394	12,27
10.	**AmerikaBirleşik Devletleri**	2.803.000	69.104	24,65
Kaynak: (Anonim,2020)				

Dünya üzerinde var olan her canlının ekosistemde dengenin sağlanmasında bir görevi vardır. Ülkemizde gelişim günden güne gelişme gösteren arıcılığın ise ekosistem de önemli bir yeri vardır.Örneğin; Kendileri küçük olan bu canlılar aslında yediğimiz besinlerin yüzde %90'nın tozlayıcısı konumundadır

1.1. Arılar ve polinasyon

Bitkisel üretim de tozlaşma çeşitli yollarla gerçekleşmektedir. Örneğin; rüzgar yolu ile, bazı böcekler ile. Tozlaşmada görev alan böcekler arasında en önemlisi arılardır., arıların yapılan birçok araştırmada sürdürülebilir çevre için tozlaşmaya yardımcı olduğu ve bitkilerde verimliliği artırdığı kanıtlanmıştır (Topal ve ark., 2013).

Yapılan araştırmalarda bitkilerin bal arılarının toplayabileceği türden polenler ürettiğini, bunu polenleri hem erkek bitkilerin çiçeklerinden hemde dişi bitkilerin çiçeklerinden toplayabileceğini bildirmişlerdir. Ancak bazı çalışmalar ise sadece dişi çiçeklerden toplanan polenleri tercih ettiğini bazıları ise sadece erkek çiçeklerden toplanan polenleri tercih ettiğini vurgulamıştır. Sonuçlara bakıldığında ise, bal arılarının hem erkek çiçeklerden verimli polenleri hem de dişi çiçeklerden kısır polenleri aradıklarını ve topladıklarını göstermektedir. Bunun sebebi ise doğada var olan çiçeklerde nektar ve polen koku ipuçları yer almakatadır. Bu kokularda polinatörler tarafından ilk yiyecek aramasında tanımlanır ve koku hafızalarına yerleşir. Arı davranışlarında, arılar polen kokularını belirleyebildikleri için bal arılarında koku kaynaklı davranış araştırılmıştır. Arılarda davranışsal özellikleri ile polen kokularını algıladıklarını, polen tek besin kaynakları olsa bile belli düzeylerde tozlaşmaya izin verdikleri vurgulanmıştır. (Goodwinand Congdon;2018). Farina ve ark. (2007), yaptıkları bir çalışmada arıların koku davranışı ile ayçiçeği bitkisinde tozlayıcı ziyaretlerini arttırdığı yönünde bir hipotez ileri sürmüşlerdir.

Arıcılığın geçmişi uzun yıllara dayansa da arıların bitkisel üretimde oynadığı rol hakkında az şey biliniyordu. Arıların tozlaşmada oynadığı önemli rol hakkındaki bilgiler on sekizinci yüzyılın ortalarına kadar uzanmaktadır. Ancak bu bilgilerin teorik olarak kullanımları 1900'lü yıllarda görülmektedir (Crane,1999; Lorenz,2021). Bal arısı kendi ihtiyaçları doğrultusunda gün içinde bal özü ve polen toplayarak zamanlarını geçirirler. Bu işlem sırasında üzerlerine yapışan çiçek tozlarını bir çiçekten başka çiçeğe taşırlar (Şahinler, 2000; Kekeçoğlu ve ark., 2014). Dünya üzerinde yer alan çiçekli bitkilerin %16'sının, tarımsal olarak üretimi yapılan bitki türlerinin yaklaşık olarak 400 tane bitki türünün polinasyonu bal arıları tarafından gerçekleştirilmektedir (Karaman,2018).

2017 yılında yapılan bir çalışmada bal arısı ve bambus arısının kiraz bitkisi üzerine ziyaret sıklığı ve etkinliğinin tozlaşmaya olan katkısı araştırılmış. Bu çalışmanın sonuçları incelendiğinde arıların iki yıllık veri ortalamasına göre bal arısı ve bambus arılarının çiçekleri ziyaret sıklığı %93, %94 olarak belirlemiş. Oransal olarak bakıldığında bambus arısı ve bal arısının diğer tozlayıcılara kıyasla daha fazla tozlama etkinliğinde bulunduğunu gözlemlemişlerdir. Yapılan araştırmada bambus ve bal arılarının ziyaret ettiği bitkilerin meyve tutma oranın en fazla olduğu sonucunu elde etmişlerdir (Topal ve ark, 2017).

FAO verilerine göre dünya nüfusunun %90'nın beslendiği 100 ürün (elma, armut, badem böğürtlen gibi) arılar tarafından tozlaştırılmaktadır (Anonim, 2016). Yonca bitkisine arıların tozlayıcı etkisini incelemek amaçlı yapılan çalışmalarda, yonca bitkisinin meyve bağlama, tohum tutma, meye ve tohum verimindeki çok önemli farkın büyük oranda tozlayıcı arılardan kaynaklandığı ortaya çıkmıştır (Avcı ve ark, 2010, Öztürk, 2015).

Bal arılarının kivi bitkisi üzerinde yer alan polenlerden yararlanma oranı oldukça yüksektir. Kivi bitkisi polenlerinden bal arılarının yararlanması üzerine yapılan araştırma sonucuna göre, bal arıları tarafından tozlaştırılan kivi çiçeklerinin %98.92'sinin meyveye dönüştüğü ancak arı girişine engel olunan kivi çiçeklerinin ise sadece %32.08'si döllenerek meyveye dönüştüğü saptanmıştır.

Apis mellifera l. kivide verim ve kaliteyi artırmada önem taşımaktadır. Arıların besin ihtiyaçları açısından bakıldığında, kivi bitkisinin bal arıları için çok iyi bir polen kaynağı olduğu belirtilmiştir. Aslında bu durumda hem bitki hem arılar için karşılıklı bir yarar söz konusudur (Kuvancı ve ark., 2016). Kivi bitkisinin tozlaşmayla kalitesinin arttırıldığı bilinci ile yapılan bir araştırmada bal arısını yiyecek arama davranışını yönlendirmek arıların kivi çiçeklerini ziyaretlerini arttırmak için, kivi bahçesinde kokuların kullanımı gerçekleştirilmiş. Apis mellifera'nın kivi çiçeklerini ziyaretindeki bu tür bir artışın, tozlaşma etkinliğini artıracağı daha iyi (daha büyük ve daha düzenli meyve şekline) bir meyve kalitesine sebebiyet vereceği düşünülmüştür. Araştırmada dişi çiçeklere

yapay kokular (şeker şurubu, şeker şurubu ve *Lavandula hybirda* özütü gibi) işlenmiş. Sonuç olarak da, çekici madde *Lavandin Grosso* serpilmiş dişi çiçeklere daha fazla bal arısı ziyareti olduğu ve daha yüksek meyve kalitesi (ağırlık, tohum sayısı, meyve büyüklüğünde düzenlilik) gösterdikleri bildirilmiştir (Meroi Arcerito ve ark., 2021). Çilek bitkisi üzerine arıların tozlayıcı etkisi araştırılmış bu araştırma sonucunda da arıların çilek meyve kalitesini, iriliğini, tozlanma ve döllenme düzeyini arttırdığı gözlemlenmiştir (Sarıdaş ve Kargı, 2017). Bakla sebzesinde arılar tozlayıcı olarak kullanılmadığın da dane verimin azalma gösterdiği, bu oranın %20-%70 arasında değişiklik göstermiş olduğu bildirilmiştir (Sıralı ve ark, 2011)

Bambus terrestris arıları özellikle Akdeniz bölgesinde sahil kesimlerinde yapılan seracılıkta domates ve biber bitkilerinin tozlaşması için kullanılmaktadır. Bu arılara bölgede ilgi oldukça fazla olup ticari amaçla üretimleri gerçekleştirilmektedir. Her geçen yıl sera alanlarında kullanılan Bambus koli sayısı artış göstermektedir.

Polinasyon amacıyla yurt dışında yer alan birçok firmadan ana arı ithalatı gerçekleştirilmektedir. Çünkü ana arı kolonileri nispeten daha düşük fiyatlarla alınabilmekte ve de arıların doğaya bağlı olarak daha kolay koşullarda yetiştirilebilmesi, koloni içinde besin toplamak amacıyla fazla sayıda bireye sahip olmaları gibi sebeplerden dolayı meyve bahçelerinde tozlayıcı olarak tercih edilmektedirler. Bambus kolonileri, yaşam döngülerini tamamlandığında yaklaşık olarak ana arılardan 60-70 adet işçi arı ve 120 adet erkek arı meydana gelir. İthalat sonucu alınan bu arıların ne kadarının doğal hayatta yuva oluşturduğu, kaçının çiftleşmesinin gerçekleştiği bilinememektedir. Bu durum aslında arılar ile diğer polinatör böcekler arasında rekabete sebep olarak doğal dengenin bozulmasına sebep olabilir bu nedenle ana arı ithalatının ve ana arı üretiminin dikkatli olarak gerçekleştirilmesi gerekmektedir. Çünkü doğal ekosistemde meydana gelen bozulma ile bitkilerin polinasyonu engellenebilir, parazit ve patojenlerin bitkiler arası taşınmasına ve de genetik çeşitlilikte açılmalara sebep olabilir (Gösterit ve Güler, 2005).

Bitkilerin tozlaşmasında görev alan arıların diğer bir yararı ise tozlaşmayı sağladığı bitkilerden meydana gelen meyve üzerinedir. Arılar ile tozlaşan bitkilerden elde edilen meyveler daha düzgün şekli ve kalitesi yüksek, meyve bağlanma oranı yüksek, meyve tohum sayısı fazla, meyve iriliği fazla, yağlı tohumlarda yağ oranı fazladır ürünler elde edilir. Bunların yanında arı ürünlerinde çeşitlilik artar, arıların polinasyonun da artış ve hasat ile üretim aynı zamanda gerçekleşme imkanı bulur (Karadeniz, 2012; Yılmaz, 2016).

İnsanların doğal kaynakları kullanımı ekosistem dengesini değiştirmede temel bir itici güç görev görmektedir. Özellikle bu itici gücün etkileri böcekleri ve polinasyon da oldukça önemli olan bal arılarını etkilemektedir. Ekosistem de meydana gelen değişimlerde arıların davranışsal olarak değişmelerine sebep olmaktadır. Özellikle hızla artan kent nüfusu nedeni ile doğal kaynakları kısıtladığı bu nedenle arıların insan egemen bir doğada farklı gıda kaynaklarına yönelmeye itmektedir. Ancak bal arılarında meydana gelen bu davranışsal değişiklik henüz tam olarak anlaşılamamıştır.

1.2.Küresel ısınma ve iklim değişikliğinin arılar üzerine etkisi

Bütün dünya da dikkat çekmeye başlayan önemli bir olayda küresel ısınmadır. Küresel ısınma ile oluşan iklimde meydana gelen değişimler her geçen gün yaşantımızı daha da etkilemektedir. İklimde oluşan değişikliklerden dünya üzerinde yaşayan birçok canlının etkileneceği öngörülmektedir. Bu değişimden en çok etkilenecek varlıkların arasında böcekler yer almaktadır. Böceklerin vücut yapısı sıcaklık ve nemde meydana gelecek ani değişimlere uyum sağlayamayarak üreme kapasiteleri, yer değiştirme sürelerini etkileyeceği öngörülmektedir (Şahinler ve ark., 2008).

Sıcak ve nem oranında meydana gelecek değişimler bölgede yaşayan canlıların bulundukları bölgeyi terk etmesine neden olacağı gibi bazı bölgelerde de istilacı tür adı verilen bölgeye özgü olmayan türlerin o bölgeye yerleşmesine olanak verebilecektir. Bunlara ek olarak ise bazı türlerin ise küresel ısınma ile yok olma tehlikesi ile karşı karşıya olduğu bildirilmektedir (Doğan ve ark., 2010). Beş yıl önce imzalan Paris İklim antlaşmasına göre küresel ısınmanın 2030 yılına kadar 2 derecenin altında tutulması gerektiği öngörülmesine karşın, Birleşmiş Milletler Çevre Programı raporuna göre (2020) küresel ısınmanın bu koşullarda 3 santigrat derecenin üzerine çıkacağını vurgulamıştır (Anonim,2021). Bu konunun arılar üzerinde etkisini ele alan çalışmada ise kış sıcaklığının artması ile 9 arı türünde bazı türleri olumsuz etkilediğini, ağırlık kaybı yaşandığını, enerji tüketimlerinin arttığını, ilkbahar mevsiminde ise yaşam döngülerinin sona erdiğini bildirmiştir. Ancak tozlaşma kabiliyeti fazla olan yaban arılarında ise adaptasyon kabiliyetinin oldukça yüksek olduğunu belirtilmiştir (Fründ ve ark., 2013). Yapılan başka bir araştırmada ise Orta Avrupa ve Balkanlar'da, İskandinavya'dan Akdeniz'e kadar uzanan 11 Avrupa ülkesindeki 16 farklı genetik orijinli 5 *Apis mellifera* alt türüne ait (carnica, ligustica, macedonica, mellifera, siciliana) 20 arılıkta bulunan 597 koloni seçilerek, genotip ve çevrenin arılar üzerine etkisine bakılmıştır. Araştırma sonuçlarında ise Yavru populasyonu Kuzey'de daha küçük olma eğiliminde iken, Güney Avrupa'ya yerleştirilen koloniler soğuk koşullara yerleştirilen kolonilere göre daha düşük yetişkin arı populasyonuna sahip olma eğiliminde olduğunu gözlemlemişlerdir. Yani bu demek oluyor ki sıcak iklimlerdeki arılar daha kısa yaşam süresi gösterirken, kuzeyde daha kısa yavru yetiştirme dönemi olmaktadır. (Hatjina ve ark., 2014).

Bal arılar dünya üzerinde birçok gıda türünün ve bitkilerin polinatörüdür. Arılar olmadan küresel gıda üretimi düşünülemez. Arıların genetik yapısına bakıldığında ise yeni çevre şartlarına uyum sağlayabilecek yapıya sahip olduğu bildirilmiştir. Ancak iklimde meydana değişimler bitkilerin çiçek kalitelerinin düşmesine neden olarak arıların kolonilerinde dolaylı yoldan kayıplara sebebiyet verebilir. Bunun yanında ise bal arısı ırkları arasında

nektar bulmak için bir rekabet ortamı yaratacağı öngörülen sonuçlar arasındadır (Le Conte ve Navajas, 2008). Bal arıları gün içerisinde nektar toplamak için bir çok çiçeği ziyaret etmektedir. Ancak ziyaret ettikleri nektar kaynağında yeterli nektar bulunmaması arılar için önemli bir stres unsurudur. Bu durumda tarlacı arılar arasında rekabeti azaltmaya yönelik bir işbirliği hedeflendiği görülmektedir (Hranitz ve ark., 2009). Daha da önemlisi ise yapılan bir çalışmada ise bal arıları, nektar ve polen kaynaklarının yetersiz olması durumunda mevcut kısıtlı besinin gelecek generasyona kalabilmesi için başlarını petek gözlerine sokarak kendilerini imha ettikleri bildirilmiştir (Yücel, 2008).

İklimsel değişimler tüm canlılarda olduğu gibi arılarında yaşam kalitelerini verimlerini hayatta kalmasını, üreme kabiliyetlerini etkilemektedir. Son yıllarda yapılan birçok araştırmada sonuçlar bunları göstermektedir. Örneğin, Yürütülen bir araştırmada Kayseri de özellikle erken ilkbahar aylarında arıların yavru yetiştirmek için ihtiyaç duydukları nektar ve polen kaynaklarının kıt olduğunu belirtmiştir. Son yıllarda ise arıcıları, küresel ısınmanın da bir etkisi olarak çiçek açma ve nektar salgılama dönemlerinin değiştiği ve bal veriminin düştüğü konusunda şikayetçi olduğunu bildirmişlerdir. Bunların önemi ise bal arılarının yavru yetiştirmek için daha fazla nektara ihtiyacının olduğu, bunun içinde mart-nisan aylarında ek yemlerle beslemenin zorunlu hale getirilmesi gerektiği vurgulanmıştır (Bekret ve ark., 2015).

Bir başka araştırmada ise sıcaklığın değişiminin, rüzgar hızının, yağış miktarının bal verimine etkisi araştırılmış. Araştırmanın sonuçlarında ise bal üretimi ile iklimsel değişikliğin pozitif korelasyon gösterdiği bildirilmiştir (Schweitzer ve ark., 2013).

Bütün canlılarda en önemli ihtiyaç olan besin maddesi sudur. Arılar içinde suyun büyük önemi vardır ki larval gıdanın %66'sı sudan oluşmaktadır. Yine arılar sıcak havalarda kovanda ki ısı dengesini ayarlamak, besinlerin sindirilerek metabolize edilmesinde, çözünmüş besin maddelerinin vücut organlarına taşınmasında, atık maddelerin uzaklaştırılmasında sudan yararlanır. Küresel ısınma ile doğa da su miktarında meydana gelen azalma ise arıların bu işlemleri gerçekleştirmesinde zorluk yaşamasına neden olacaktır (Yörük ve Şahinler,2013).

İşçi arılar tarlacılık ve diğer koloni faaliyetlerini gündüz gerçekleştirmektedirler, geceleri ise bu faaliyetler önemli ölçüde azdır. Kolonide ki bal arılarında oksijen tüketimi ile karbondioksit üretimi incelendiğine en düşük metabolizma oranları sabah, en yüksek oranın ise öğleden sonra olduğu gözlenmiştir. Buna ek olarak ise Kolonilerde gündüz gözlenen metabolizma oranları geceye oranla daha fazla olduğu bildirilmiştir (Southwick ve Moritzs, 1987). Laboratuvarda çevre ısısının sabit tutulduğu arılarda ise metabolizma oranları karşılaştırıldığında gündüz gözlnen metabolizma oranlarının geceye oranla 8 kat daha fazla olduğunu bildirilmiştir. Ancak ışığın yoğunluğunun ve karanlık şartlar altında metabolizma ritminin içsel sosyal saat tarafından belirlenerek sabit kaldığını gözlemlemişlerdir (Southwick ve Moritz, 1987).

Arılar için diğer önemli nokta ise kovan sıcaklığının ve nemimin sabit tutulmasıdır. İşçi arılar tarafından gerçekleştirilen bu işlem, nektarın bala dönüşmesi (olgunlaşma), açık gözlerdeki yavruların kurumaması, yumurtaların yüksek oranda çatlayarak larvaların oluşması için de gereklidir. Diğer bir açıdan ise ana arının yumurtladığı yumurtaların çatlaması, larvaların gelişebilmesi için mevcut rubet oranın %90-95 oranında olması gerekmektedir. Bu rutubet oranın daha fazla ya da daha az olduğu (% 100,%80,%50 ve %20 nem oranında) çalışmalar yapılmış ve bu durumda yumurtaların larvaya dönüşümün azaldığı, yumurtaların kuruduğu için çatlayamadığı bildirilmiştir (Doull, 1976). Yine ana arının çiftleşme uçuşuna çıktığı dönemlerde ise iklimde meydana gelen değişimler nedeni ile oluşan yağmurlu havalarda ana arı bu uçuşu gerçekleştirememekte, yada tam çifteleşememe gibi sorunlar nedeni karşılaşılmaktadır. Bu durum sonucunda ise ana arının verim kalitesi azalmaktadır.

Küresel ısınmanın diğer bir sonucu ise bitkilerin çiçeklenme döneminin başlangıcında, böceklerin (tozlayıcıların) ilk görülmeye başladığı zamanlar ve sezonları , sıcaklıkta meydana gelen artmalar ile birlikte bu dönemlerin-tarihlerinde değiştiği ve arttığı gözlemlenmiş. Tüm türler arasında meydana gelen bu fenolojik tepkiler farklılık gösterse de bitkiler ve tozlayıcıları arasında bu tepkilerin oranları aynı olduğu ortaya çıkmıştır. Yani bitkilerin çiçeklenme ve tozlaşma aktivite zamanın sıcaklıktan çok güçlü etkilendiğini gösterirken, bitki ve tozlayıcıların fenolojisi, coğrafik dağılımı aynı zamanda bulunma oranları iklim değişikliğinden etkilenmektedir (Hegland ve ark., 2009).

Küresel iklim değişikliğinin artış gösterdiği son dönemlerde biyoçeşitlilik oldukça önem arz etmektedir. Bal arılarının bölgeye adaptayon yetenekleri oldukça güçlü olsa da ülkelerde kalkınma politikalarının sonuçları ile bölge yerli arılarının geleceği tehlikeliye girmektedir. Koç ve Karacaoğulu 'nun gerçekleştirdikleri araştırmada, Ege Bölgesi koşullarında Anadolu arısı Ege ekotipi, Kafkas ve İtalyan ırkı genotiplerinden oluşturulan gruplarda, yavru alanı, arılı çerçeve sayısı, uçuş etkinliği, hırçınlık ve bal verimi gibi bazı davranış ve fizyolojik özellikleri incelenmiş. Genetik olarak farklılığı bulunan gruplar da 10 dönemde ölçülen arılı çerçeve sayıları, yavru alanları, uçuş etkinliği bakımından dönemler ve bal verimlerinin, genotipler arası farkların, önemli olduğu bildirilmiş. Bölgede Kafkas genotipinin küresel iklim değişikliğinin devam etmesi durumunda bu ırkın yetiştirilmesinin olanaksız hale geleceği bildirilmiştir (Koç ve Karacaoğlu, 2012).

Sonuç

Ekosistem üzerinde var olan bir düzen ve denge vardır. Bu dengenin sağlanmasında arıların önemi oldukça fazladır. Birçok bitki türünün tozlaşmasında görev alan arılar sayesinde bitki çeşitliliği artmakta olup bu bitkilerde elde edilen ürün kalitesi-miktarı da artış göstermektedir. Arılar ile tozlaşması gerçekleşen bitkilerden meydana gelen meyvelerin miktarları daha fazla olup daha düzgün şekilli ürünler meydana gelmektedir.

Arılar birçok bitki türünün polinasyonunu gerçekleştirmektedir. Bitki çeşitliliğinin devamı için arıların önemi bir kez daha karşımıza çıkmaktadır. Nesli tükenmek üzere olan bazı bitkilerin nesillerinin devamını sağlamaktadırlar. Tükettiğimiz gıdaların %80 'nin tozlayıcısı arılardır. Arılar sayesinde gıdaların raf ömrü uzayarak sofralarımıza kadar gelebilmektedir.

Ekosistem de ki yeri oldukça önemli olan arı ırklarının sadece doğaya olan faydaları değil biz insanlara da olan faydalarını düşünerek bu canlıları koruma altına almalıyız. Nesillerini devamı için mümkün olduğunda tarım ilaçlamalarından kaçınıp, eğer ilaçlama yapılacaksa bu canlılar baz alınarak ilaçlama gerçekleştirilmelidir. 30.11.2011 tarihli Resmi Gazetede 28128 sayı ile yayınlanarak yürürlüğe girmiş Arı Yönetmeliğinde zirai ilaçlama tedbirleri olarak uyuması gereken hususlara yer verilmiştir. Bu yönetmelik kapsamında zirai mücadele gerçekleştirilmelidir. Arıcıların bu konuda bilinçlendirilmesi, arıcılık eğitimlerinin verilmesi gerekmektedir.

Yine çağımızı için önemli bir sorun haline gelen küresel iklim değişikliğine karşı yapılacak bilimsel çalışmaların arttırılması gerekmektedir. Ani ısı değişimleri sonucu meydana gelen floradaki etkileri doğrudan arıcılığı ve arıların nektar kaynaklarını da etkilemektedir. Dolaylı yoldan yine arıcılar için işçilik ve gezginci arıcılığın yapılabilmesi için nakliye ücretlerinin artmasına neden olarak üretim maliyetleri fazlalaşmaktadır.

İklimsel ve coğrafik faktörlerde türlerin biyoçeşitliliğinin dağılımı için önem taşımaktadır. Bu nedenle bölgeye uygun ırkların yetiştirilmesi, bu ırklar ile arıcılığın sürdürülmesi açısından önem taşımaktadır.

Arı neslin tükenmesinin insan neslinin de tükenmesi demek olduğunu aklımızdan çıkarmamalıyız. Einstein de söylediği gibi ' Arılar olmasa insanlığın 4 yıl ömrü kalır '.

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ID: 712

Insecticidal activity of the seed powders of Bush banana, *Uvaria afzelli* Scott Elliot against maize weevil, *Sitophilus zeamais* Motschulsky (Coleoptera: Curculionidae).

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Abstract

The seed powders of bush banana, *Uvaria afzelli* Scott Elliot were sun-dried and pulverized and stored in labeled containers. The powders` activity was investigated on maize weevil, *Sitophilus zeamais* Motschulsky in the laboratory for mortality, oviposition and adult emergence effects using standard methods. The long-term storage and viability of the treated maize grains were also investigated using emergent holes and the ability of the grains to germinate respectively as indices. The results showed that dosage treatment at 9 g/90 g of maize was the most potent against *S. zeamais.* This dosage treatment caused 100 % mortality of weevils within 15 days of exposure. The least potent powder dosage was 3 g/90 g of maize and this caused 42.25 % mortality of weevils within 20 days of exposure. The powder also caused a significant reduction in the number of eggs laid and adult emergence. The most negligible percentage adult emergence of 8.25 % was recorded in maize grains treated with 4.5 g/20 g of powder while the highest was recorded in grains treated with 1.5 g/20 g dosage of seed powder. The least grain damage of 12.12 % was recorded in grains treated with 9 g/90 g of seed powder while the highest (18.13 %) was recorded in maize grains treated with 3 g/90 g of seed powder. The three seed powder dosages used showed positive protectant ability because weevil perforation index did not exceed 50. The seed powder increased seed viability as germinability ranged from 82.34 % to 85.25 %. The results obtained showed that *U. afzelli* seed powder effectively controlled *S. zeamais,* enhanced germinability of maize and could serve as alternative to conventional insecticide.

Key words*: Uvaria afzelli*, *Sitophilus zeamais,* oviposition, seed powder, mortality, adult emergence,seed viability.

ID: 713

Investigation of Vegetable Milk (Extract) Production from Pumpkin Seeds

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Abstract

In order to prevent the food shortage in the world, it has become important to obtain consumable food products from the by-product of fruits and vegetable processing. In this study, the production of vegetable milk from the waste pumkin seeds of the pumking industry was investigated. Pumpkin seeds were obtained from a local company producing pumpkin products in Sakarya, and vegetable milk was obtained by water extraction. Composition and color analyzes of the raw and roasted pumpkin seed milks were carried out. Raw and roasted pumpkin milks were flavored with coffee and vanilla and sensory evaluatio conducted on a hedonic scale with 33 panelists. As a result of the sensory analysis, it was revealed that pumpkin seed milk flavored with vanilla and coffee was more liked than unflavored (plain) pumpkin seed milk. No sensory differences were detected between roasted and raw pumpkin seed milks.

Key Words: *Pumpkin seed, Vegan, Vegetable milk, Waste*

Bal Kabağı Çekirdeğinden Bitkisel Süt (Öz) Üretiminin İncelenmesi

Özet

Dünyada yaşanan gıda yetersizliğinin önüne geçebilmek için gıda ham maddelerinin işlenmesi sonrası atık olarak ortaya çıkan kısımlarından tüketilebilir gıda ürünü elde edilmesi önemli hale gelmiştir. Bu çalışmada bal kabağı ürünleri üretiminde ortaya çıkan atık çekirdekten bitkisel süt üretimi incelenmiştir. Sakarya'da lokal bir bal kabağı ürünleri üreten firmadan bal kabağı çekirdekleri temin edilmiş ve özü çıkartılarak bitkisel süt elde edilmiştir. Elde edilen çiğ ve kavrulmuş bal kabağı çekirdeği sütlerinin kompozisyon ve renk analizleri gerçekleştirilmiştir. Çiğ ve kavrulmuş bal kabağı sütleri kahve ve vanilya ile aromalandırılarak 33 panelist ile hedonik ölçekte duyusal olarak değerlendirilmiştir. Yapılan duyusal analiz sonucunda vanilya ve kahve ile aromalandırılmış bal kabağı çekirdeği sütlerinin aromalandırılmamış (sade) bal kabağı çekirdeği sütlerinden daha çok beğenildiği ortaya çıkmıştır. Kavrulmuş ve çiğ bal kabağı çekirdeği sütlerinin arasında duyusal farklılık tespit edilmemiştir.

Anahtar Kelimeler: *Balkabağı çekirdeği, Vegan, Bitkisel süt, Atık*

ID: 715

Do IBA and Paclobutrazol Applications Increase Rooting Performance of Blackberry Cuttings?

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Abstract
Difficulties in adventitious root formation in blackberry (*Rubus fructicosus* L.) cuttings create a disadvantage for producers. The aim of this study is to investigate the effect of different growth regulator applications on the rooting ability of blackberry hardwood cuttings in order to avoid this problem. The experiment was carried out in the polycarbonate greenhouse of Tokat Gaziosmanpaşa University Agricultural Research and Application Center. In the experiment, in addition to the control (pure water) group, Indole-3-Butyric Acid (6000 ppm IBA) and different doses of paclobultrazole (1000 ppm PBZ1, 2000 ppm PBZ2, 3000 ppm PBZ3) were applied to hardwood cuttings separately and in combination. After the application, the cuttings were planted in perlite medium and left to root for 90 days. At the end of this period, in the cuttings removed; rooting rate, callus formation rate, root number, root length and root diameter parameters were examined. As a result of the study, the highest rooting rate was obtained from the IBA applied cuttings (%42.22), followed by the PBZ1 applied cuttings closest (%33.33). In addition, it was determined that PBZ applications had positive effects on root diameter compared to the control group. The results obtained are important in terms of contributing to the literature and benefiting the enterprises.
Key Words: *Rubus fructicosus L., Hardwood cutting, Callus, IBA*

IBA ve Paclobutrazol Uygulamaları Böğürtlen Çeliklerinin Köklenme Performansını Arttırır Mı?

Özet
Böğürtlen (Rubus fructicosus L.) çeliklerinde adventif kök oluşumunda yaşanan zorluklar üreticiler açısından bir dezavantaj oluşturmaktadır. Bu çalışmanın amacı yaşanan bu sıkıntının önüne geçmek adına farklı büyüme düzenleyici uygulamalarının böğürtlen odun çeliklerinin köklenme kabiliyeti üzerindeki etkisini araştırmaktır. Deneme, Tokat Gaziosmanpaşa Üniversitesi Tarımsal Araştırma ve Uygulama Merkezine ait polikarbon serada yürütülmüştür. Denemede, kontrol (saf su) grubuna ek olarak İndol-3-Bütirik Asit (6000 ppm IBA) ve farklı dozlarda paclobultrazol dozları (1000 ppm PBZ1, 2000 ppm PBZ2, 3000 ppm PBZ3) odun çeliklerine ayrı ayrı ve kombinasyon şeklinde uygulanmıştır. Uygulama sonrasında çelikler, perlit ortamına dikilmiştir ve 90 gün boyunca köklenmeye bırakılmıştır. Bu süre sonunda sökülen çeliklerde; köklenme oranı, kallus oluşum oranı, kök sayısı, kök uzunluğu ve kök çapı parametrelerine bakılmıştır. Çalışma sonucunda, en yüksek köklenme oranı IBA uygulanan çeliklerden elde edilmiştir (%42.22) ve bunu en yakın PBZ1 uygulanan çelikler takip etmiştir (%33.33). Ayrıca PBZ uygulamalarının kök çapı üzerine kontrol grubuna kıyasla olumlu etkilerinin olduğu saptanmıştır. Elde edilen sonuçlar literatüre katkı sağlaması ve işletmelerin faydalanması açısından önem arz etmektedir.
Anahtar Kelimeler: *Rubus fructicosus L., Odun çeliği, Callus, IBA*

Giriş

Rosaceae familyasının bir üyesi olan böğürtlen (*Rubus* L.) bitkisi (Antunes ve ark., 2002), Türkiye'de yabani olarak da yetişebilen bir üzümsü meyvedir. Böğürtlen lif, antosiyanin, antioksidan ve temel vitaminler açısından zengindir (Wu ve ark., 2010). Böğürtlen, sürgün ve doku kültürünün yanı sıra otsu, odunsu ve kök çelikleri ile çoğaltılabilmektedir (Antunes ve ark., 2004). Meyvecilikte elde edilen ürünlerin homojen özellik göstermesi, vejetatif çoğaltma yöntemleriyle üretilen fidanlardan geçmektedir (Yıldız ve ark., 2009). Dolayısıyla çelikle çoğaltma yöntemi en çok tercih edilen yöntemlerden biridir. Çelikle çoğaltmanın başarılı olması, genetik köklenme potansiyeline ek olarak, ana bitkinin fizyolojik koşulları, çelik dikim zamanı, hormonal denge, sıcaklık, ışık ve neme bağlıdır (Fachinello ve ark., 2005). Çeliklerin köklenme potansiyelinin artmasında bazı büyüme düzenleyiciler kullanılmaktadır. Bunlar arasında en yaygın olanı, köklenme yüzdesini artıran ve köklenmeyi teşvik eden İndol-3-Bütirik Asit (IBA)'tir (Han ve Ark., 2009). En çok kullanılan sentetik oksinler arasında olan IBA, çok sayıda türde etkisini göstermektedir. Ayrıca toksik olmaması ve oksinin bozulmasına yol açabilecek enzim sistemlerinin etkisine çok az duyarlıdır (Pires ve Biasi, 2003). Literatüre bakıldığında IBA ile yapılan çalışmalarda, IBA'nın köklenmeye olumlu etkisinin olduğu görülmektedir (Yıldız ve ark. 2009; Koyuncu ve ark. 2004; Erdoğan ve Aygün 2007; Karadeniz ve Şişman 2004).

Paclobutrazol (PBZ), hücre uzamasını engelleyen bir büyüme düzenleyicidir. (Couture, 1982). Bitki gelişimini engelleyici etkiye sahip olduğu da bilinmektedir (Soumya ve ark., 2017; Geboloğlu ve ark., 2015). Paclobutrazol, giberellin sentezini inhibe etmesi nedeniyle etilen üretimini yavaşlatarak, sitokinin ve ABA içeriğini artırması

sonucunda fitohormonların durumunun değişiminde etkide bulunur (Kamoutsis ve Sereli, 1999). Köklenme çalışmalarında Paklobutrazolun tek kullanımı ve IBA ile kombinasyon yapılan çalışmalarında köklenmeye olumlu etkisinin olduğu belirtilmiştir (Henrique ve ark., 2006; Çekiç ve ark., 2012; Bueno ve ark., 2021).
Literatüre bakıldığında üzümsü meyvelerde IBA kullanımı 2500 ppm ile 7500 ppm arasında, PBZ kullanımının ise 100 ppm ile 3000 ppm arasında değiştiği görülmektedir. Bu çalışmanın amacı IBA ve PBZ'nin ayrı ayrı ve birlikte kullanımının böğürtlen odun çeliklerinde köklenme potansiyeline etkisini incelemektir.

Materyal ve Yöntem

Çalışma 2021-2022 yıllarında, Tokat Gaziosmanpaşa Üniversitesi Araştırma ve Uygulama Merkezine ait polikarbon serada yürütülmüştür. Denemede kullanılan çelikler, aynı Araştırma ve Uygulama Merkezinde bulunan Jumbo böğürtlen çeşidinin 1 yaşlı dallarından temin edilmiştir. 15 cm boyunda kesilen çelikler, polikarbon sera içerisinde yer alan sisleme ünitesine sahip köklendirme masalarında perlit ortamına dikilmiştir. Dikimden önce çeliklere kontrol grubu (saf su) haricinde; 6000 ppm IBA, 1000 ppm, 2000 ppm ve 3000 ppm PBZ ayrı ayrı ve kombinasyon şeklinde uygulanmıştır. Çeliklerin üçte birlik kısmı IBA solüsyonunda 5 saniye, PBZ solüsyonunda ise 15 dakika boyunca bekletilmiştir. Denemede pozitif kontrol olarak 6000 ppm IBA kullanılmıştır. Deneme, tesadüf parselleri deneme desenine göre 3 tekerrürlü ve her tekerrürde 15 çelik olacak şekilde planlanmıştır. 90 gün süre ile perlit ortamında bekletilen çelikler, çalışma sonunda özenle çıkarılmış ve köklenme oranı, kallus oluşum oranı, kök sayısı, kök uzunluğu ve kök çapı parametrelerine bakılmıştır. Elde edilen veriler SAS paket programı kullanılarak varyans analizine tabi tutulduktan sonra uygulamaların karşılaştırılmasında Duncan çoklu karşılaştırma testi ($P<0.05$) kullanılmıştır.

Çizelge 1. Çalışmada kullanılan Bitki Büyüme Düzenleyicileri ve dozları.

Uygulamalar	IBA (Konsantrasyon – ppm)	PBZ (Konsantrasyon – ppm)
Kontrol (Saf Su)	0	0
IBA	6000	0
PBZ1	0	1000
PBZ2	0	2000
PBZ3	0	3000
IBA+PBZ1	6000	1000
IBA+PBZ2	6000	2000
IBA+PBZ3	6000	3000

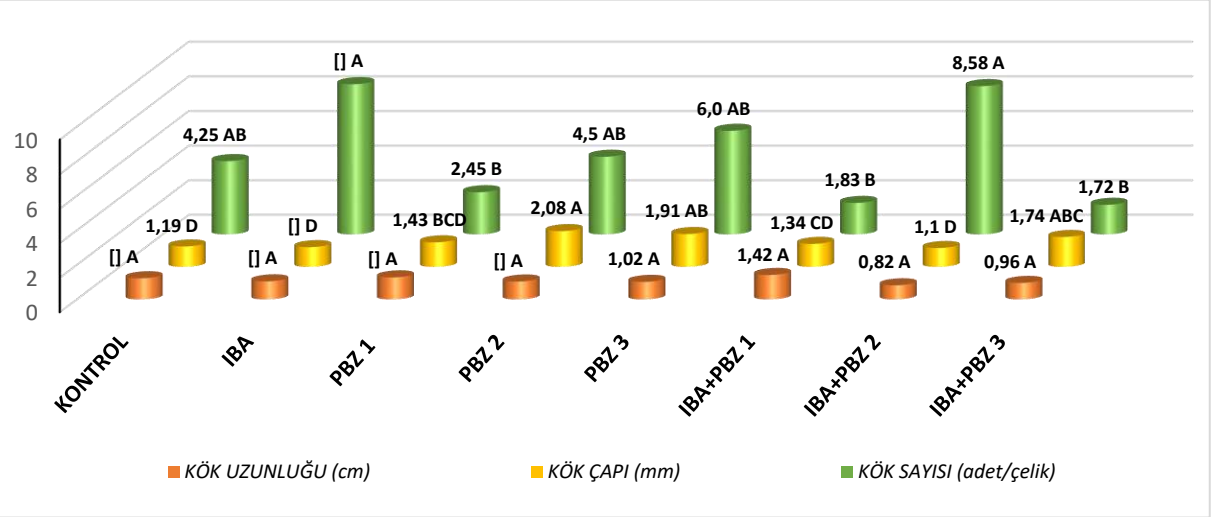
Bulgular ve Tartışma

Kök uzunluğu, kök çapı ve kök sayısı:

Çalışmada, farklı büyüme düzenleyicilerle muamele edilen böğürtlen odun çeliklerinin; kök uzunluğu (cm), kök çapı (mm) ve kök sayısı parametrelerine ait veriler Çizelge 2' de belirtilmiştir. Elde edilen verilere göre kök uzunluğu ölçümlerinde istatiksel açıdan bir fark görülmemiştir. Buna karşılık kök çapı ve kök sayısı parametrelerinde istatistiki olarak fark oluşmuştur. Denemede, kök çapı verilerine bakıldığında, en yüksek değer PBZ2 uygulamasından elde edilirken en düşük değerler ise kontrol grubu ile birlikte IBA ve IBA+PBZ2 uygulamalarında görülmüştür. Çalışmada kök sayısı bakımından en düşük değerler PBZ1, IBA+PBZ1 ve IBA+PBZ3 uygulamalarında ortaya çıkmış, en yüksek değerler ise IBA ve IBA+PBZ2 uygulamasında saptanmıştır. PBZ2 ve PBZ3 ile muamele edilen çelikler ise kontrol grubu ile benzer özellik göstermiştir.
Yaptığımız çalışmada, yapılan uygulamaların kök uzunluğunu artırmada herhangi bir etkisinin olmadığı sonucuna ulaşılmıştır. Çekiç ve ark., (2013) kara dut ve mor dut ile yaptıkları çalışmada, kara dutta kök uzunluğunu artıran en iyi uygulamanın 2 cm ile IBA uygulaması, Mor dutta ise 3.03 cm ile IBA+PBZ uygulaması olduğunu bildirmiştir. Yıldız ve ark., (2009) yaptıkları çalışmada, kara dut çeliklerine uyguladıkları 7500 ppm IBA ile en yüksek kök uzunluğu değerine (9.58 cm) ulaştıklarını rapor etmişlerdir. Bueno ve ark., (2021)'nın yaptıkları çalışmada, 1000 ppm IBA uygulaması sonucunda 13,27 cm kök uzunluğu, 200 ppm PBZ uygulamasında ise 10,89 cm kök uzunluğu elde edildiği bildirilmiştir. Literatürdeki bu değerler bizim bulduğumuz değerlere göre yüksek çıkmıştır. Bunun sebebi kullanılan materyalin farklı tür olmasından kaynaklanmış olabilir.
Kök çapına bakıldığında, yapılan uygulamalar arasında en etkili uygulama, PBZ2 (2.08 mm) olmuştur, bunu PBZ3 (1.91 mm) uygulaması takip etmiştir. Çekiç ve ark., (2013) yaptıkları çalışmada kara dut için 2000 ppm PBZ uygulaması sonucunda kök çapının 0.2 mm bulunduğunu, IBA+PBZ uygulaması sonucunda ise 1.3 mm ile en yüksek değere ulaşıldığını ifade etmiştir. Aynı çalışmada mor dut için ise en iyi sonucun 2.1 mm ile PBZ uygulamasından elde edildiğini ifade edilmiştir. Bu çalışmada karaduttan elde edilen değerler bizim elde ettiğimiz değerlerden düşük olurken, mor dut için ifade edilen değerler çalışmamızla uyuşmaktadır. Serdar ve ark., (2021) 6000 ppm toz IBA uygulaması sonucunda 1.1 mm kök çapı elde etmiştir. Bizim çalışmamızda da benzer sonuç çıkarak 6000 ppm IBA uygulaması sonucunda 1.15 mm kök çapı elde edilmiştir.
Kök sayısına bakıldığında, yapılan uygulamalarda kök sayısını artırmada en başarılı uygulama IBA (8.69 adet/çelik) olurken, bunu IBA+PBZ2 uygulaması (8.58 adet/çelik) takip etmiştir. Bulduğumuz bu değer, Zenginbal

ve Demir, (2018)'in 4000 ppm IBA uygulaması sonucunda bulduğu değere (9.64 adet/çelik) benzerdir. Başka bir çalışmada ise Hussain ve ark., (2014) 2000 ppm IBA uygulaması sonucunda 13.5 adet/çelik değerine ulaştıklarını belirtmiştir. Belirtilen bu değer bizim bulduğumuz değerden yüksektir. Bu uyuşmazlık, farklı yetiştirme ortamı ve farklı kök bölgesi sıcaklıklarından kaynaklanmış olabilir.

Çizelge 2. Farklı büyüme düzenleyici uygulamalarının böğürtlen odun çeliklerinde kök uzunluğu, kök çapı ve kök sayısı parametrelerine etkisi.

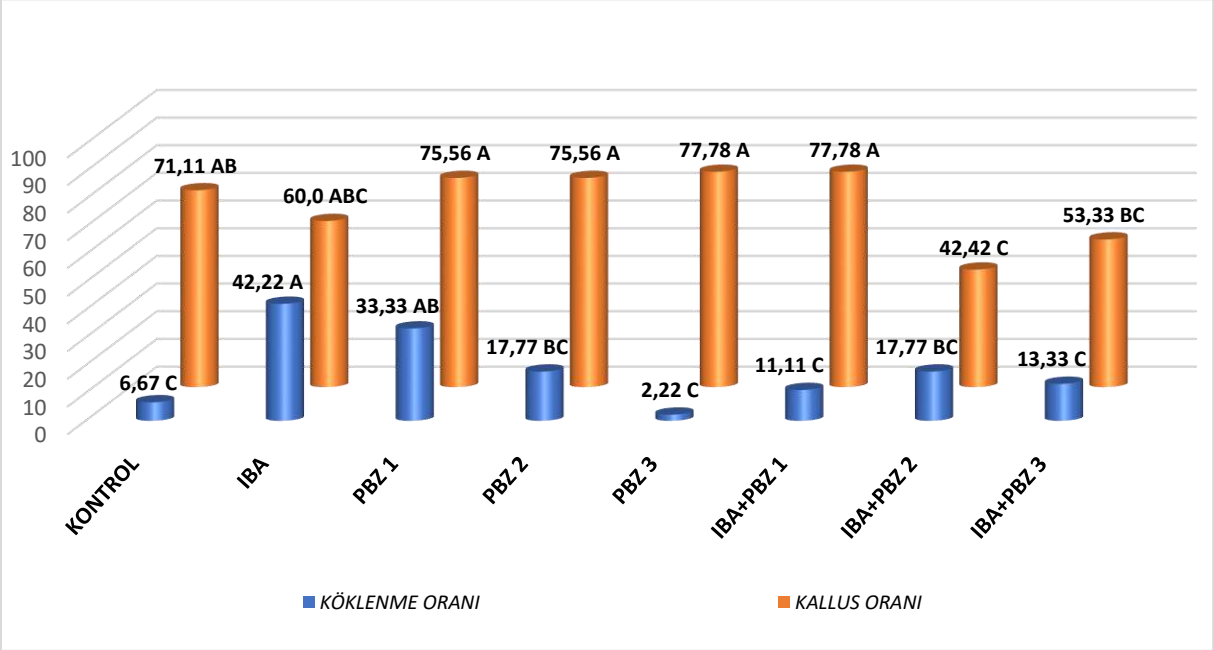


IBA=6000 ppm Indol Butiric Acid, PBZ1=1000 ppm Pacobultrazol, PBZ2=2000 ppm Paclobultrazol, PBZ3=3000 ppm Paclobultrazol, IBA+PBZ1=6000 ppm Indol Butiric Acid+1000 ppm Pacobultrazol, IBA+PBZ2=6000 ppm Indol Butiric Acid+2000 ppm PaclobultrazoL, IBA+PBZ3=6000 ppm Indol Butiric Acid+3000 ppm Paclobultrazol. Harflendirmeler uygulamaları temsil etmektedir. Aynı satırda bulunan aynı harfler, uygulamalar arasında fark bulunmadığını göstermektedir ($p<0,05$).

Köklenme oranı ve kallus oluşum oranı:

Çalışmada, farklı büyüme düzenleyicilerin böğürtlen odun çeliklerine uygulanması sonucu ortaya çıkan köklenme ve kallus oluşum oranlarına ait veriler Çizelge 3'de verilmiştir. Verilerin istatiksel analizi sonucunda her iki parametre için uygulamalar arasında fark olduğu saptanmıştır. Köklenme oranı bakımından en yüksek değer IBA uygulamasından elde edilmiştir, bunu PBZ1 uygulaması takip etmiştir. En düşük değerler ise kontrol gurubu ile birlikte PBZ3, IBA+PBZ1 ve IBA+PBZ3 uygulamalarında ortaya çıkmıştır. PBZ2 ve IBA+PBZ2 uygulamaları ise kontrol grubu ile benzerlik göstermiştir. Kallus oluşum oranı bakımından en yüksek değerler PBZ1, PBZ2, PBZ3 ve IBA+PBZ1 uygulamalarından elde edilmiştir. En düşük değer ise IBA+PBZ2 uygulamasında tespit edilmiştir. Ayrıca kallus oluşumu ile köklenme oranı arasında bir bağlantı kurulamamıştır. Önceki çalışmalarda, Bueno ve ark., (2021) böğürtlenin köklenme performansı üzerine yaptıkları çalışmada 2000 ppm IBA + 400 ppm PBZ uygulaması sonucunda %36.67 köklenme elde ettiklerini bildirmiştir. Bu değer bizim bulduğumuz değerle uyuşmaktadır. Yapılan başka çalışmalarda, Karadeniz ve Şişman, (2004) 2000 ppm IBA uygulaması sonucunda %23.4 köklenme, Yıldız ve ark., (2009) ise 6000 ppm IBA uygulaması sonucunda %24 köklenme başarısı tespit ettiklerini rapor etmiştir. Bu sonuçlar elde ettiğimiz verilere kıyasla daha düşüktür. Roussos ve ark., (2020) yaptıkları çalışmada, 2000 ppm IBA uygulaması sonucunda %85 köklenme elde ettiklerini bildirmiş, Çekiç ve ark., (2013) ise mor dut çelikleri ile yaptıkları köklenme çalışmasında IBA+PBZ uygulaması sonucunda %79.6 değerine ulaştıklarını ifade etmiştir. Bulunan bu sonuçlar, bizim çalışmamıza göre daha yüksek çıkmıştır. Literatürde belirtilen bu farklılıklar; çelik alma zamanı, çelik dikim zamanı, uygulama dozları, yetiştirme ortamının ısısı ve kullanılan genotiplerin farklı olması gibi birçok nedenden kaynaklanmış olabilir.

Çizelge3. Farklı büyüme düzenleyici uygulamalarının böğürtlen odun çeliklerinde köklenme oranı ve kallus oluşturma oranına etkisi (%).



IBA=6000 ppm Indol Butiric Acid, PBZ1=1000 ppm Pacobultrazol, PBZ2=2000 ppm Paclobultrazol, PBZ3=3000 ppm Paclobultrazol, IBA+PBZ1=6000 ppm Indol Butiric Acid+1000 ppm Pacobultrazol, IBA+PBZ2=6000 ppm Indol Butiric Acid+2000 ppm PaclobultrazoL, IBA+PBZ3=6000 ppm Indol Butiric Acid+3000 ppm Paclobultrazol. Harflendirmeler uygulamaları temsil etmektedir. Aynı satırda bulunan aynı harfler, uygulamalar arasında fark bulunmadığını göstermektedir ($p<(0,05$).

Sonuç

Yapılan bu çalışmada Böğürtlen odun çeliklerine IBA ve PBZ uygulamaları yapılarak çeliklerin köklenme performansları incelenmiştir. Çalışma sonucunda, uygulamaların kök uzunluklarını artırmada kayda değer bir etkisi olmamıştır. Çeliklerin kök sayısı ve köklenme oranlarında en etkili uygulama 6000 ppm IBA (pozitif kontrol) uygulaması olmuştur. En yüksek kallus oluşumu PBZ1, PBZ2, PBZ3 ve IBA+PBZ1 uygulamalarında görülmüştür. Çalışmada, kallus oluşumu ile kök sayısı, kök çapı veya köklenme oranı arasında doğrudan bir ilişki kurulamamıştır. IBA'ya kıyasla PBZ, kök çaplarının artmasında daha etkili olmuştur. PBZ2 uygulaması sonucunda daha kalın kökler oluşmuştur ancak kök sayısı oluşturmada IBA kadar etkili olamamıştır. Sonuç olarak çalışmamızda IBA'nın çelik başına kök sayısını artırdığı, PBZ'nin ise kök çaplarını artırdığı tespit edilmiştir. Bu doğrultuda çalışmamız fidan canlılığının sağlanması için en uygun dozların belirlenmesine yönelik yapılacak olan çalışmalara kaynak oluşturmaktadır.

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Comparison of egg production and stress level of white and brown layer hens kept in different production systems

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Abstract

This study was performed to compare the egg production level and stress level of white and brown layer hen genotypes kept in conventional cage (CC) and free-range (FR) system. A total of 960 white (Atabey (AB) and Lohmann White (LW)) and brown (Atak-S (AS) and Lohmann Brown (LB)) layer hens (n=240 hens/genotype/production system) were used in the experiment. The experimental groups were assigned as four groups: 1- AS in FR system, 2- AB in FR system, 3- LW in CC, 4- LB in FR system. Production performance was determined as the mean of egg production, egg weight and efficiency of feed utilization between 64 and 72 weeks of age. Stress level was assessed by determination of heterophil/lymphocyte ratio (H/L) at 72 weeks of age. The mean of egg production was found as 69.4% in AS in FR, 76.9% in AB in FR, 71.6% LB in FR, and 77.5% in LW in CC ($P<0.01$). The mean of egg weight was changed between 64.0 g and 67.8 g among the experimental groups ($P<0.01$). More efficient of feed utilization was observed in LW in CC system (2.02, $P<0.01$). At 72 weeks of age, the H/L ratio was found to be highest in the LW in CC system than the other experimental groups (1.47, $P<0.01$). These findings concluded that the hens kept in CC had a higher egg production with an efficient of feed utilization but was more stressful compared to the FR production system.

Key Words: *Conventional cage, Free-range, Egg production, Feed efficiency, H/L ratio*

Farklı Üretim Sistemlerinde Yetiştirilen Beyaz ve Kahverengi Yumurtacı Tavukların Yumurta Verimi ve Stres Düzeylerinin Karşılaştırılması

Özet

Bu çalışma konvansiyonel kafes (KK) ve serbest dolaşımlı yetiştirme sisteminde (SD) yetiştirilen beyaz ve kahverengi genotipli yumurtacı tavukların yumurta verim seviyesi ve stres düzeylerinin karşılaştırılması amacıyla yürütülmüştür. Çalışmada beyaz (Atabey (AB) ve Lohmann Beyaz (LB)) ve kahverengi (Atak-S (AS) ve Lohmann Kahverengi (LK)) yumurtacı genotipler olmak üzere toplam 960 adet tavuk kullanılmıştır (n=240 tavuk/genotip/yetiştirme sistemi). Denemede dört farklı grup oluşturulmuştur: 1- AS genotipi SD sistemde, 2- AB genotipi SD sistemde, 3- LB genotipi KK sisteminde, 4- LK genotipi SD sistemde. Üretim performansının değerlendirilmesi için 64-72 haftalık yaş dönemi için ortalama yumurta verimi, yumurta ağırlığı ve yemden yararlanma oranı belirlenmiştir. Stres düzeyinin değerlendirilmesi için 72 haftalık yaşta heterofil/lenfosit oranı (H/L) belirlenmiştir. Ortalama yumurta verimi SD sistemde yetiştirilen AS genotipi için %69.4, SD sistemde yetiştirilen AB genotipi için %76.9, SD sistemde yetiştirilen LK genotipi için %71.6 ve KK sisteminde yetiştirilen LB genotipi için %77.5 olarak bulunmuştur ($P<0.01$). Ortalama yumurta ağırlığı deneme gruplarında 64.0 g ile 67.8 g değerleri arasında değişim göstermiştir ($P<0.01$). Yemden yararlanma oranının ise KK sisteminde yetiştirilen AB genotipi için daha düşük olduğu gözlenmiştir (2.02; $P<0.01$). 72 haftalık yaşta H/L oranı KK sisteminde yetiştirilen LB genotipli tavuklarda 1.47 değeri ile diğer deneme gruplarından daha yüksek olduğu tespit edilmiştir ($P<0.01$). Elde edilen bu bulgular, serbest dolaşımlı yetiştirme sistemi ile kıyaslandığında, konvansiyonel kafes sisteminde yetiştirilen tavukların yumurta veriminin daha yüksek olduğu ve yemi daha etkin şekilde kullanabildikleri, ancak stres seviyelerinin ise daha yüksek olduğunu göstermektedir.

Anahtar Kelimeler: *Konvansiyonel kafes, Serbest dolaşımlı yetiştirme sistemi, Yumurta verimi, Yemden yararlanma oranı, H/L oranı*

Giriş

Yumurta tavukçuluğu, Türkiye'de hayvansal üretim içerisinde önemli ve büyük bir paya sahip (2020 yılı 19.788.000.000 adet yumurta üretimi, Tepa, 2021), ülke ekonomisi ve tüketicilerin beslenmesine sağladığı katkı bakımından da oldukça aktif bir üretim faaliyetidir (Demircan ve ark., 2010). Son yıllarda hayvan refahı ile ilgili gelişmeler ve tüketicilerin sağlıklı ve güvenilir gıda tüketimi konusundaki taleplerin artışına bağlı olarak kanatlı üretiminde bazı değişiklikler ve yenilikler gündeme gelmiştir (Wojciechowska-Solis, 2021). Yaşanan bu gelişmelere paralel olarak, başta AB ülkeleri olmak üzere dünya genelinde yumurta tavukçuluğunda hayvan refahının dikkate alındığı alternatif yetiştirme sistemleri gündeme gelmiştir (Mutibvu ve ark., 2017).

Yumurta tavukçuluğunda konvansiyonel kafes sistemi yaygın şekilde kullanılmaktayken, entansif üretimde tavukların dar alanda barındırılması, yüksek stres ve düşük refah seviyesi gibi olumsuzluklardan dolayı (Campo ve ark., 2010), Avrupa Birliği Komisyonu konvansiyonel kafeslerde yumurta tavukçuluğunu 2012 yılında üye ülkelerde kullanımının yasaklanması kararını almıştır (EC/1999/74). Bu karara paralel olarak, serbest yetiştirme

sistemi ve organik üretim olmak üzere bazı alternatif sistemler geliştirilmiştir. Bu üretim sistemlerinde hayvanlara gezinti alanlarının sağlanması, otlatma imkanının verilmesi, doğal davranışların sergilenmesine olanak tanınması hayvan konforu ve refahının iyileştirmesine katkı sağlamaktadır (Ferrante ve ark., 2009).
Türkiye'de yumurta üretiminde farklı üretim sistemleri kullanılmakta olup, üretimin büyük bir kısmı kafes sistemi ile sağlanmaktadır. Mevcut veriler incelendiğinde, 2018 yılındaki yumurta üretiminin yaklaşık %78.3'lük kısmı konvansiyonel ve zenginleştirilmiş kafeslerde, diğer %21.7'lik kısmının ise serbest dolaşımlı yetiştirme sistemi ve organik yumurta tavukçuluğu olmak üzere diğer alternatif yetiştirme sistemlerinden sağlandığı görülmektedir (Tepa, 2021).
Bu çalışmanın amacı, konvansiyonel ve serbest yetiştirme sisteminde yetiştirilen farklı yumurtacı genotipleri (Atak-S, Atabey, Lohmann) yumurtlama performansı, yumurta ağırlığı ve stres indikatörü olarak kabul edilen H/L oranı bakımından karşılaştırmaktır.

Materyal ve Yöntem

Bu çalışma, Bursa Uludağ Üniversitesi Ziraat Fakültesi bünyesindeki hayvancılık işletmesinde bulunan kanatlı yetiştirme biriminde, dört farklı genotipli (beyaz yumurtacılar: Atabey (AB), Lohmann Beyaz (LB); kahverengi yumurtacılar: Atak-S (AS), Lohmann Kahverengi (LK)) toplam 960 adet yumurtacı tavuk kullanılarak, iki farklı yetiştirme sisteminde (konvansiyonel kafes (KK) ve serbest dolaşımlı yetiştirme sistemi (SD)) yürütülmüştür. Dört farklı deneme grubu oluşturulmuştur (n=240 tavuk/genotip/yetiştirme sistemi): 1- AS genotipi SD sistemde, 2- AB genotipi SD sistemde, 3- LB genotipi KK sisteminde, 4- LK genotipi SD sistemde. Çalışma 64-72 haftalık yaş döneminde sürdürülmüştür.
Konvansiyonel sistemde 3 katlı batarya tipi kafes sistemi kullanılmıştır. Serbest dolaşımlı yetiştirme sistemi ise kapalı barınak ve açık gezinti (otlatma) alanı olmak üzere iki kısımdan oluşmaktadır. Yetiştirme standartları ve çevresel koşullar bakımından çalışmada kullanılan genotip için önerilen bakım ve besleme standartları uygulanmıştır. Denemede yumurtacı tavuklar 2800 kcal/kg ME, %16.5 ham protein, %4.00 Ca ve % 0.37 yararlanılabilir P içeren II. dönem ticari yumurta yemi ile beslenmiş olup, çalışma boyunca yem ve su *ad libitum* düzeyde sağlanmıştır. Aydınlatma süresi olarak günlük 16 saat aydınlık:8 saat karanlık programı uygulanmıştır. Araştırma dönemi boyunca çevre sıcaklık ve nem değerleri minimum-maksimum değerleri ölçen termometre ve higrometre kullanılarak günlük olarak (kümes içi ve gezinti alanı) kaydedilmiştir. Serbest dolaşımlı yetiştirme sisteminde otlatma alanı İngiliz çimi (*Lolium perenne*, %60), yonca (*Medicago sativa*, %30) ve ak üçgül (*Trifolium repens*, %10) bitkileri kullanılarak oluşturulmuştur. Konvansiyonel kafes sistemi ve serbest dolaşımlı yetiştirme sistemlerinde tavuklara sağlanan kümes ve barındırma koşulları Tablo 1'de verilmiştir.

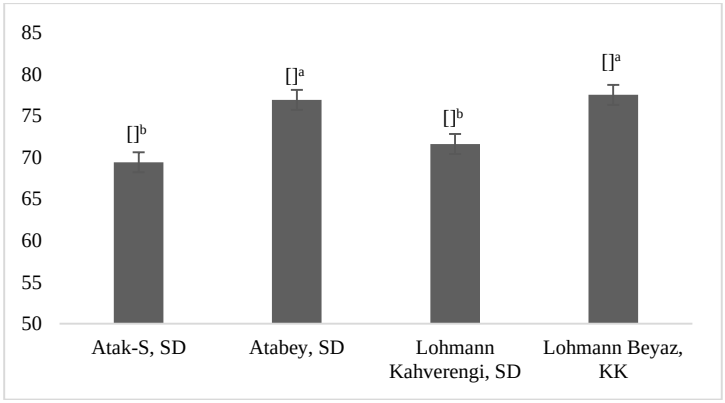
Kümes ve barındırma koşulları	Konvansiyonel kafes sistemi	Serbest dolaşımlı yetiştirme sistemi (kapalı alan)	Serbest dolaşımlı yetiştirme sistemi (gezinti alanı)
Barındırma yoğunluğu	562.5 cm^2/tavuk	3.33 tavuk/m^2	5 tavuk/m^2
Yumurta kanalı	Var	-	-
Tünek	-	18 cm tünek alanı/tavuk	-
Folluk	-	3.5 tavuk/folluk	-
Eşelenme alanı	-	Var	Var

Çalışmada üretim performansının değerlendirilmesi için, 64-72 haftalık yaş dönemi için ortalama yumurta verimi, yumurta ağırlığı ve yem dönüşüm oranı belirlenmiştir. Yumurta veriminin belirlenmesi içi, yumurta toplama işlemi günlük olarak ve her gün aynı saatte olacak şekilde kayıt altına alınmıştır. Elde edilen veriler kullanılarak ortalama yumurta verimi (tavuk/gün, %) belirlenmiştir. Ortalama yumurta ağırlığının belirlenmesi için, deneme gruplarına ait günlük olarak toplanan yumurtalar, haftanın hep aynı günü olmak üzere haftalık olarak teker teker ±0.1 g hassasiyetle tartılarak belirlenmiştir. Her haftaya ait ortalama yumurta ağırlığı kullanılarak, deneme grubu bazında 64-72 haftalık ortalama yumurta ağırlığı hesaplanmıştır. Yem dönüşüm oranının belirlenebilmesi için deneme gruplarına verilen yem günlük olarak kayıt alına alınmış ve haftalık yem tüketim değerleri belirlenmiştir. Yem dönüşüm oranının hesaplanması için tüketilen yem miktarı yumurta kitle ağırlığına bölünmüştür.
Stres düzeyinin değerlendirilmesi için 72 haftalık yaşta heterofil/lenfosit oranı (H/L) belirlenmiştir. Bu amaçla, her deneme grubundan rastgele seçilen 5 adet tavuktan kan alınmış, alınan kan örneklerinden her bir lama bir damla kan damlatılarak epiferik yayma işlemi ile frotiler hazırlanmıştır. Frotilerin açık havada kurutulmasından sonra May-Grünwald ve Giemsa yöntemleri ile boyanmıştır (Gross ve Siegel 1983). Hazırlanan bu preperatlar dijital kameralı mikroskop (Leica, DM-500, İsviçre) ile incelenmiştir. Mikroskobik incelemede her bir preperat ×100 'lük objektif ile hücre sayımı işlemine tabi tutulmuştur. Sayım işlemi her bir preperat üzerinde lenfosit, nötrofil, monosit, heterofil, özonofil olmak üzere toplam 100 adet lökosit tamamlanana kadar devam etmiştir. Elde edilen heterofil ve lenfosit değerleri kullanılarak heterofil lenfosit oranı belirlenmiştir.
Denemede elde edilen verilerin gruplar arasındaki istatistiksel önemli farklılıklar genel varyans analizi ile Minitab 16 paket programı kullanılarak belirlenmiştir. Denemede elde edilen yüzde değerler açı transfarmosyonu (arc-sin) uygulandıktan sonra varyans analizi yapılmıştır. Deneme gruplarının ortalamaları arasındaki farklılıkların

karşılaştırılması için Tukey testi uygulanmıştır. Verilerin istatistiksel analizleri *P<0.01* olasılık düzeyinde yapılmıştır.

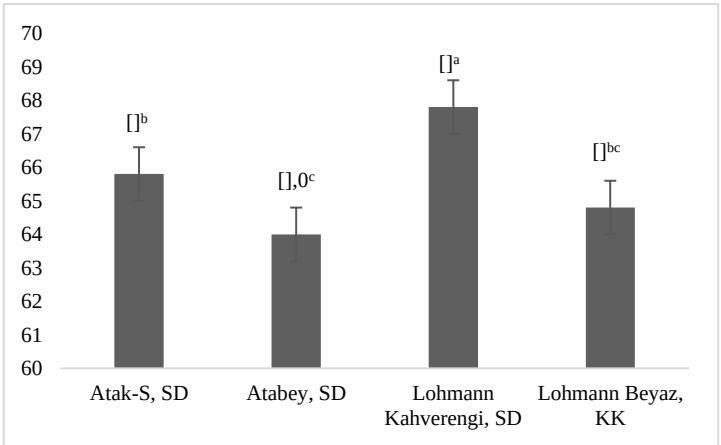
Bulgular ve Tartışma

Çalışmada, farklı genotipli tavukların konvansiyonel sistem ve serbest dolaşımlı yetiştirme sistemlerinde 64-72 haftalık yaş dönemleri arasındaki yumurta verimi Şekil 1'de gösterilmiştir. Çalışma sonucunda elde edilen veriler kıyaslandığında, en yüksek yumurta verimi konvansiyonel kafes sisteminde yetiştirilen Lohmann Beyaz genotipli yumurtacı tavuklarda (%77.5), en düşük yumurta verimi ise serbest dolaşımlı yetiştirme sisteminde Atak-S genotipli kahverengi yumurtacı tavuklarda (%69.4) gözlenmiştir (P<0.01). Konvansiyonel kafes sisteminde yumurta veriminin diğer gruplardan daha yüksek olması, yetiştirme sistemleri arasında tavuklara sağlanan çevresel koşullardan kaynaklanması muhtemeldir (Meng ve ark., 2015). Nitekim, serbest dolaşımlı yetiştirme sisteminde tavukların gezinti alanında daha fazla enerji harcaması yumurta veriminin konvansiyonel sisteme göre daha düşük olmasına neden olmuş olabilir. Ayrıca, çalışmada farklı genotiplerin kullanılması da bu farklılığa neden olduğu daha önce yapılan çalışmalarda açık bir şekilde ortaya konmuştur (Rakonjac ve ark., 2021; Sozcu ve ark., 2021).



Şekil 1. Deneme gruplarının yumurta verimi bakımından karşılaştırılması (P<0.01)

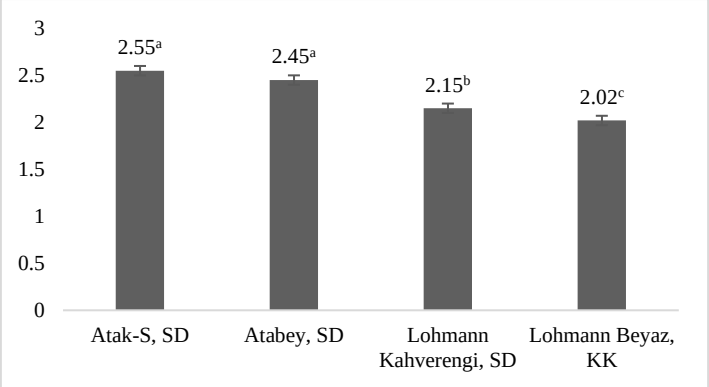
Çalışmada, farklı genotipli tavukların konvansiyonel sistem ve serbest dolaşımlı yetiştirme sistemlerinde 64-72 haftalık yaş dönemleri arasındaki ortalama yumurta ağırlığı Şekil 2'de gösterilmiştir. Yetiştirme sisteminin ortalama yumurta ağırlığı üzerine etkileri hakkında farklı literatür bildirişleri bulunmaktadır. Hidalgo ve ark. (2008) serbest yetiştirme sisteminden elde edilen yumurtaların konvansiyonel kafes sisteminden elde edilen yumurtalardan daha ağır oluğunu ifade etmiştir. Diğer yandan, serbest dolaşımlı yetiştirme sistemi ve organik üretim sisteminde yumurta ağırlığının daha düşük olduğunu bildiren araştırmalar da bulunmaktadır (Minelli ve ark., 2007; Krawczyk, 2009). Mevcut bulgular incelendiğinde hem yetiştirme sisteminin hem de genotipin yumurta ağırlığı üzerine etkili faktörler olduğu açıkça görülmektedir.



Şekil 2. Deneme gruplarının yumurta ağırlığı bakımından karşılaştırılması (P<0.01)

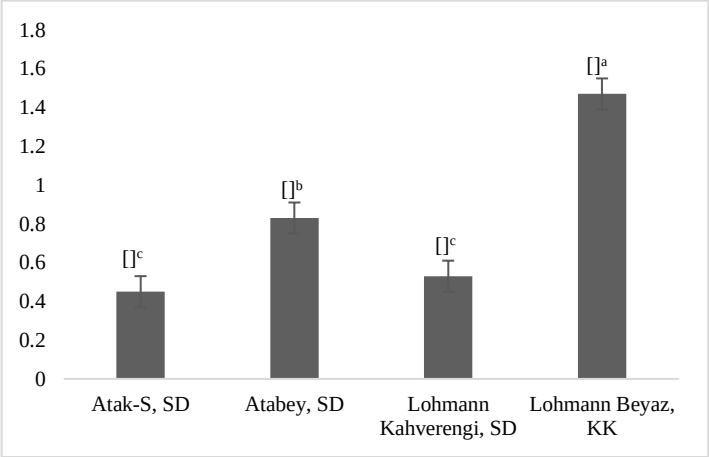
Çalışmada, farklı genotipli tavukların konvansiyonel sistem ve serbest dolaşımlı yetiştirme sistemlerinde 64-72 haftalık yaş dönemleri arasındaki ortalama yemden yararlanma oranları Şekil 3'te gösterilmiştir. En etkin yem dönüşüm oranının konvansiyonel kafes sisteminde yetiştirilen Lohmann Beyaz genotipli yumurtacı tavuklarda elde edildiği gözlenmektedir. Rakonjac ve ark. (2021) yapmış oldukları çalışmanın sonucunda, kafeste ve organik

üretim sisteminde yetiştirilen Lohmann LSL Beyaz yumurtacı tavuklar için yem dönüşüm oranını sırasıyla 1.87 ve 2.65, ATAK-S kahverengi yumurtacı genotip için ise sırasıyla 2.32 ve 2.43 olarak bulduklarını ifade etmiştir.



Şekil 3. Deneme gruplarının yemden yararlanma oranı bakımından karşılaştırılması (P<0.01)

Çalışmada, farklı genotipli tavukların konvansiyonel sistem ve serbest dolaşımlı yetiştirme sistemlerinde 72 haftalık yaşta H/L oranı değerleri Şekil 4'te gösterilmiştir. Konvansiyonel kafes sisteminde yetiştirilen Lohmann Beyaz genotipli yumurtacı tavuklarda bu değerin diğer deneme gruplarındakine göre daha yüksek olduğu gözlenmiştir (P<0.01). Belirli çevre koşulları altında tavukların stres faktörlerine maruz kalması sonucunda, bazı kan değerlerinde değişimler meydana gelmekte olup, H/L oranı bu değerler arasında yer almakta ve stres indikatörü olarak kabul edilmektedir. Yumurtacı tavuklarda stres düzeyinin artmasıyla beraber H/L oranında artış meydana gelmektedir (Davis ve ark., 2008). Mevcut çalışma bulguları ile Shini (2003) tarafından bildirilen bulgular benzerlik göstermektedir.



Şekil 4. Deneme gruplarının H/L oranı bakımından karşılaştırılması (P<0.01)

Elde edilen bulgular incelendiğinde, farklı genotiplerin farklı yetiştirme sistemlerindeki yumurta verimi ve stres seviyeleri değişkenlik göstermektedir. Bu nedenle, farklı çevre koşulları altında özellikle alternatif yetiştirme sistemlerinde yumurtacı tavukların verimliliğinin ve refah seviyelerinin değerlendirilmesi pratik açıdan önem taşımaktadır.

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ID: 717

Smart Agriculture Stages in the World

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Abstract
Global climate change, regional economic and political crises, and problems experienced just outside our borders have a significant impact on agriculture and food markets. In order to increase agricultural productivity, techniques are sought for soil and product management, more economical use of resources and minimizing damage to the environment. It is aimed to give up the classical production and to implement an application form that handles the land with a non-homogeneous variable approach. Turkey is one of the most important agricultural countries of the world. In this new era, we call the age of smart life, which has the potential to become an important player in national and global markets with its sensitive and smart agriculture applications supported by new electronic-based technologies. New technologies such as the Internet of Objects, Artificial Intelligence, and Big Data appear as basic technologies for "Smart Agriculture" in parallel with all sectors. It is aimed to increase productivity, quality and added value in agriculture with smart technologies. With Agriculture 4.0, a significant competitive advantage will be achieved by working less but smarter, obtaining more and quality products with less resources. In this process, Turkey has to maximize the development and use of technology in the agricultural production system and create a structure that can compete in the international arena.
Smart agriculture technologies are mainly developed to ensure sustainability. Smart agriculture technologies are needed for our farmers to maintain their profitability and for the optimization of all our agricultural inputs. In order to develop these technologies for a sustainable agriculture in Turkey, we must produce the right strategies and policies.
Key words: *agriculture 4.0, precision agriculture, smart agriculture, sustainability, yield,*

Dünya'da Akıllı Tarım Aşamaları

Özet
Küresel iklim değişikliği, bölgesel ekonomik ve siyasi krizler ile sınırlarımızın hemen dışında yaşanan sorunlar tarım ve gıda piyasalarını önemli ölçüde etkilemektedir. Tarımsal verimliliği artırmak için toprak ve ürün yönetimini, kaynakların daha ekonomik kullanımını ve çevreye verilen zararın en aza indirilmesini sağlayan tekniklerin arayışına gidilmektedir. Klasik üretimden vazgeçilerek, araziyi homojen olmayan değişken bir yaklaşımla ele alan bir uygulama biçiminin hayata geçirilmesi hedeflenmektedir. Türkiye dünyanın en önemli tarım ülkelerinden birisidir. Akıllı yaşam çağı olarak adlandırdığımız bu yeni dönemde elektronik temelli yeni teknolojilerle desteklenen hassas ve akıllı tarım uygulamaları ile ulusal ve küresel pazarlarda önemli bir oyuncu olma potansiyeline sahiptir. Nesnelerin İnterneti, Yapay Zekâ, Büyük Veri gibi yeni teknolojilerin tüm sektörlere paralel olarak "Akıllı Tarım" için de temel teknolojiler olarak karşımıza çıkmaktadır. Akıllı teknolojiler ile tarımda verimlilik, kalite ve katma değeri artırma hedeflenmektedir. Tarım 4.0 ile daha az ama daha akıllı çalışarak, az kaynakla daha fazla ve kaliteli ürün elde ederek önemli rekabet avantajı yakalanabilecektir. Türkiye bu süreçte, tarımsal üretim sisteminde teknoloji geliştirmeyi ve kullanımını üst düzeye çıkarıp, uluslararası alanda rekabet edebilecek bir yapıyı oluşturmak durumundadır.
Akıllı tarım teknolojileri temel olarak sürdürülebilirliği sağlamak amacıyla geliştirilmektedir. Çiftçimizin karlılığını sürdürebilmesi için, tüm tarım girdilerimizin optimizasyonu için, akıllı tarım teknolojilerine gereksinim vardır. Türkiye'de sürdürülebilir bir tarım için bu teknolojileri geliştirebilmek için doğru strateji ve politikaları üretmeliyiz.
Anahtar Kelimeler: *akıllı tarım, hassas tarım, sürdürülebilirlik, tarım 4.0, verim*

Giriş

Dünya nüfusunun 2030 yılında 8,6 milyar, 2050 yılında yaklaşık 10 milyar ve 2100 yılında 11,2 milyar olacağı tahmin edilmektedir (Anonim, 2020a). Bu tahminler doğrultusunda küresel gıda talebinde %70' lik bir artış olacağı bildirilmektedir (Güzey vd., 2020; Rehman vd., 2022). FAO'nun değerlendirmelerine göre, insan nüfusunun %60'ından fazlası tarıma bağımlıdır ve toplam arazi alanının yaklaşık %12'si tarımsal üretim altındadır (Mistry vd., 2022). Tarih boyunca medeniyetlerin gelişimine katkı sağlayan tarım sektörü, dünyanın en büyük besin kaynağıdır. Ayrıca 2020 yılından itibaren tüm dünyayı etkisi altına alan Koronavirüs salgını ile yaşam döngüsünde tarımın ne kadar önemli bir rol oynadığı daha net ortaya çıkmıştır. Dünya nüfusundaki artışın yanı sıra kentleşmenin artması da gıda talebine olan ihtiyacı artırmaktadır. Toprak erozyonu, ormansızlaşma, yanlış kullanım, aşırı otlatma, yanlış ekim nöbeti, dengesiz gübre kullanımı gibi nedenlerle tarım alanlarının giderek

azalmakta olduğu belirtilmektedir (Kılavuz ve Erdem, 2019). Küresel ısınma sonucu iklim değişiklikleri, tarım arazilerinin ve doğal kaynakların azalması, sürekli değişen piyasa gereksinimleri, tarım sisteminin değiştirilmesi gerektiğini göstermektedir. Sürdürülebilir tarım ilkelerini gerçekleştirmek için teknoloji, araştırma ve geliştirme mümkün olan en geniş ölçüde kullanılmalıdır (Friha vd., 2021). Mevcut sorunlar ve gelecekte ortaya çıkabilecek sorunların çözümü, tarım sektörünün gelişmesini ve modernleşmesini zorunlu hale getirmiştir (Rehman vd., 2022). Geleneksel tarım yöntemlerinin yetersiz kaldığı günümüzde, verimliliği artıran ve maliyetleri düşüren Tarım 4.0 (akıllı tarım) uygulamalarına odaklanmak gerekmektedir (Kılavuz ve Erdem, 2019). Modern toplumlarda yenilikler, tarımsal kalkınmanın ön koşulu olarak kabul edilmektedir. Yeni değerler üretmenin bir yolu olarak tanımlayabileceğimiz inovasyon, yaşam süreci boyunca her alanda olduğu gibi tarım sektöründe de varlığını sürdürmektedir. Tarımda sürdürülebilir yenilikleri gerçekleştirirken çevre üzerindeki olumsuz etkileri azaltmak veya önlemek, ekonomik ve sosyal çıkarlar dengesini gözetmek önceliklidir (Şenol, 2021). Bu doğrultuda tarlalarda bitki ekimi, ürün hasadı, ilaçlama, sulama, toprak, bitki ve hayvan sağlığı, sıcaklık izleme, gübreleme, yabancı ot kontrolü ve rutin tekrarlı çalışmalar kapsamında birçok faaliyette sensörler, uçan gözler (drone) kullanılmaktadır. Akıllı tarım kapsamında (tarım 4.0) nesnelerin interneti (IoT) teknolojisi ve robotlar gibi uygulamalar kullanılmaya başlanmıştır (Baran ve Karaçuha, 2021).

1.Tarımda Dijital Dönüşüm Aşamaları

İnsanoğlu 150 bin yıllık dünya serüvenini yaklaşık 140.000 yıllık yaşam biçiminde büyük bir değişiklik olmadan atlatmıştır. Göçebe bir hayat sürerken, avcılık ve toplayıcılık ile karşılandıkları yerde yiyecekleri biterse yiyecek bulabilecekleri başka bir yere göç etmişlerdir. Doğanın döngüsü ile uyum içinde olan insan yaşamı, yaklaşık 12 bin yıl önce (M.Ö. 9500) kalıcı bir dönüşüm geçirmiştir. Yerleşik hayata geçişle birlikte toprağın sunduğu imkanlar kullanılarak üretime yani tarıma geçilmiştir (Pakdemirli vd., 2021). Tarımda sürdürülebilirlik en önemli konudur ve sürdürülebilirliği sağlamanın yolu da tarım sektöründe yenilikleri hayata geçirmekten geçmektedir. Dijital tarımda gelinen durum bir anda gerçekleşen bir süreç değildir. Sanayi devriminin evrelerinde olduğu gibi "Tarım 4.0" da yıllarca süregelen bir gelişim evresi yaşamıştır (Kılavuz ve Erdem, 2019; Güzey vd., 2020). Bu dönüşüm sürecinin bir sonraki basamağının "Toplum 5.0" veya "süper akıllı toplum" olduğu belirtilmektedir. Tarım 4.0 üzerine kurulu insan odaklı bir yaklaşımı hedefleyen bilgi toplumu türü olarak tanımlanmaktadır.

Bu aşamalar;

Tarım 1.0 Hayvan gücü ve mekanizasyonun birlikte kullanımı

Tarım 2.0 Tarımda motor ve traktörlerin kullanılmaya başlanması

Tarım 3.0 Yönlendirme sistemleri ve hassas tarım uygulamalarına geçilmesi

Tarım 4.0 Biyoloji ve teknolojinin birleşmesi

Tarım 5.0 Robotik ve yapay zekâ, olarak belirtilmektedir (Güzey vd., 2020; Saracel ve Aksoy, 2020)

Tarımın gelişim evrelerini detaylı ele almak, tarım devriminin uzun bir süreç olduğunu anlamakta daha etkin olacaktır.

1.1. Tarım 1.0

İnsan ve hayvan gücünün ön plana çıktığı geleneksel tarım çağı olarak tanımlanmaktadır (Friha vd., 2021). Yoğun tarımsal üretimin baskın olduğu, üretimin ve verimliliğin düşük olduğu, tarımın doğa ve iklim koşullarına bağlı olduğu bir dönem olarak bildirilmektedir. Yeni makinelerin tanıtıldığı, tarım için yeni ticari yaklaşımların oluşturulduğu, ekili alanların genişletildiği, tarım bilimi ve mühendisliğinin olgunluğa ulaştığı bir aşama olarak tanımlanmaktadır (Yaman vd., 2021). Tarım 1.0, insan gücü dönemi olarak adlandırılmakta ve bu dönemde "Ne kadar çok kişi iseniz, o kadar güçlüsünüz" ifadesi kullanılmaktadır (Pakdemirli vd., 2021).

1.2. Tarım 2.0

"Yeşil Devrim" olarak bilinen bu evre 1950'li yılların sonlarında başlamıştır. Azot takviyesi, sentetik pestisitler, gübreler ve tarımsal uygulamalarda gelişmiş makinelerin kullanımı, verim potansiyelini ve getirilerini büyük ölçüde artırmıştır. Küçük aile çiftliklerinin yerini büyük işletmelerin almaya başladığı, hibrit tohumların geliştirildiği ve modern sulama sistemlerinin ilk örneklerinin kullanılmaya başlanmasının bu dönemde olduğu belirtilmektedir. Bu süreçte ilk kez 1960'lı yıllarda şarap hasat makineleri kullanılmış ve 1982'de ilk genetiği değiştirilmiş bitkiler dikilmiştir. İçten yanmalı motorun kullanımı bu aşamanın belirleyici unsuru olarak kabul edilmektedir (Yaman ve ark., 2021). Ticaretle yetiştirilen bitkilerin taşınması, üçlü ve dörtlü münavebe sisteminin kullanılması bu döneme rastlamaktadır. Tarım 2.0 dönemi, arazi gücü dönemi olarak tanımlanmakta ve "Ne kadar araziniz varsa, o kadar güçlüsünüz" ifadeleri kullanılmaktadır (Pakdemirli vd., 2021).

1.3. Tarım 3.0 (Hassas Tarım)

Önceki dönemlerden farklı olarak, yüksek üretkenlik, verimlilik ve sürdürülebilirlik taleplerini etkin bir şekilde birleştiren, dijitalleşme, yeni biyoloji ve çeşitli mühendislik disiplinleri arasındaki artan yakınlaşmadan üretken stratejilerin temeli olarak yararlanan Tarım 3.0'ın temel bileşenlerinden bilgi, makinenin yerini almaktadır. Fiziksel çalışmadan çok düşünsel çalışma, neyin üretildiğinden çok nasıl üretildiği ön plana çıkmaktadır. Hassas tarım olarak tanımlanan bu aşama, askeri GPS sinyallerinin halka tanıtılmasıyla başlamıştır. Bu dönemde biçerdöverlere, verim takibi sağlayan sistem ve ekranların yerleştirildiği, tarımsal veri işlemeye olanak sağlayan bilgisayar programlarının ortaya çıktığı belirtilmektedir (Yaman vd., 2021). Tarım 3.0'ın en önemli özelliğinin tohum

ıslahına başlanması, sulama imkân ve kabiliyetlerinin gelişmesi, üretimde gübre, aşı, zirai ilaç ve makine kullanımı olduğu belirtilmiştir. Tarım 3.0 döneminde "Ne kadar çok makine ve girdiniz varsa o kadar güçlüsünüz" ifadeleri kullanılmaktadır (Pakdemirli vd., 2021).

1.4. Tarım 4.0 (Akıllı Tarım)

Sanayi 4.0 ile sanayide yaşanan devrime benzer şekilde tarım sektöründe de yaşanmaya başlanmıştır. Bu süreç "Tarım 4.0, Akıllı Tarım, Dijital Tarım", E-Tarım olarak adlandırılmakta ve genel olarak sensörler, algılayıcılar, mikro işlemciler, otonom karar sistemleri, bulut tabanlı bilgi ve iletişim teknolojileri gibi akıllı teknolojilerin tarım sektöründe uygulanmasını ifade etmektedir. İnternet tabanlı portallar ve çeşitli algoritmalar sayesinde büyük verilerin depolanması, analiz edilmesi, tarladan sofraya kadar tüm sürecin takip edilmesi ile geleceğe yönelik tahminler yapmanın mümkün olduğu bildirilmektedir. Tarım 4.0 uygulamaları, tarım sektörünün daha verimli, rekabetçi, çevre dostu ve sürdürülebilir olması için önemli ve etkili araçlar oluşturmaktadır. Tarım 4.0'da kullanılan teknolojiler; Tedarikçiler, üreticiler, aracılar ve teknoloji sağlayıcılar yani tarım sektöründe çalışan farklı aktörlerin faaliyetlerini kapsamaktadır. Nesnelerin interneti, büyük veri ve akıllı algoritmalar ile tüm bu aktörlerin faaliyetleri bir araya getirilebilir (Anonim, 2020a). Akıllı tarım yöntemleri, daha az girdi (su, enerji, gübre, zirai ilaçlar) kullanarak tarımsal üretimin niceliğini ve kalitesini artırmayı amaçlamaktadır. Akıllı tarım yöntemleri esas olarak yeni sensör teknolojileri olan uyduya dayanmaktadır (Güzey, 2020). Akıllı tarım, kaynakları daha verimli kullanan ve hassas bir yaklaşıma dayalı olarak daha verimli ve sürdürülebilir tarımsal üretim sağlama, üreticiye daha iyi karar verme veya daha verimli ticari faaliyetler ve yönetim şeklinde katma değer sağlama potansiyeline sahiptir. Bu açıdan akıllı tarım, birbirine bağlı yönetim bilgi sistemleri, hassas tarım ve tarımsal otomasyon-robot olmak üzere üç teknoloji alanıyla güçlü bir şekilde bağlantılı olduğu bildirilmektedir (Duman, 2019).

1.5. Tarım 5.0

Tarım 5.0 aşamasının tamamen robotik uygulamalar, araçlar ve yapay zekâ etrafında şekilleneceği tahmin edilmektedir (Yaman vd., 2021). Hassas tarım ve otonom karar destek sistemleri ilkelerini takip ederek, insan gücü olmayan üreticilerin eylemlerini içermektedir (Zambon vd., 2019). Genel olarak, üreticilerin mahsulleri hasat etmesi ve mahsullerin verimli olması için gerekli kültürel süreçleri uygulaması için birçok işçiye ihtiyaç vardır. Ancak toplumda kentleşme giderek artmakta ve tarımla ilgilenen insan sayısı azalmaktadır. İşçi sıkıntısına yardımcı olacak çözümün ise yapay zekâ özelliklerini entegre eden tarım robotları olduğu belirtilmektedir. Tarım robotlarının ortaya çıkmasıyla birlikte birçok ülkede verimliliğin arttığı ve maliyetlerin düştüğü gözlemlenmektedir. Bu teknolojinin dezavantajının küçük ölçekli çiftçilerde daha belirgin olduğu ve bunun sebebinin teknolojinin maliyeti olduğu bildirilmektedir (Saiz-Rubio ve Rovira-Más, 2020).

2. Akıllı Tarım Çağı

2011 yılında Almanya'nın bilişim teknolojileri ile sanayinin bir araya geleceği, entegre bilgisayar sistemleri ile maksimum verimle üretimin yapılacağı ve yapay zekanın ön plana çıkacağı bir sanayi devrimine gireceği açıklanmıştır. Tarım sektörü ile bilgisayar sistemlerinin entegre olmasının büyük önem taşıdığı bildirilmiştir. Bu evre, tarım sektörünün tüm değer zinciri basamaklarının birbiri ile gerçek zamanlı ve sürekli bağlantı halinde olacağını ifade etmektedir (Saygılı vd., 2018). Toprak ve ürün yönetiminin tarımsal verimliliği artırmasını, kaynakların daha ekonomik kullanımını ve çevreye verilen zararı en aza indirmesini sağlayan bir teknik, "Tarım 4.0", "Akıllı Tarım", "Dijital Tarım" olarak tanımlanmaktadır. Güvenli ve sağlıklı gıdaya erişim sağlamaktadır, bilgi paylaşımını ve karar verme süreçlerini hızlandırmaktadır. Akıllı tarım ile geleneksel üretimin terk edilmesi ve homojen olmayan arazinin değişken koşullarına uygun tarımsal faaliyetlerin uygulanması amaçlanmaktadır. Akıllı tarım teknikleri, toprak işlemeden hasada kadar bitkisel üretimin hemen her evresinde kullanılabilmektedir (Koç vd, 2020). Tarım 4.0 uygulamaları, tarım makineleri ve sahaları sensörlerle donatılarak ve birbirleri ile haberleşerek yapılmakta olup, modern teknolojilerin kullanımı ile verim ve kalitenin artırılması hedeflenmektedir. Akıllı sistemler ile tarımsal üretim için çok önemli olan iklim koşulları, toprak durumu, bitkilerin mineralleri, sulama ve hasat süreleri gibi faktörler hızlı ve eş zamanlı olarak üreticilerin bilgisine sunulmakta ve kaynakların verimli kullanılması sağlanmaktadır. Teknolojiye dayalı bu uygulamalar ile yüksek kaliteli ve besin değeri yüksek ürünler üretilerek üretim maliyetleri önemli ölçüde düşürülebilmekte ve ülkelerin uluslararası rekabet gücü artırılmaktadır.

Sonuç olarak, nesnelerin interneti (IOT) olarak adlandırdığımız makinelerin birbirleriyle senkronizasyon halinde olması, bilgi ve iletişim teknolojileri (BİT) tarım sektöründeki teknolojik uygulamaların temel yapısını oluşturmakta ve bunlara bağlı olarak büyük veri analizi ve akıllı algoritmalar ile verimlilik ve kalite artışı sağlanabilmektedir (Saygılı vd., 2018).

3. Akıllı Tarım Bileşenleri

Akıllı Tarım bileşenlerinin kullanımı, maliyetleri düşürürken faydaları artırmaktadır ve çiftçilerin çevresel zorlukların üstesinden gelmesine ve daha sürdürülebilir tarım geliştirirken artan nüfusun besin ihtiyacını karşılamak için gıda üretimini sürdürmelerine yardımcı olabilecek çözümler sunmaktadır. En etkili çözüm, sorunun tespiti ve uygulama hatalarına karşı önleyici, zamanında ve doğru müdahalelerin yapılmasıdır. Çözüm sürecini kolaylaştırmak ve kısaltmak için Akıllı Tarım araçlarından destek alınmaktadır.

3.1. Nesnelerin İnterneti (Nİ, IoT)

Fiziksel olarak tanımlanmış nesnelerin birbirleriyle veya daha büyük sistemlerle bağlantı halinde olduğu iletişim ağıdır. İnsan müdahalesi olmadan internet üzerinden gerçekleşen bir iletişim sistemidir. IoT teknolojisi enerji sistemleri, iletişim, lojistik, tarım, sağlık ve sanayi gibi birçok alanda kullanılmaktadır (Bıçakçı, 2019). Söz konusu IoT teknolojisi ile çiftçiler bir telefon veya tablet ile arazilerini uzaktan kontrol edebilmektedirler. Bu teknoloji ile tarım arazilerine ne tür tohumların ekileceğinden, ihtiyacı olan gübre miktarına, değişen iklim koşullarının izlenmesine kadar birçok konunun izlenmesine olanak sağlayan düzeneklerden oluşmaktadır (Ercan vd., 2019). Nesnelerin İnterneti (IoT) teknolojisi çiftlik yönetim sistemine başarıyla uygulandığında, yüksek verim kalitesinde hasat elde etmek için tarımsal çevre kontrolünden ürün gelişme evresine kadar bilgilerin doğru bir şekilde izlenmesine yardımcı olmaktadır (Duman ve Özsoy., 2019). Nesnelerin interneti teknolojisinin kullanıldığı akıllı tarım sayesinde çiftçinin tarım işi kolaylaşmakta ve aynı zamanda uygulanan politika ile üretilen ürünlerin verim ve kalite değerleri artmaktadır. Akıllı tarım uygulamaları sayesinde çiftçiler, tablet veya telefon kullanarak tarlalarını uzaktan kontrol edebilmekte, mobil uygulamalarla sulama, nem, sıcaklık gibi birçok işlemi izleyebilmektedirler.

Nesnelerin İnterneti 5 katmandan oluşmaktadır;

- Algılama Katmanı
-Ağ Katmanı
-Orta Katman
-Uygulama Katmanı
-İş Katmanı

Çeşitli sensörler (toprak PH, sıcaklık, nem, ışık yoğunluğu vb.) farklı parametrelerin ölçümü için ürün alanına yerleştirmektedir. Her bir aygıt tanımlama amaçlı atanan IP (Internet Protocol) adresi ile ağda yer almaktadır. Sensörler ile ürün alanından toplanan veriler, kablosuz veya diğer yöntemlerle internete bağlı ağ geçidi kullanılarak buluta (cloud) gönderilmektedir. Bulut ortamındaki veriler analiz edilerek veya doğrudan çiftçilerin akıllı telefonlarına veya bilgisayarlarına iletilmektedir. Bu durum çiftçilerin doğru kararlar almasında etkin bir rol oynamaktadır. Akıllı tarımda kullanılan uygulamalardan bazıları tarım arazilerinin takibi ve otomatik olarak sulanmasıdır. Akıllı sulama sistemleri, toprağın ihtiyacı olduğu noktaya tam ihtiyacı olduğu kadar su verebilmektedir. Sistemde bir su sızıntısı olması durumunda bunu üreticiye bildirebilmektedir. Sulamanın bu şekilde amaca odaklı verimli kullanımı, toprağın kalitesinin ve küresel ısınmanın tehdidi altındaki bölgelerde su kaybını önleyip mevcut rezervlerinin korunmasını sağlamaktadır (Rajalakshmi ve Mahalakshm., 2016; Mohanraj vd., 2016). Araştırmacıların çalışmaları sonucunda, sahaya özgü hassas gerçek zamanlı tarla izleme, değişken oranlı sulama ile minimum su kullanarak verimliliği en üst seviyeye çıkarmak için sulama sisteminin kontrolünü amaçlayan dağıtılmış kablosuz sensör ağı kullanan bir uzaktan algılama ve kontrollü sulama sistemi geliştirmişlerdir (Kim vd., 2008). Başka bir çalışmada depoda sıcaklık bakımı, nem bakımı ve hırsızlık tespiti dahil akıllı depo yönetimi geliştirilmiştir (Gondchawar ve Kawitkar., 2016). Önerilen bir bitki sulama sisteminde, toprak nem sensörü ile topraktaki nem seviyesi kontrol edilerek, nem seviyesi düşükse bitkiye su sağlamak için bir su pompası çalıştırılmaktadır. Sistem toprakta yeterli nem bulduğunda su pompası otomatik olarak kapanacaktır. Sistem pompayı her açtığında veya kapattığında, su pompasını ve toprak nemi durumunu günceller ve IOT modülü aracılığıyla kullanıcıya bir mesaj göndermektedir (Rajakumar vd., 2018). Başka bir çalışmada mikrodenetleyiciye senkronize olan ESP8266 wi-fi modülü şeklinde bir IOT ağı üzerinden internete verilerin aktarıldığı bir çalışma önermişlerdir. Sistem, kontrolöre verilen bilgilere göre su pompasının açılıp-kapatılması, LDR ve Lazer kullanarak yaprağın klorofil içeriğinin ve azot içeriğinin elde edilmesi amacıyla kullanıldığından otomatik sulamayı geliştirmeyi amaçlamaktadır (Kumar ve Ramasamy., 2017).

Nİ teknolojisinin özellikle seracılığa sağladığı birçok fayda vardır:

• Veriler bulutta depolanmakta ve böylece serada yetiştirilen ürün hakkında, yetiştiriciler için bilgi havuzu oluşmaktadır. Oluşan havuzdan üreticiler istedikleri kriterler hakkında bilgi edinme imkanına kavuşmaktadır.

•Toprak nemi izlenerek su kullanımı azaltılır ve su israfı önlenir. Toprak neminin tarla kapasitesinde kalması sağlanır ve bu şekilde maksimum verim ve kalite sağlanır.

• Sera havasının CO_2 oranı izlenerek ve kullanımı kontrol edilerek karbondioksit gübrelemesi yapılır. Bu sayede kimyasal gübre kullanımı azaltılmakta ve çevre dostu bir su ürünleri yetiştiriciliği sağlanmaktadır.

• Sera içindeki havanın bağıl nemi kontrol edilerek hastalık ve zararlılar kontrol altına alınır. Bu sayede kimyasal ilaç kullanımı azaltılmış olur. Güvenli gıda üretilir ve çevreye duyarlı bir tarım yapılır (Kalkışım, 2020).

3.2. Bulut Bilişim / Hesaplama

Bulut teknolojisi ile müşterinin esnek taleplerini minimum çaba veya hizmet sağlayıcı etkileşimi ile karşılamak için internet üzerinden paylaşılan kaynakları, yazılımları, uygulamaları ve hizmetleri sağlamaktadır (Topakcı ve Ünal., 2010). Toprak ve havayla ilgili araştırma, mahsul ve çiftçiyle ilgili verilerin tümü merkezi bir konumda saklanabilir ve veri kullanılabilirliği sağlanmaktadır. Akıllı tarım teknolojisi, geleneksel tarımsal üretim sistemini monotonluktan kurtarır ve tarlaları küçük parçalar halinde değerlendirme olanağı sağlamaktadır. Akıllı tarım teknolojisinin bileşenleri olan GPS, GIS, uzaktan algılama ve mahsul verimi görüntüleme sistemleri, arazideki

farklılıkları tespit etmek için kullanılmaktadır. Belirlenen veriler, akıllı tarımın son ve en hayati halkası olan değişken oranlı uygulama sistemi yardımıyla değerlendirilerek sonuçlandırılmaktadır (Uzun vd., 2018). Bulut bilişimin tarım için faydalı bir teknoloji olmasının yanında bazı zorlukları da vardır. Bunlar; Ağ bağlantısı ve sürekli internet bağlantısı ihtiyacı, çiftçinin teknolojiyi verimli kullanamaması, daha az fiziksel kontrol, bilgisayar korsanlarının hedefi olması, düşük hızlı bağlantılarla verimsiz çalışma ve güvenlik riskleri olarak ifade edilebilir (Choudhary ve ark., 2016).

3.3. Uydu ve Hava Araçları

Son yıllarda gelişen teknoloji ile birlikte tarımsal faaliyetlerde uydu ve hava araçları yaygın olarak kullanılmaktadır. Özellikle uçaklara yerleştirilen sensörler yardımıyla tarımsal üretimde, nakliyede, tarımsal ilaçlamada, yangın söndürmede ve arazinin verimli kullanımında ürün miktarını tahmin etmek mümkündür. Uydu görüntüleri yardımıyla sahadaki sorunlu alanlar belirlenir ve üreticiler bu noktaya odaklanmaktadır. Akıllı sulama, gübreleme ve ilaçlama ile yüksek verim elde edilebilmektedir. Akıllı tarım sayesinde tarlanın bulunduğu alandaki hava ve toprağın nem ve sıcaklık ölçümleri gerçek zamanlı olarak yorumlanabilmektedir (Tamura vd., 2018; Ercan vd., 2019; Kirmikil ve Ertaş., 2020).

3.4. Büyük Veri

Büyük veri, yaygın olarak kullanılan programların depolama, yönetim ve işleme kapasitesinin ötesinde olan veri kümelerini tanımlamak için kullanılan bir terimdir. Büyük verinin devasa boyutları ile ondan yararlanmak için gereken analitik karmaşıklığının birleşimi, yeni sınıf teknolojilerinin ve bunları yönetmek için araçların geliştirilmesine yol açmaktadır (Donzia vd, 2018). Tarımda büyük veri uygulamaları; fırsatlar arasında kıyaslama, sensör kullanımı ve hesaplama, tahmine dayalı modelleme ve mahsul bozulma riskini yönetmenin yanı sıra çiftçilere farklı tarımsal kaynaklardan toplanan gerçek zamanlı verilerden ipuçları sağlama yer almaktadır. Sonuç itibari ile büyük veri, tarım sektöründe gelecekteki sonuçlarına (tahmini verim modeli, tahmini yem alım modeli, vb.) tahmin edilebilir iç görüler sağlamak, gerçek zamanlı operasyon kararlarını yönlendirebilmek ve yeni iş modelleri kurmayı sağlamaktadır (Wolfert vd., 2017).

3.5. İnsansız Hava Aracı (Drone)

Pilotu olmayan araçlar olarak tanımlanmaktadır. İHA'ların tarımda kullanımı, akıllı tarımda kullanılacak verilerin altyapısını oluşturacak olan uzaktan algılama ve bitki izleme tekniklerine bağlıdır. Bitkilerde hastalık ve zararlı tespiti, verim/olgunluk tahmini, yabancı ot tespiti, su kaynakları kontrolü ve işçi denetimine yönelik pasif uygulamalar olarak belirtilmektedir (Türkseven vd., 2016; Ercan vd., 2019)

3.6. Otonom ve Robotik

Otonom ve robot teknolojileri hemen her sektörde verimli kullanıldığı gibi tarım sektöründe de başarılı bir şekilde kullanılmaktadır. Bu teknolojilerin fiyatlarının karşılanabilmesi için büyük ölçekte tarım arazilerine ihtiyaç duyulmaktadır. Arazide ürünleri ve saplarını birbirinden ayıran otonom biçerdöverler, tarlaları hassas bir şekilde süren ve tohumlayan otonom traktörler ve tarım makineleri bu alana örnek gösterilebilmektedir. Çiftçi robotlar ekim yapılacak olan tarlanın her bir alanını analiz ederek tohumu maksimum verim alınabilecek noktaya ekebilmektedir. Ayrıca tarlada bulunan zararlı otları belirleyip zirai ilacı uygulayarak temizleyen robot sayesinde zararlı otlara yönelik yapılacak ilaçlama oranı ve insan emeği önemli oranda düşürülmektedir (Uzun vd., 2018). Bu yönde yapılan çalışmalara bakıldığında; (Blasco vd., 2002) tarafından sebzelerde tüketicinin güvenilir ürün isteği yönünde yabancı otlarla mücadele etkin kontrol sağlayabilecek hafif yapılı, kolay hareket edebilen robot tasarımı sunulmaktadır. Sistemin verimli çalıştığı İspanya'da marul yetiştiriciliği yapılan bir alanda ispat edilmiştir. Sebze alanlarında yapılan çalışmalara bakıldığında: Domateste (*Lycopersicon esculentum L.*) yabancı otlarla mücadele amacıyla hedef odaklı bir robotik sistem kullanılmıştır (Lee vd., 1999) ve Lahanada (*Brassica oleracea* L.) da benzer bir uygulama yapılmıştır. (Mao vd.,2014) tarafından fide dikimiyle ilgili seralarda kullanıma sunulan bir robot geliştirilmiştir. Hava ile entegre işçilik açısından yüksek hızda fide dikim tapası mevcut bir sistemdir (Hu vd., 2014). Marul ile yabancı otlar arasında gerçekleşen rekabette marul bitkisinin ekonomik özelliğinden dolayı doğaya tutunabilmesini sağlayacak, organik tarımda da kullanılabilen marul robotu marulun etrafındaki yabancı otları parçalayıp ve marula gübre uygulayıp verimin çift yönlü olarak yükselmesinde fayda sağlamaktadır (Kushwaha vd., 2016). Başka bir çalışmada öncelik amaç, bitkiden sinyal almaktır, kültür bitkisine floresan özellikte bir bileşiğin uygulanıp gerekli sinyalizasyonun oluşumu sağlandıktan sonra görsel sistem bulunan bir yabancı ot mücadele aracı yabancı otlarla mücadele edebilmektedir. Yapılan çalışmada kullanılan görsel etkisi yüksek olan bir bileşik kullanılmıştır ve kereviz köklerine çeşitli dozlarda uygulaması yapılmıştır. Etkili düzeyde uygulanan bileşik sayesinde robotikler kereviz bitkilerini görülebilir kılıp yabancı otların robotların görsel aksamlarınca kolay fark edilebilir olmasını sağlayacaktır (Su vd., 2020; Çolak ve Işık., 2021). Robotların önümüzdeki senelerde tarımsal üretimin bazı önemli işlerde büyük traktörlerin yerini alacağı düşünülmektedir. Tarımsal uygulamalarda yabancı ot ve zararlılarla mücadelede robot benzeri traktörler, ekim robotları, mahsul hasat robotları, gübreleme, ilaçlama ve otonom robotlar gibi çeşitli robotların kullanılması öngörülmektedir (Tekin, 2013). İlaçlama ve Ayıklama Robotları, veri tabanlarındaki yabancı ot görüntülerini kullanarak yabancı otları tespit edip toplamak veya pestisitleri bitkiye değil doğrudan yabancı ota uygulamak üzere eğitilmekte ve geliştirilmektedir. Artan sayıda yabani otların pestisitlere karşı dirençli hale gelmesi, bunların toplam maliyeti ve kullanımı ile bu teknoloji hem çiftçilerin altyapısına hem de çevreye büyük bir destek

sağlamaktadır (David, 2017). Akademik bir çalışmada, kablosuz robot, farklı çevresel değişkenleri ölçmek için çeşitli sensörlerle kuşatılmıştır. Robot; nem algılama, kuşları ve hayvanları uzaklaştırma, böcek ilacı püskürtme, ileri veya geri hareket etme ve açma-kapama elektrik motorunu kontrol etme gibi görevleri yerine getirebilen temel özelliklere sahiptir. Önerilen kablosuz mobil robot arazilerde test edilmiş, okumalar izlenmiş ve sistemin akıllı tarım sistemleri için çok kullanışlı olduğunu gösteren tatmin edici sonuçlar gözlemlenmiştir (Krishna vd., 2017).

3.7.) Siber Fiziksel Sistemler

Siber-fiziksel sistemler, hassas kontrol ve optimizasyon sağlamak için siber unsurları fiziksel bileşenlere entegre etmektedirler. Tarımda akıllı makineler ve sensörler yaygınlaştıkça ve bunlardan elde edilen verilerin miktarı ve kapsamı arttıkça süreçler giderek daha fazla veriye odaklı ve veriye dayalı hale gelmektedir. Yönetim görevlerine dayalı olarak Akıllı Tarım, yalnızca sahadaki değişkenlik üzerine geliştirilen verilerle değil, aynı zamanda gerçek zamanlı olaylar tarafından tetiklenen bağlam ve durumsal farkındalık ile hassas tarımın ötesine geçmektedir. Akıllı cihazlar, geleneksel araçlara (yağmur ölçer, traktör, dizüstü bilgisayar vb.) otonom bağlam farkındalığı ekleyerek bu araçları genişletir. Bu durumda, robotların kontrolde önemli bir rol oynayabileceği öne sürülmüştür, ancak rolü analiz ve planlamadaki insanlar makineler tarafından daha fazla desteklenir, böylece siber-fiziksel döngü neredeyse özerk hale gelmektedir (Wolfert vd., 2017). Siber fiziksel sistemlerin iklim, toprak ve mahsuller ile ilgili gerekli ve uygun oluşumları yüksek doğrulukla toplayabilmesi beklenmektedir. Toplanan veriler sulama, nem, bitki sağlığı vb. gibi dış kaynakları yönetmek için kullanılmaktadır. Burada önemli unsurlar akıllı cihazlar ve sensörlerdir. Akıllı cihazlar ve sensörler ile tarımda kullanıcılara faydalı içerik bilgileri sunulmaktadır. Literatürde topraktaki iyonik konsantrasyon, nem ve besin maddeleri hakkında bilgi elde etmek için sensörler bulunmaktadır (Ali vd., 2017; Pandey vd., 2018); güneş ışınlarından elde edilen fotovoltaik enerjinin güç kaynağı olarak kullanılması ve çeşitli sulama işlerinin gerçek zamanlı uzaktan yönetimi; kurumsal mimari ile simülasyon için buluşsal tabanlı bulanık vaka tabanlı akıl yürütme ve değer akışı eşleme kullanarak yeni akıllı tahmine dayalı tarımsal gıda izlenebilirliği sağlayan siber-fiziksel tabanlı yaklaşımlar sunulmaktadır (Chen, 2018).

4.Dünyada Akıllı Tarıma Dayalı Seçilmiş Teknolojiler

Tablo.1 Akıllı tarıma dayalı uygulamalar

Referans	Uygulama	Tanım
Friha vd., 2021	Toprak Analizi	Arazi yönetimi, toprak özellikleri hakkında bilgi verir. Çiftçilerin arazi yapısı hakkında bilgi sahibi olmasını ve alınmasını gereken önlemleri anlamalarında yardımcı olur.
Saba vd., 2017	Farm Manager	Farm Manager uygulaması ekimden önce uygulanması gereken teknikler konusunda yardımcı olmaktadır.
Friha vd., 2021	Zararlı Yönetimi	Zararlı oluşumu bilgilerini toplayarak zararlı kontrol çözümleri sunmaktadır.
Saba vd., 2017	Agrippa	Mahsullerin geçmişini (Ekim, gübreleme, hasat vb.) depolamaktadır.
Friha vd., 2021	Gübre Yönetimi	Gerekli optimum gübre bileşimini belirlemektedir Ayrıca fiyat kıyaslamasını dikkate almaktadır.

Tablo.2 Akıllı tarımda üretimi arttırmak için kullanılan IOT tabanlı sensörler

Referans	Sensörler	Tanım
Sudarshan vd., 2019	DHT11 Sensörü	Sıcaklık ve nemi ölçmektedir
Ganesh vd., 2018	SEN0193 Sensörü	Toprak nemini ölçmektedir
Nagamani vd., 2019	SKU SEN0189 Sensörü	Bulanıklık sensörü suyun kalitesini belirlemektedir
Jayasuriya vd., 2018	BH1750 Sensörü	Işık yoğunluğunu ölçmektedir
Odesola vd., 2019; Boursianis vd., 2020	Yağmur Sensörü	Yağmur basıncını ölçmektedir

Rehman vd.,2022

5.Dünya'da Akıllı Tarım 'da Önde Gelen Ülkeler

Tarım sektöründe öncü olarak bilinen Hollanda ve İsrail Tarım 4.0 uygulamalarını diğer ülkelere göre daha hızlı kabullenmişlerdir. Bu ülkelerin yanında, Tayvan'ın Tarım 4.0'a uygun, kayda değer önemli çabaları büyük değişimler ortaya çıkarmıştır (Kılavuz ve Erdem., 2019). Türkiye'de bu ülkeleri model almayı hedeflemektedir.

5.1.) Hollanda'da Dijital Tarım

Hollandalı çiftçiler, yüksek verimli sulama sistemleri, tohumda ileri teknolojiler, yenilenebilir enerji sistemleri, robotlar ve otomasyon sistemleri, büyük veri analizi ve akıllı yazılımları çiftliklerinde kullanarak dijital tarım dönüşümünde büyük başarı elde etmektedirler. 2019 verileri incelendiğinde Hollanda Küresel Rekabet Edebilirlik Endeksi'nde 4. sırada yer almaktadır (Kırmikil ve Ertaş., 2020). Hollanda'da tarım sektöründe hassas tarım uygulamaları ile su ve gübrenin verimli bir şekilde kullanımı sağlanmaktadır (Tekinerdoğan, B. ,2018). Avrupa'nın en küçük ve en yoğun nüfusa sahip ülkesi olan Hollanda, yeniliklere açık olan kümelenme (Porter) modelini benimsemektedir. Kümeleme modelinin özellikleri; İlgili ve destekleyici şirketlerin coğrafi olarak yoğunlaşması, birbirlerinden bilgi alma ve güvene dayalı ilişkilere sahip olma, tohum şirketleri arasında olumlu etkileşim, ticaret, lojistik, üretim, eğitim, araştırma, şehre yakınlık ve diğer destekleyici tarım sektörlerinin varlığını kapsamaktadır (Vossenaar, 2018). Tarım ürünlerini işlemeye yönelik makineler, robotik yumuşak meyve toplayıcılar gibi yüksek düzeyde otomasyona sahiptir, tarımda dünyanın en başarılı üniversitesi olan Wageningen Üniversitesi, yaşam bilimleri ve doğal kaynaklarda bilimsel ve ticari konularda araştırmalar yapmaktadır. Hollanda'nın dijital tarımdaki bu başarısının sürdürülebilir ve teknolojiye dayalı tarım politikalarını benimsemesinden kaynaklandığı görülmektedir (Erdem ve Lider., 2019). Hollanda hükümeti, tarımda uzun vadeli ve verimliliği artırıcı uygulamalar için uydu verilerini satın almıştır ve elde ettiği verilerle üreticilere ürün gelişimi, toprak ve atmosfer gibi bilgileri online olarak açıklamaktadır. Bu veriler sayesinde üreticilerin ürünlerini yakından takip ederek verimlilik artışı ve sürdürülebilir tarım sağladıkları belirtilmektedir (Saygılı vd., 2018). Hollanda'nın tarımda dünyanın önde gelen ülkeleri arasında olmasının başlıca nedenleri; Altyapının sağlam olduğu, tarım üniversitelerine gerekli önemin verildiği, çiftçilerin devletle iş birliği içinde olduğu gösterilmektedir.

5.2. Tayvan'da Dijital Tarım

Tarım sektörü Tayvan ekonomisinde en büyük payı kapsamaktadır. Tarımda akıllı tarım uygulamaları ve teknolojik cihazlarıyla dünyada adından söz ettirmektedir. Ülke; Kapalı tarım, LED sektörü, IoT teknolojileri, damla sulama sistemleri, hassas tarım uygulamaları, güneş panelleri, dikey çiftlikler, drone'lar, robotlar ve otomasyon sistemleri gibi Tarım 4.0'da kullanılan tüm bileşenlerin önemli bir üreticisi olduğu görülmektedir. Ayrıca Tayvan, Asya ve Çin pazarlarına girmek isteyen tarım şirketleri için oldukça önemli bir ülkedir. Sahip olduğu mühendislik altyapısı ile akıllı tarımda ihtiyaç duyulan diğer tüm faktörler için nitelikli iş gücü sağlayabilmektedir (Kılavuz ve Erdem, 2019). Tayvan, 2019 Küresel Rekabetçilik Endeksi'nde (Anonim, 2019c) 12. sırada yer almaktadır. Tarımda iklim değişiklikleri sonucunda verim düşüşleri ve ürün kayıpları yaşanmakta bu soruna çözüm olarak Tayvan kapalı tarıma önem vermektedir. Kapalı tarımda LED teknolojilerine ihtiyaç duyulmakta olup, Tayvan bu konuda dünyanın en büyük ikinci LED sektörüne sahiptir ve LED teknolojisindeki gelişmeler kapalı tarımı desteklemektedir. Robot ve drone üretimine önem veren Tayvan, büyük ölçekli tarımsal projelerin ihtiyaç duyduğu enerji kaynakları için güneş pili üretiminde de dünyada ilk sırada yer almaktadır. Taoyuan'da bulunan Yes Health iFarm, tamamen kontrol edilebilen akıllı bir çiftlik sistemine sahiptir. 14 kata sahip olan dikey tarım tesisinde, kontrol edilebilen nem, sıcaklık ve hava akışları yanında klasik müzik ile de bitkilerin besin maddelerini emilimi araştırdıkları bir diğer konudur (Kılavuz ve Erdem., 2019). Gençleri tarıma çekmek, Tayvan'ın uluslararası rekabete açık ihracat endüstrisinin gelişmesine yardımcı olacağı düşünülmektedir ve bu amaçla yetenek geliştirmede yeni nesil için yeni bir tarımsal eğitim stratejisi geliştirilmektedir. Bu eğitim, akıllı tarım 4.0 çerçevesine sıkı sıkıya bağlı kalarak, önde gelen endüstrilerin iş başında eğitim ve uluslararası uzmanlıkla ilgili taleplerini karşılamayı amaçlamaktadır. Tarım 4.0 kapasitelerini ve teknik istişareleri hızlandırmak için endüstri-hükümet-akademik-araştırma ittifaklarından uzmanlar ve akademisyenler, önde gelen 10 sektör için "4.0 Endüstri Hizmet Ekibini oluşturmuşlardır. "Akıllı Üretim ve İnsan Makineleri Koordineli Yardımcı Cihaz Geliştirme", "Tarımsal Teknik Uzman Sistem Uygulaması" ve "Dijital Hizmet ve İzlenebilirlik Veri Değişimi" olmak üzere üç profesyonel teknik grubun yanı sıra "İş Yönetimi ve Operasyon Destek" teknik destek grubu bulunmaktadır (COA, 2016).

5.3. İsrail'de Dijital Tarım

İsrail'in tarımsal işgücü kıtlığı, ekilebilir tarım arazilerinde yüksek tuz içeriği, doğal su alanlarının kıtlığı, ülke konumu ve yüzölçümü gibi olumsuz etkileri olsa da dijital tarımda başarılı ülke örnekleri arasında dikkat çekici bir konumda olduğu belirtiliyor. Ülke gıda ihtiyacının %95'ini üreterek sektöre yön vermektedir. Tarım teknolojisi, yüksek teknoloji ürünleri, iletişim ve kimya sektörlerinde dünyanın önde gelen ülkelerinden biridir. Tarım sektöründe toprak ve su kıtlığı altında yüksek teknolojileri kullanmaktadır. Damla sulama sistemini dünyaya tanıtan, verimsiz alanlarda her türlü tarım ürününü elde eden, kuraklığa dayanıklı tohum çeşitleri elde eden, tarımsal faaliyetlerde kendi kendine yeten, hasat sonrası dayanıklılık sağlayan operasyonlar gerçekleştiren ve başarıyı yakalayan bir ülkedir. İsrail, tarımdaki olumsuzlukları avantaja çevirmeyi başarmış ülkeler arasında öncüdür. (David, 2017; Kılavuz ve Erdedem.,2019). Görüldüğü gibi İsrail, teknolojiyi en iyi şekilde kullanarak olumsuz koşullarda kendini geliştiren ve Türkiye dahil birçok ülkeye damlama sulama sistemlerini, gelişmiş tohum, gübre ve tarım teknolojileri satan bir ülkedir.

5.4. Japonya'da Dijital Tarım

Japonya, 2019 verilerine göre Küresel Rekabetçilik Endeksi'nde 6. sırada yer almaktadır (Anonim, 2019c). Tarımda çalışan nüfus az, yaş ortalaması yüksek, vergileri yüksek ve kırsal kesimde üretilen ürünler ancak büyük

şehirlerde veya uluslararası pazarlarda ihraç edilebilmektedir. Ancak Japonya akıllı tarıma yaptığı yatırımlarla sektöre ivme kazandırmıştır. Robotlar aracılığıyla her 8 saniyede bir meyve toplayarak hasadı hızlandırmışlardır. Biyolojik çiftlikler kurmuşlardır. Biyo-çiftliklerde çiftçiler bilgisayarlarla sıcaklık, ışık ve nemi kontrol edebilmektedirler. Kameralar ve sensörler ile doğru hasat zamanı, toprağın su tutma kapasitesi, sıcaklık, haşere kontrolü ve gün ışığı süresini belirleyebilmektedir. Aynı zamanda sahip olduğu lens sistemi ile zararlı güneş ışınlarını engelleyerek üretim yapabilmektedir (Saygılı vd., 2018).

5.5. ABD'de Dijital Tarım

Amerika Birleşik Devletleri dünyanın en büyük tarım ihracatçısıdır. Bunun temel nedeni teknolojiye yaptığı yatırımlar ve teknoloji kullanımını öğretmesidir. Enstitülerde üretimde verimliliği artırmayı, su, zirai ilaç ve gübre tasarrufu sağlamayı, maliyetleri düşürmeyi, çevreye verilen zararı azaltmayı ve gıda güvenliğini sağlamayı; Fizik, mühendislik, bilgisayar bilimleri ve teknoloji gibi konularda da eğitim desteği sağlamaktadır. Amerika dünya badem üretiminin %80'ini üretmektedir. Bademlerin su ihtiyacının fazla olması nedeniyle üretim maliyeti oldukça yüksektir. Badem ağaçlarına yerleştirilen sensörler yardımıyla toprak analizleri yapılarak bu sorun önlenmiştir. Üreticilerin sulama sistemlerine aktarılan bilgileri toplayarak %20 tasarruf sağlandığı ve uygun sulamanın sağlandığı görülmüştür. NASA'ya gönderilen gözlem uydusu ile nem miktarı ölçülmüştür ve üç günde bir kuraklık, iklim değişikliği ve taşkınlar hakkında detaylı bilgi alınabilmektedir (Saygılı vd., 2018).

5.6.Türkiye'de Dijital Tarım

Günümüzde uygulanan tarımsal destekler arasında mazot, gübre, toprak analizi, fark ödemesi, hayvancılık, sertifikalı tohum/fidan kullanımı ve tohum üretimi, Tarım Muhasebesi Veri Ağı sistemine katılım, organik ve iyi tarım, biyolojik ve biyoteknik kontrol, tarımsal yayım ve danışmanlık hizmetleri, Ar-Ge projeleri yer almaktadır. Ancak bu desteklerin tarımın geliştirilmesi, üreticilerin kırsalda kalmasının sağlanması ve üretimde verimliliğin artırılması açısından pek yeterli olmadığı görülmektedir. Dijital tarım uygulamaları, suyun verimli kullanımı, toplulaştırmalı tarım, çiftçilerin eğitimi ve danışmanlık, parça parça üretimden seri üretime geçiş, kooperatifler gibi uygulamaların yanı sıra devletin önemli yatırımları desteklemesi gerekmektedir. Bu sayede uzun vadede Türkiye net tarım ürünleri ihracatçısı olurken, tarımsal desteklerin bütçe üzerindeki yükü en aza indirilmiş olacaktır. Diğer sektörlerden farklı olarak tarımın devlet desteğine ihtiyacı vardır, ancak bu destek doğrudan gelir desteği değil, tarımsal Ar-Ge, su yönetimi, dijital tarım uygulamaları, çiftçi eğitimi ve rehberliği şeklinde destekler olmalıdır. Günümüz iklim değişikliklerinde piyasa mekanizması ile tarımda optimal üretim ve fiyatın oluşmayacağı ve tarımın piyasa mekanizmasına bırakılamayacak kadar önemli stratejik bir sektör olduğu kabul edilmelidir. Sadece gıda açısından değil, sanayinin ihtiyaç duyduğu ve yetersiz üretim nedeniyle ithal edilen tüm girdiler akıllı tarım uygulamaları ile ülke içinde üretilmeye çalışılmalıdır. Türkiye bu potansiyele sahiptir, sadece doğru ve uzun vadeli politikalara ihtiyaç duymaktadır. Tarım sektörü, devlete yük olan bir sektörden doğru politikalarla ekonominin rekabet gücü yüksek sektörlerinden biri haline gelmelidir. Ayrıca çiftçinin gelir düzeyi artarken, Türkiye gıda güvenliği ve sağlığı açısından dışa bağımlılığını azaltmakta ve köyden kente göçü azaltmaktadır (Kılavuz ve Erdem, 2019).

Dünyada çok az ülke Türkiye kadar bitki çeşitliliğine sahiptir. Ancak bu avantajlı coğrafyada tarım sektörünün mevcut durumu, profesyonel ve uygun yöntemlerle değil, ortalama olarak geçimlik tarım yapılmaktadır (Anonim., 2018b). Ülkedeki tarımsal işletmelerin çoğu, geçimlik tarıma, ölçek ekonomisi sorunu nedeniyle düşük üretkenliğe ve pazar için düşük üretime yol açan küçük aile işletmeleri şeklindedir. Ayrıca yüksek girdi maliyetleri ile azalan üretim sonucu gıda fiyatları artmakta, üretimin tüketime oranının düşmesi nedeniyle ithalat yapılmaktadır. Avrupa Komisyonu, AB ile üye ülkeler arasındaki bütçenin tarım politikalarında daha etkin kullanılmasını sağlayacak değişiklikler kapsamında su yönetiminde büyük önem taşıyan dijital tarımın yaygınlaştırılmasına karar vermiştir. Akıllı sulama teknolojilerinin yaygınlaşması ile su israfı önemli ölçüde azaltılacak ve geri dönüşüm çalışmaları ile tarım sürdürülebilir hale gelecektir. Türkiye'nin sürdürülebilir tarım için, daha önce bahsi geçen Tayvan, Hollanda ve İsrail örneklerinde olduğu gibi detaylı bir politikaya, tarımda dijitalleşmeye, Ar-Ge ve bilimsel çalışmalara ve hükümet desteğine ihtiyaç duymaktadır. İsrail olumsuz koşullarda bile kendine yetecek tarım üretimi yapıyorsa, coğrafi olarak büyük ve verimli topraklara sahip ülkemizde de kapsamlı Ar-Ge çalışmalarına, kooperatifleşmeye, tarım eğitimine ve tarımda makineleşmeye yönelerek dünyanın tahıl ambarı ve sebze meyve ihracatçısı konumuna gelinmesi mümkün olacaktır (Kılavuz ve Erdem, 2019). Türkiye'de tarımsal kırsal örgütlenme ile ilgili birçok bakanlık ve kuruluş bulunmaktadır. Tarımsal faaliyet ve organizasyonların birçok kurum tarafından yürütülmesi, yetki çatışmasına ve hizmetlerde verimsizliğe neden olmaktadır. Ülkede çok sayıda kooperatif olmasına rağmen, kooperatiflerin çoğu küçük ölçeklidir ve çok azı kooperatif ilkelerine uygun bir yapıya sahiptir. Ayrıca yönetim, mevzuat, finansman, organizasyon, eğitim ve araştırma gibi birçok sorunu vardır. Gerçekte kooperatifler, tarımda modernleşme ve verimliliği artırmada önemli kuruluşlardır. Gelişmiş ülkeler geçmişte olduğu gibi bugün de tarımda ciddi örgütlenmeleri desteklemişlerdir. Bu nedenle Türkiye'de kooperatif sektörünün sorunlarının çözülmesi ve desteklenmesi, tarımda verimlilik artışı açısından öncelikli olarak ele alınması gereken bir konudur (İnan vd., 2000; Kılavuz ve Erdem., 2019; Semerci, 2022). Hollanda ve İsrail başta olmak üzere bu ülkelerin başarısının teknolojiye dayandığı aşikardır. Toplam ihracat ve ithalatlarında Bilgi ve İletişim Teknolojileri (BİT) ürünlerinin payına bakıldığında Tarım 4.0 sürecine uyum sağlamış ülkelerin bu ürünlerin hem ihracatında hem de ithalatında yüksek değerlere sahip olduğu görülmektedir. Bu ülkeler

teknoloji ile verimliliklerini arttırabilmişlerdir (İTB, 2019). Tarımsal teknolojiler ise genel olarak tarım dışı sektörler tarafından üretilmektedir. Toprak işleme aletlerinden hasat makinelerine kadar çok değişik mekanik teknolojinin üretilmesinden kullanımında ülkemiz çok ciddi atılımlar yapmış ve ihracatın ithalatı karşılama oranı artmıştır. İthalatın özellikle 2010'da itibaren artış göstermesi tarım sektöründe teknoloji kullanımın çeşitlendiğini ve ihtiyaçların arttığını göstermektedir. Öte yandan tarım sektöründe yeni teknolojilerin benimsenmesinde en önemli faktör üreticilerin gelir düzeyidir. İşletme büyüklüğü verimliliği etkilerken yeni teknolojilerin benimsenmesi ve kullanılmasını etkiler. Küçük çaptaki aile işletmelerinde emek verimliliğinin düşük olması gelir düzeyini de etkilemektedir. Bu durum da yeni teknolojilerin benimsenmesi ve kullanılmasını geciktirmektedir. Ancak üreticinin eğitim düzeyi bazen küçük işletmelerde bile yeni teknolojinin kullanılmasını olumlu yönde etkilemektedir (UİB., 2017). Ülkemizde tarımda yaşanan bu teknolojik dönüşüm için atılması gereken adımlar; Üreticiler (çiftçiler), özel sektör (üreticiler, teknoloji tedarikçileri), birlikler ve kooperatifler, kamu ve üniversitelerden oluşan bir sektörün tüm paydaşlarının iş birliği ile gerçekleştirilebilir. Nitekim bu konuda yapılan bazı çalışmalarda bu paydaşların iş birliğini görmek mümkündür (İTB, 2019).

6.Ülkemizde Akıllı Tarım için Yapılan Çalışmalar

Günümüzde üzerinde önemle durulan hassas tarım kavramı, yerini hassas tarımın kendisini içeren yeni ve popüler bir kavram olan akıllı tarıma (SMART Farming) bırakmıştır (Türker vd., 2015). Türkiye'de akıllı ve dijital tarım adı altında projeler ve akademik çalışmalar vardır. Akıllı tarım konusundaki tüm bu hedeflerin anlamlı ve temelli olabilmesi için Ar-Ge ve İnovasyon çalışmalarına öncelik verilmelidir. Bu çalışmaların başarısında Ar-Ge harcamalarının milli gelir içindeki payı önemlidir. Vodafone Türkiye ve TABİT (Tarımsal Bilişim ve İletişim Teknolojileri) ortaklığında kırsal kalkınmaya destek olma amacıyla Aydın ilinde kurulan Vodafone Akıllı Köy, dünyanın ve Türkiye'nin uçtan uca dijital teknolojilerle donatılmış ilk akıllı köyü olma yolunda hızla ilerlemektedir. Geleneksel tarım yöntemlerinin ileri teknoloji ile birleştirildiği Vodafone Akıllı Köy 'ün başlıca amaçları arasında tarımsal üretimdeki verimliliği bilgi ve teknolojiler ile arttırmak, tarımda genç istihdamı arttırmak, teknolojinin diğer köylere de yayılmasını sağlamak bulunmaktadır. Bitkisel üretim maliyetlerinde minimum %20, hayvansal üretim maliyetlerinde minimum %22 ve sulamada minimum %20 tasarruf amaçlanmaktadır. (Tabit, 2019). 2020 Vodafone Akıllı Köy faaliyet raporunda 2,5 ayda kavun yetiştiriciliğinde %150 verim artışı, %85 gelir artışı sağlandığı belirtilmektedir. Ege Üniversitesi, Boğaziçi Üniversitesi, Ankara Üniversitesi ve Konya Gıda Tarım Üniversitesi olmak üzere bu alandaki çalışmalar ulusal ve uluslararası iş birlikleri ile artmaya başlamıştır. Ege Üniversitesi İİBF ve İzmir Ticaret Borsası ortaklığı ile yürütülen "Türk Tarımının Global Entegrasyonu: Tarım 4.0" projesi de bu alanda yapılan çalışmalardan biridir. Agritech (Tarım Teknolojilerinde İngiltere-Türkiye İşbirliğini Desteklemek için Kapasite Geliştirme ve Ağ Oluşturma Projesi, 2016-2017 Prosperity Fund, İngiltere Büyükelçiliği ve Boğaziçi Üniversitesi Eş Finansmanı), Turkcell Akıllı Tarım, Farmbot vb. yine özel sektör ve üniversite paydaşlarınca yapılan akıllı tarım çalışmalarındandır (Kaya., 2019). Tarla.io**,** Türkiye genelinde 8 yıldır hizmet veren, akıllı tarım alanında faaliyet gösteren başarılı bir firmadır. Firma hasat, zirai mücadele, sulama, planlama yazılımları, seracılık sistemleri, insansız araçlar ve dijital mekanizasyon teknolojilerinden yararlanarak hem bireysel çiftçiler hem de tarım ile ilişkili tüm kurumlar için bilgi hizmetleri sunmaktadırlar (Ercan vd.,2019). 2012 yılında kurulmuş, veri tabanına kayıtlı 500 bin kayıtlı üretici, 117 farklı ürün, 450 bin hektar tarımsal alan ve 1500 milyon TL değerinde zirai ürüne hitap eden tarım teknolojileri üreten "Doktar Tarım ve Hayvancılık Bilgi Sistemleri Araştırma ve Geliştirme Sanayi ve Ticaret Anonim Şirketi'dir. TUBİTAK destekli Ege Üniversitesinde kurulmuş tarım doktoru olarak da adlandırılan bu kuruluş, çiftçilere veya üreticilere tarım teknolojileri konusunda servis sağlamaktadır. 2015 Haziran ayında TUBİTAK Uzay Teknolojileri Araştırma Enstitüsü ve Ankara Üniversitesi Ziraat Fakültesi ortaklığıyla gerçekleştirilen Akıllı Tarım Fizibilite Projesi (AKTAR) ile İç Anadolu Bölgesi'nde yetişen ürünler için hassas tarım modelleri geliştirmesi hedeflenmektedir. Projenin öncelikli amacı, akıllı tarım uygulamaları için sulama ve gübreleme modellerinin gelişmesini sağlamaktır. Proje alanı 400 hektar olarak belirlenmiş ve çeşitli ürünlerin analizi yapılmaktadır.

AKTAR projesi ile uzaktan algılanan sistemler ile verim haritalama, sulama, gübreleme ve tarımsal hastalıkların tespiti gibi verilerin değerlendirilmesi amaçlanmıştır (ATP, 2019). Tarım ve Orman Bakanlığı, stratejik planlarında, mevzuat düzenlemelerinde ve raporlarında akıllı tarım teknolojileri kapsamında çalışmalardan ve hedeflerden bahsedilirken, teknoloji altyapısıyla ilgili birimlerde uygulama aşamasına geçilmiştir.

Bunlardan bazıları;

Tarım Bakanlığı'nın 2018 yılı faaliyet raporunun Akıllı Tarım Ar-Ge çalışmaları başlığında bu konuya dikkat çekilerek şu ifadeler kullanılmaktadır; "Dünyanın Smart Farming (Akıllı Tarım) olarak tanımladığı uygulamalar Daire Başkanlığımız ve bağlı Enstitüler tarafından yakından izlenerek ülkemize uyarlanması ve teknoloji seviyesinin arttırılmasına bu sayede tarımsal girdilerin optimize edilerek karlılık oranının arttırılması hedeflenmektedir." Nitekim bu kapsamda buğday hasadında dane kayıplarının takip edilmesi ve takibine yönelik sistemin geliştirilmesi için biçerdövere bağlanan sensörler ve GPS sistemi ile bir ana modüle bağlı GSM/GPRS sistemi üzerinden uzaktan izleme merkezine veri aktarımı gerçekleştirilmiştir. Tarım Bakanlığı'nın 2018 yılı raporunda olduğu gibi bu yıldaki III. Tarım Orman Şûrası'nın sonuç bildirgesinin 20. Maddesinde de "Tarımsal verimliliğin artırılması ve kaynakların daha etkin kullanılması için bilişim teknolojisini tarım sektörüne entegre

ederek Akıllı Tarım Uygulamalarının yaygınlaştırılması, Akıllı Tarım konusunda yetişmiş çiftçi/mühendis/ara eleman sayısının özel programlar uygulanarak artırılması" dile getirilmektedir. Ancak 2019-2023 Stratejik Planı'nda, akıllı/dijital/hassas tarım başlığı yer almazken, metot ve teknoloji geliştirmek amaç ve hedefler arasında gösterilmektedir. Ayrıca Tarım Reformu faaliyet alanı için Tarım Teknolojileri ve Mekanizasyon ürün/hizmet olarak yer almaktadır. Bunlara ek olarak aşağıdaki belgelerde de akıllı tarıma ilişkin vurgular bulunmaktadır: Türkiye'nin Stratejik Vizyonu 2023 Projesi'nde Tarım, Gıda ve Hayvancılık taslağında da "Uzaktan algılama ve erken uyarı sistemleri ile bilişim sistem ve yazılımları geliştirilmesi" geliştirilmesi hedeflenmektedir. Son olarak 11. Kalkınma Planı'nda tarım öncelikli gelişme alanları içinde birinci sırada yer alırken, "Akıllı tarım teknolojileri başta olmak üzere yenilikçi ve çevreci üretim teknikleri geliştirilecek ve desteklenecektir." Maddesi de Politika ve Tedbirler arasında sayılmaktadır.

7.Tarım 4.0' da SWOT Analizi

Türkiye'de akıllı tarım teknolojileri sunan kuruluşların bulunması ve bazı üreticilerin bu teknolojileri geliştirmek için bu kuruluşlarla iş birliği içinde olması, Tarım 4.0'ın uygulanabilirliğindeki en güçlü yönleridir. Ancak bu teknolojilerin Türk tarımında kullanımındaki zaafların giderilmesi için uzun yıllara ve tarım politikalarında önemli iyileştirmelere ihtiyaç olduğu söylenilebilir. Çünkü bu zaafların başında Türkiye'de akıllı teknolojilerin bilinmemesi, üreticilerin yaş ortalamasının yüksek ve eğitim seviyesinin düşük olması nedeniyle bilgi teknolojileri okuryazarlığının yetersizliği ve teknolojik girdilerde dışa bağımlılığın neden olduğu yüksek yatırım maliyeti gelmektedir. Ancak Türkiye'de genç nüfus oranının yüksek olması, 'akıllı telefon' gibi teknolojik cihazların yaygınlaşması ve bu teknolojilere aşinalık göz önüne alındığında, genç nüfusu daha fazla tarım sektöründe almaya teşvik edecek politikalarla Tarım 4.0'ın uygulanabilirliği daha da mümkün hale getirilebilir. Bununla birlikte, Tarım 4.0 teknolojilerinin emek faktörünü aşarak tarımsal işgücünün istihdamı için bir tehdit oluşturabileceği endişesi de yaygındır.

Güçlü Yönler	**Zayıf Yönler**
- Türkiye'de akıllı tarım teknolojileri sunan kuruluşların bulunması - Faaliyet gösteren akıllı tarım kuruluşları ile iş birliği yapan üreticilerin olması - Üreticilerin faydalandıkları akıllı tarım teknolojilerinden olumlu dönüş sağlamaları - Öncü kuruluşlar ve kamu kurumları tarafından akıllı tarım çalışmalarının yürütülmesi - Akıllı tarım teknolojilerine yönelik sertifika programlarına ilginin artması	- Türkiye'de akıllı teknolojilere yönelik farkındalığın eksikliği - Ülke nüfusunun bilgi teknolojileri okuryazarlığı konusundaki yetersizliği - Tarım üreticilerinin yaş ortalamasının yüksekliği - Tarım işletmelerinin küçük ölçekli oluşu - Kırsal alanda teknolojik altyapı eksikliği - Teknolojik girdilerde dışarıya bağımlılık yaşanması
Fırsatlar	**Tehditler**
- Türkiye'de genç nüfusun fazla olması - Akıllı telefon vb. cihazların yaygın kullanımı - Tarım ve teknoloji kuruluşları tarafından Ar-Ge ve eğitim alanlarına yatırım yapılması yönündeki talepler - Akıllı tarım teknolojilerinin yeni istihdam olanakları sağlaması	- Tarım sektöründe köklü bir değişim yaratacak olması - Değişime uyum sağlanmasında zorluk yaşanması - Sektörler arası entegrasyonda karşılaşılacak güçlükler

(Ercan vd., 2019)

8.Sonuç ve Öneriler

Tüm dünyada olduğu gibi ülkemiz de gelişen ve değişen bir çağdadır. Türkiye, yer altı kaynakları, ürün çeşitliliği ve coğrafi konumu nedeniyle tarım için çok uygun bir ülkedir. Ancak, tarım arazileri ve tarım işletmelerindeki parçalanma ve daralma nedeniyle ülkemizde mülkiyet belirsizliği, üretimde verim düşüklüğü, işletmelerin rekabet gücü zayıf, işletmelerde süreklilik sağlanamaması, modern insan yaşamına ve hayvancılık üretim tesislerine yer verilmemesi, köylerde yaşamak istemeyen gençlerin köyleri terk etmeleri, mali zorluklar gibi kırsal alanlardaki yapısal sorunları içerir. SWOT analizi ışığında ülkemizin bir tarım ülkesi olduğu düşünüldüğünde mevcut zafiyetlerin azaltılması ve tehditlerin ortadan kaldırılması gerekmektedir.

Tarım sektöründe Ar-Ge çalışmaları artırılmalı, çiftçiler tarafından internet ve mobil cihazların erişilebilirliği ve kullanımı yaygınlaştırılmalı, ziraat mühendisleri ve teknikerlerinin yetiştirildiği üniversitelerin lisans ve ön lisans programlarında Tarım 4.0 konusu okutulmalıdır, Türkiye'nin bir tarım ülkesi olduğu, özel sektörle devlet-üniversite işbirliği, başarılı proje örneklerinin duyulması ve yaygınlaştırılması, küçük ölçekli tarım işletmelerinin

teknolojiden yararlandırılması, bilinçlendirme çalışmaları yapılması, üretim maliyetlerinin düşürülmesi için çalışılması unutulmamalıdır. İthal ürün almamak için tarım sektörünün stratejik önemi genç nesillere anlatılmalı ve bu alanda iş yapmaları teşvik edilmelidir. Üretimde teşvik vermek ve yeniliklere açık olmak gerekmektedir. Dünya nüfusundaki artış eğilimine bağlı olarak tarım sektörünün önemi bir kez daha ortaya çıkmıştır. Bu nüfusun gıda ihtiyacını geleneksel üretimle karşılamak oldukça zordur. Bu nedenle akıllı tarım teknolojileri için altyapı sağlamlığı, araştırma ve geliştirme çalışmaları artırılmalı, üreticiler bilgilendirilmeli ve farkındalık artırılmalıdır.

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Endomembrane trafficking pathways for the development of symbiotic membrane compartments during Rhizobium-legume symbiosis

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Abstract

Legumes are a large family of plants that, because of their capacity to fix atmospheric nitrogen, are essential components of the agricultural ecosystem and an important source of production of food, feed, forage, and other compounds with industrial and commercial uses. The symbiosis between legume plants and soil-living rhizobia provides the most significant amount of organic nitrogen in the global nitrogen cycle. The rhizobia infection of the plant root triggers several important events in the root cell, ending in a nodule formation - a nitrogen-fixing compartment. Some signal molecules have been studied, like the Nod factor and genes related to nod factor synthesis, thread, and peribacteroid formation. Still, little is known about the genes and proteins involved in membrane and protein trafficking and targeting in the nodule, which is one of the most important processes in nodule formation and development. Here I will describe the use of different advanced molecular and cell biology techniques to understand the mechanisms involved in membrane and protein delivery to the symbiosomes for its development and maintenance in a model legume plant *Medicago truncatula*.

***Keywords**: Golgi-ER transport, Arf1, Sar1, Symbiosome, Root nodule, Medicago truncatula.*

Rhizobium-baklagil simbiyozu sırasında simbiyotik membran bölmelerinin gelişimi için endomembran taşımacılığı yolları

Özet

Baklagiller, atmosferik nitrojeni sabitleme kapasiteleri nedeniyle tarımsal ekosistemin temel bileşenleri olan ve endüstriyel ve ticari kullanımları olan gıda, yem, kaba yem ve diğer bileşiklerin önemli bir üretim kaynağı olan geniş bir bitki ailesidir. Baklagil bitkileri ve toprakta yaşayan rizobi arasındaki simbiyoz, küresel azot döngüsünde en önemli miktarda organik azot sağlar. Bitki kökünün rhizobia enfeksiyonu, kök hücrede bir nodül oluşumu ile sonuçlanan birkaç önemli olayı tetikler - nitrojen sabitleme bölmesi. Nod faktörü gibi bazı sinyal molekülleri ve nod faktörü sentezi, iplik ve peribakteroid oluşumu ile ilgili genler üzerinde çalışılmıştır, ancak zar ve protein taşımacılığı ve nodülde hedefleme ile ilgili genler ve proteinler hakkında çok az şey bilinmektedir. nodül oluşumu ve gelişimindeki en önemli süreçlerden biridir. Burada, bir model baklagil bitkisi Medicago truncatula'da gelişimi ve bakımı için sembiyozomlara membran ve protein dağıtımında yer alan mekanizmaları anlamak için farklı gelişmiş moleküler ve hücre biyolojisi tekniklerinin kullanımını rapor edilmiştir.

***Anahtar Kelimeler**: Golgi-ER taşınımı, Arf1, Sar1, Simbiyozom, Kök nodülü, Medicago truncatula*

Introduction

The symbiosis between *Rhizobium* and the plant species in the Leguminosae family is of great interest to sustainable agriculture, and the *Medicago truncatula*, a model plant from this family, is a target for agronomists to understand the molecular biology of plant-microbe interactions (Ivanov et al. 2010, Bai et al. 2022). During the symbiosis process, plant roots get infected by Rhizobium, leading to cell division and the development of root nodules, specific organs built by the plant and colonized by the invading bacteria. The bacteria are released into the plant cells, surrounded by a membrane of plant origin, the so-called peribacteroid membrane. In a short time, these bacteria differentiate into bacteroids and fix atmospheric nitrogen, which is supplied as a nitrogen source to the plant, and in return, they are provided with assimilates by the plant (Hirsch, 1992, Tsyganova et al., 2021).

Rhizobia attach to emerging root hairs - possibly with the help of lectins - forming microcolonies. As a consequence of Nod-factor activity (host-specific lipo-Chito oligosaccharide signal molecules synthesized by bacteria), the root tips coil, entrapping the rhizobial colony within pockets formed by the walls of the curled root hairs. The hair walls adjacent to the microcolonies are degraded, and the rhizobia invade the underlying periplasmic space of the root hair. Plasma membrane-derived infection threads, originating from curled root hairs, act as a trigger for rhizobia to enter the root tissues and eventually progress toward the root cortex, where a nodule primordium has been initiated (Hirsch, 1992). The release of rhizobia from infection threads into the cytosol of nodule primordial cells and subsequent cellular localization of bacteria leads to the formation of fully functional nitrogen-fixing nodules. Large numbers of symbiosomes are formed and localized in each nodule, which means that enormous amounts of membrane material and proteins must be delivered to the symbiosome membrane for its development and efficient function.The ability of nodule cells to control protein trafficking and targeting to the symbiosome is essential for nodule development and function. The mechanisms by which proteins are targeted to

this novel sub-cellular compartment to accommodate its demand for membrane proteins are poorly understood. Protein targeting the symbiosome must rely on the plant secretory system; however, little is known about protein trafficking and targeting in symbiosomes and root nodules (Hanton *et al*., 2007). Small GTP binding proteins (Rop, Rab, Arf, Sar) and cytoskeletal reorganization play a unique symbiotic role in infection thread formation and symbiosome development. In this communication, I would like to elucidate the role of these GTP binding proteins in nodule formation and development by using the model plant *Medicago truncatula.*

Material and Methods

Medicago truncatula cv. Jemalong seeds were surface sterilized in concentrated HCl (37%) for 10 min. After washing several times with sterile water, seeds were spread on agar plates with a plant minimal medium adjusted to pH 5.7 (Rolfe et al., 1980) and germinated for two days in the dark at room temperature. Each seedling was inoculated on agar plates with 0.1 ml *Sinorhizobium meliloti* 2011 grown to an O.D. of 0.6 in YEP medium (5 g/L yeast extract, 10 g/L peptone, 5 g/L NaCl, pH 7.0) supplemented with 600 mg/L streptomycin. Mature root nodules were harvested four weeks after infection. Plants were grown under the following conditions: 25°C, 65% humidity, 200 µE/m2*s, and 16 h light/8 h dark. Nodules, roots, and other plant parts were separated and were used for RNA isolation, cDNA synthesis, and R-T PCR. Control plants were grown without Rhizobium under the same conditions.

qPCR procedure and raw data analyses

Primers used for qPCR experiments were designed using Primer 3 software (Rozen and Skaletsky 2000) and are listed in Table 1. qPCR was performed using the Platinum SYBR Green qPCR SuperMix UDG Kit (Invitrogen, Karlsruhe, Germany) following the manufacturer's instructions on a Rotor-Gene 6000 (Corbett Research; http://www.corbettlifescience.com/) cycler. Raw data were analyzed with the CAmpER software tool (Blom, personal communication; http://www.cebitec.uni-bielefeld.de/groups/brf/software/camper_info/) implementing an algorithm based on a four-parametric logistic model (FPLM) (Tichopad et al. 2003) of the fluorescence curve. The FPLM algorithm was used to calculate efficiency-corrected crossing points (cCPs) that were subsequently analyzed using the REST software (Tichopad et al. 2003). Visualizations were created using Microsoft Excel 2007.

Table 1. Primer pairs were used for Quantitative Real-Time PCR.

Gene	Forward Primer	Reverse Primer
*AtARFB*1c	CATCGCTCCTCTCAGGTCTTG	GAGGACACTCTGGAGGCAC
*AtArlA*1d	GAGGACATGATTCCTACAGTGGG	CACTCAATGATGGCTTGCTCAG
*MtArf*1	CTGGATGTAGTGGCGCTGT	CCAAGACAAGATTCGTCCACTG
*MtSar*1	CGCTCAGGTGGATGCTGTAGTC	CATGAACACCTCCAAAGGACG

Results and Discussion

Arf1 and Sar11 expression in the roots and nodules of *Medicago truncatula*

Not much work has been reported about the role of Arf1 and Sar1 in vesicular trafficking in root nodules. To find out the role of Arf1 and Sar1 in membrane trafficking in symbiosome formation and root nodule development in *M. truncatula,* it is important to establish the expression pattern of endogenous Arf1, and Sar1in the roots of *Rhizobium* treated and nontreated plants grown under controlled culture conditions. To examine the possible involvement of intracellular vesicle trafficking in the early steps of symbiotic interactions, the expression of the *MtArf* and *MtSar* genes were analyzed, which are the key GTP binding proteins in the regulation of membrane trafficking between ER and Golgi in eukaryotes (Pimpl et al., 2000; Jurgens, 2004).

Inoculation of *M. truncatula* roots with *S. meliloti* caused a strong induction of the *MtSar1* transcript (see Fig.1). We found that *Mt*Sar1 expression was induced around 6 times in nodules compared to the roots of non-inoculated plants (Fig.1). *At ArfB1c* which is shown to be dominantly expressed in *A. thaliana* roots (Vernoud et al., 2003), the expression of the similar transcript MtrIMGAAC144806_7.1 was also found to be nodule specific and highly expressed in Rhizobium inoculated plants, as predicted in our previous bioinformatics analysis (Fig 1, Yuksel and Memon 2008). Indeed, no ArfB1c transcript accumulation was observed in the roots of non-inoculated plants (Fig. 1). This indicates that this Arf is possibly nodule specific and expressed in host plant roots after rhizobium infection indicating its role in nodule development. Intriguingly another MtArf 1(MtrGB57486383) transcript was expressed both in roots and nodules of inoculated and non-inoculated plants suggesting its general role in vesicular trafficking in plant cells. Several isoforms of Arf1 have been identified in the *M. truncatula* genome (Yuksel and Memon 2008), but their exact function in root and nodules has not been defined. In our preliminary experiment with Arf1 protein expression, we observed a significant increase in Arf1 protein expression with rhizobial infection, and the main pool of the Arf1 in both nodules and roots is possibly present in the active form (Memon 2012).

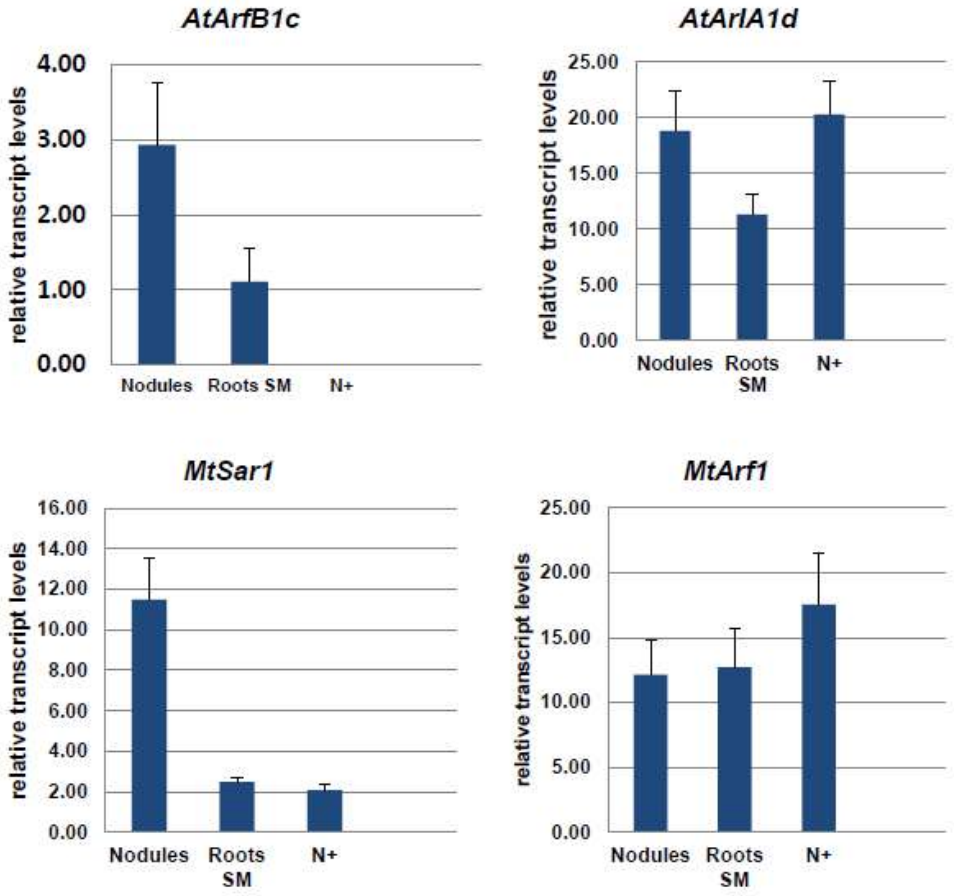

Fig. 1. Expression levels of Arf1, Arl1, and Sar1 (at mRNA level) in the nodules and roots of *Medicago truncatula*. Ubiquitin was used as an internal control. Nodules and roots SM were harvested from the Rhizobium inoculated plants. N+ roots were harvested from un-inoculated plants, which were supplied with nitrogen fertilizer.

Expression of arf-like gene (Arl) in the roots and nodules of Medicago truncatula

Our previous bioinformatics analysis with EST database of *M. truncatula* and *L. japonicus* showed two *Arl* like genes expressed in nodules Yuksel and Memon 2008). We designed the primers targeted to one of these genes (Mtr GB13780535) homologs to *AtArlA1*d. RT-PCR experiments showed that this transcript was highly expressed in nodules and to a lesser extent in roots of Rhizobium inoculated plants, but its expression was also observed in un-inoculated roots (see Fig.1). This could suggest the dual role of Arl in both early and late secretory pathway.

These results clearly suggest that several Arf and Sar proteins are involved in early and late secretory pathways during rhizobium-legume interaction and nodule development. Further work will identify the components of trafficking in the early and late secretory pathway in legume roots and nodules and elucidate the mechanism of transport through the Golgi complex to the root nodule.

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Comparative structural analysis of heavy metal ATPases in Arabidopsis thaliana, Arabidopsis halleri, Brassica rapa, and Brassica juncea

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Abstract
Arabidopsis thaliana has eight genes encoding members of the type P_{1B} heavy metal–transporting ATPase, subfamily of the P-type ATPases. We focused our study on four ATPases, mainly HMA1, HMA2, HMA3, and HMA4, which are closely related and most similar in their sequences. We carried out the bioinformatics analysis of these metal ATPases and obtained their structure in *A. thaliana*, A. *halleri*, and other heavy metal accumulators in *Brassica* spp. *A. thaliana* is a model plant for research because of the duplications and other evolutionary events. These evolutionary events provided a chance to elucidate their regulation and function in the cell. All previous bioinformatics analyses have given some information about their regulation, but not much work has been done on their structural and interactome analysis. Experimental determination of 3D structures is essential to understand better these proteins' function, which is crucial for the proper functioning of all plant cellular processes. Especially, docking sites and domains need to be worked out to understand the role of these transporter proteins and their interaction in plant cells. These bioinformatic analyses will help the researcher understand these ATPases' role in detoxifying the toxic metals from the cells of accumulator plants. Further research on gene cloning, gene expression, and generating new accumulator plants for phytoremediation is needed for the reclamation of polluted soils from toxic heavy metals.
Keywords: *Metal P-type ATPases, Protein Structure prediction, Interactome, hyperaccumulator plants, Brassicas*

Arabidopsis thaliana, Arabidopsis halleri, Brassica rapa ve _Brassica juncea_'daki ağır metal ATPaz'ların karşılaştırmalı yapısal analizi

Özet
Model bir bitki olan *A. thaliana*, P-tipi ATPaz'ın alt ailesi olan P_{1B}-tipi ATPazın sekiz üyesine sahiptir. *Arabidopsis thaliana*, duplikasyonlar ve diğer evrimsel olaylar nedeniyle HMA'ların ve diğer birçok proteinin araştırılmasında tercih edilmektedir. Bu evrimsel olaylar, HMA'ların düzenlenmesinde ve hücredeki işlevlerinin açıklanmasında önemli rol oynamaktadır. Önceki biyoinformatik araştırmalarda, HMA'ların bazı fonksiyonları hakkında bilgi mevcut olmasına rağmen, bunların yapıları ve interaktomları üzerinde yeterli çalışma bulunmamaktadır. Bu çalışmada, bu sekiz üye arasından yakın ilişkili ve yüksek benzerlik oranına sahip olan HMA1, HMA2, HMA3 ve HMA4 üzerinde detaylı biyoinformatik analizi gerçekleştirilmiştir. *A. thaliana* ile aynı familyaya ait *A. halleri* ve bazı *Brassica*'nın akümülatör türlerinden HMA1-HMA4 dizileri elde edilerek biyoinformatik veritabanları aracılığıyla karşılaştırılmıştır. Bu biyoinformatik çalışmalar, akümülatör bitki hücrelerinden toksik metalleri detoksifiye etmedeki HMA'ların rolü hakkında bilgi vermektedir. Ayrıca, bitkide hücresel süreçlerin aktif bir şekilde sürdürülebilmesi için bu taşıyıcıların 3D yapılarının deneysel olarak belirlemek oldukça önemlidir. Bu bağlamda, bu taşıyıcıların yapısal analizleri bazı protein veritabanları kullanılarak yapılmıştır. Bu sonuçlar, toksik ağır metallerce kirlenmiş toprakların ıslahı için mevcut akümülatör bitkilerin üretimine ve ayrıca gen klonlama, gen ekspresyon bilgileri ile fitoremediasyon için uygun yeni akümülatör bitkilerin geliştirilmesine katkı sağlayacaktır.
Anahtar Kelimeler: *Metal P-tipi ATPaz'lar, Protein Yapısı tahmini, Interactome, hiperakümülatör bitkiler, Brassicas*

Introduction

Heavy metals (H.M.s) are functionally classified into two categories: i) essential metals such as copper (Cu), iron (Fe), and zinc (Zn), and ii) non-essential metals such as cadmium (Cd), lead (Pb), and mercury (Hg) (Ozturk et al., 2012; Pinto and Ferreira, 2015; Memon et al., 2021). Both of these classes are essential for plant growth. Recently, this requires more attention because heavy metals above their normal ranges are highly toxic to both plant and animal life (Van der Zaal et al., 1999; Dehkordi et al., 2010). The toxic amount of heavy metals in the soil adversely affects soil ecology, reduces agricultural production or product quality, deteriorates groundwater quality, and ultimately harms living organisms' health.

Plants are capable of various cellular mechanisms and can detoxify heavy metals by either compartmentalizing metals at the subcellular level or depositing them in leaf trichomes in innocuous form. Some plant species can accumulate and detoxify the large amounts of heavy metals present in the soil (Memon et al., 2001; Memon and

Schroder, 2009; Memon and Zahirovic, 2014). The natural phenomenon of heavy metal tolerance became of most significant concern and interest in plant research to study the gene expression and regulation in some well-known accumulator plants such as *Arabidopsis halleri*, *Noccaea caerulescens*, *Pteris vittata*, and *Brassica juncea.* In addition, heavy metal toxicity may block essential functional groups of enzymes, disrupt the structural appearance of biomolecules, generate oxidative stress, etc. (Hall, 2002; Mills et al., 2005; Kraemer, 2009, Meraklı et al., 2022).

Metal hyperaccumulator plants

A specific group of plants has shown a great potential to absorb and translocate metals from roots to shoots and are termed hyperaccumulators (Baker et al., 2002; Chaney et al., 2007, Sytar et al., 2021). Heavy metal accumulator plants have developed several detoxification mechanisms in the cell, such as metal chelation and sequestration, metal storage in the vacuolar compartment, and excreting metal in the trichomes of the leaves (Memon et al., 2001; Memon, 2020). The distinctive characteristic of hyperaccumulator plants is to translocate toxic metals from roots to shoots efficiently, sub-compartmentalize them in the cell and keep the metal away from the metabolic processes (Van der Ent et al., 2013; Sytar et al., 2021). A set of functional genes such as P-type ATPase, ZIP, and NRAMP are crucial in plant cell metal homeostasis (Hall and Williams, 2003; Williams and Mills, 2005; Memon, 2016). For instance, P_{1B}-ATPases, also known as heavy metal ATPases (HMAs), play a critical role in phytoremediation via the long-distance transport of various metals between plant organs (Colangelo and Guerinot, 2006). In recent years, significant scientific progress has been made in understanding the molecular mechanisms of metal uptake and transport in hyperaccumulator plants, including several members of the *Brassicaceae* family.

Heavy metal ATPases

Heavy metal transporting ATPases (HMAs) are membrane-bound proteins having 6–8 predicted transmembrane helices (Axelsen and Palmgren 2001; Smith et al. 2014). They contain 31 amino acids (aa) of heavy metal-associated domain featuring GMTCxxC, a short C-terminal domain, and a very long N-terminal domain (Bull and Cox, 1994).

Here we intend to elucidate the heavy metal tolerance and accumulation mechanisms in the plant species in the Brassicaceae family with the role of the HMAs (HMA1-HMA8) in response to heavy metal stress. The phylogenetic relationships of the HMA1-HMA8 proteins from *Brassica* spp., *A. thaliana*, *A. halleri*, *Noccaea caerulescens* (*Thlaspi caerulescens*) were assessed using multiple sequence alignment and phylogenetic tree construction (Fig. 1). Using different bioinformatics tools, we have identified eight heavy metal transporter genes (HMA1-8) in different plant species in *Brassicaceae* (three *Arabidopsis* spp., four *Brassica* spp., and *Noccacea caerulescens* (*Thlaspi caerulescens*). The phylogenetic relationships among HMAs were established using the MEGA X program for phylogenetic tree construction, and the relative similarity rates among the genes and plant spp were estimated (Fig.1). HMA1-8 protein sequences from *Arabidopsis thaliana, Arabidopsis halleri, Arabidopsis lyrata, Brassica napus, Brassica rapa, Brassica juncea, Brassica oleracea, Noccaea caerulescens* (*Thlaspi caerulescens*) were retrieved from NCBI and UniProt, and a phylogenetic tree was constructed. The phylogenetic tree shows the evolutionary relationship of HMA1-8 transporters using a Neighbour-joining tree without distance corrections. In Fig. 1, we observe two sister groups, one group being AhHMA1 and NcHMA7, and the other one HMA1-8, each having a common ancestor. BoHMA5, AtHMA5, and AtHMA7 share a common ancestry with BnHMA5 and BrHMA5, and similarly, BrHMA3 and AtHMA3 share their ancestry with BoHMA3 and BnHMA3. NcHMA2 and BoHMA2 share a common ancestry with BnHMA2 and BrHMA2, and similarly, BrHMA3 and AtHMA3 share their ancestry with BoHMA3 and BnHMA3. On
the other hand, AtHMA2 and AlHMA2 share a common ancestry with AtHMA6, BrHMA2, BnHMA2, BoHMA2, NcHMA2, BnHMA3, BoHMA3, AtHMA3, BrHMA3, NcHMA5, AtHMA7, AtHMA5, BoHMA5, BrHMA5, and BnHMA5.

HMA1-8 sequences from *A. thaliana* were compared to its homologs in other species in *Brassicaceae*; for example, *B. juncea*, *B. rapa, B. napus*, *B. oleacea*, *A. lyrata, A. halleri*, and *N. caerulescens*. Phylogenetic analysis showed a very close relationship of BnHMA1 to BoHMA1; AtHMA1 to NcHMA8; AtHMA2 toAlHMA2; BrHMA2 toBnHMA2; BnHMA3 to BoHMA3; AtHMA4 to AhHMA4; BoHMA4 to NcHMA4; BjHMA4 to BrHMA4; AlHMA4 to NcHMA3. HMA transporters are divided into the Cu/Ca/Zn/Cd/Co-ATPases group, the Zn/Cd/Pb/Co-ATPases group, and the Cu-ATPases group (Hermand et al., 2014). BnHMA2 and BnHMA4 are reported to belong to the Cu/Ca/Zn/Cd/Co-ATPases group. It is inferred from the phylogenetic tree analysis that HMA4 in *A. thaliana, A. halleri,* and *B. napus* are evolutionary closely related and are homolog to each other. HMA2 in Brassica and Arabidopsis phylogenetically were closely related, and HMA4 showed similar distribution patterns in the phylogenetic tree. NcHMA4 and BoHMA4, BjHMA4 and BrHMA4 were in the same group, and AtHMA4 and AhHMA4 were also placed in the same group.

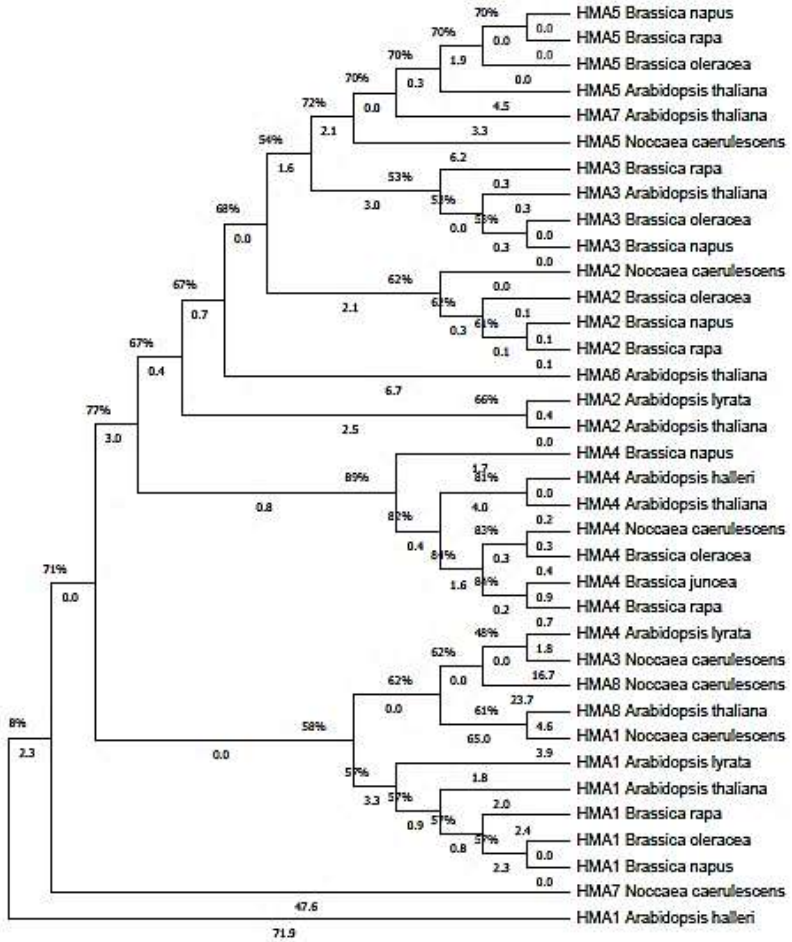

Fig. 1. The protein sequences of HMA1-8 family transporters from different plant species from the *Brassicaceae* family were obtained from NCBI and UniProt. The protein sequence IDs are AtHMA1 (Q9M3H5), AhHMA1 (Q70IH7), AlHMA1 (XP_020875667), NcHMA1 (JAU82411), BrHMA1 (XP_009137459), BnHMA1 (XP_022573707), BoHMA1 (XP_013595810), AtHMA2 (Q9SZW4), AlHMA2 (XP_002867367), BrHMA2 (XP_009128090), BnHMA2 (XP_013748024), BoHMA2 (XP_013609995), NcHMA2 (JAU82907.1), AtHMA3 (P0CW78), AhHMA3 (AJ556182), AlHMA3 (XM_002867320), BrHMA3 (XP_009137892), BnHMA3 (XP_013752152), BoHMA3 (XP_013591300), NcHMA3 (A0A1J3HSX9), AtHMA4 (AT2G19110), AhHMA4 (ABB29495), AlHMA4 (XP_020869480), BrHMA4 (XP_009150707), BjHMA4 (AFJ94635), BnHMA4 (XP_022561353), BoHMA4 (XP_013629797), NcHMA4 (JAU89865), AtHMA5 (OAP12074), BrHMA5 (XP_009112946), BnHMA5 (XP_013748077), BoHMA5 (XP_013606061), NcHMA5 (JAU39366), AtHMA6 (AT4G33520), AtHMA7 (NP_199292), NcHMA7 (JAU79906), AtHMA8 (NP_001031920), NcHMA8 (JAU85510). The neighbor-joining phylogenetic tree was constructed using MEGAX after CLUSTALW alignment of the full-length amino acid sequences of heavy metal ATPases in different plant species in *Brassicaceae*. The tree is unrooted, and its branch length represents the relative evolutionary distances between the input proteins.

3D structure prediction and validation of HMA transporters

Using PyMol software, the 3D structure was generated and visualized. The confidence of the visualization was checked with respected Ramachandran plots (data not shown) (Van der Zaal et al. 1999). The results showed that there were 580 (88.8%) residues in the favored region for HMA1, 544 (81.3%) residues for HMA2, 409 (89.5%) residues for HMA3, and 544 (81.2%) for HMA4. The number of residues found in the outlier region is considered, further confirming the accuracy of the 3D structure prediction. The results are as follows: for HMA1, 25 (3.8%), for HMA2, 50 (7.5%), for HMA3, 6 (1.3%), and HMA4, 51 (7.6%) residues were found in the outer region. Analysis and prediction of the 3D structure of HMAs in plants are vital for a complete understanding of the function, interactions, possible ligands, conserved domains, their homologs, and many other functional properties. The 3D structures of HMA proteins are predicted by the Phyre2 tool and are shown in Figure 3. It is concluded that all HMAs (HMA1 to HMA4) in *Arabidopsis* cells have shown similarities in their secondary structural elements, including the number of alpha helices, beta sheets, and loops. The 3D structure of HMA2 and HMA4 is remarkably similar, and both are localized in the plasma membrane.

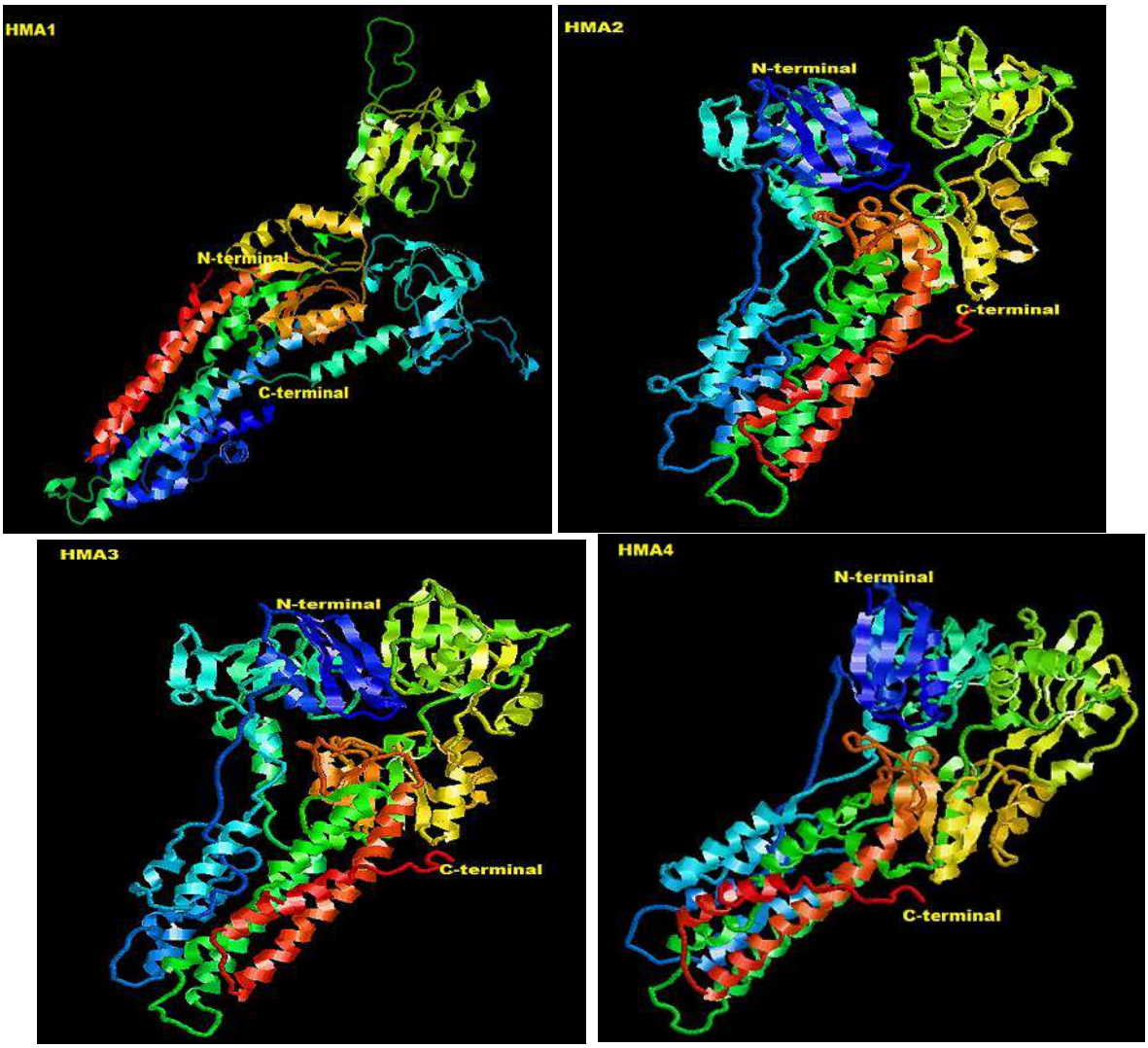

Fig. 2. Predicted 3D structures of proteins HMA1, HMA2, HMA3, and HMA4 in *Arabidopsis thaliana*.

In conclusion, HMA transporters are divided into the Cu/Ca/Zn/Cd/Co-ATPases group, the Zn/Cd/Pb/Co-ATPases group, and the Cu-ATPases group. HMA2 and HMA4 transporters are involved in metal transport from roots to shoots and belong to the Cu/Ca/Zn/Cd/Co-ATPases group.

The bioinformatics analysis of HMAs in *Brassica* species showed many similarities. HMA1-8 sequences from *A. thaliana* were compared to its homologs in other species in *Brassicaceae*; for example, *B. juncea*, *B. rapa*, *B. napus*, *B. oleacea*, *A. lyrata*, *A. halleri* and *N. caerulescens*. Phylogenetic analysis showed a very close relationship among these ATPases. In the 3D structural composition of proteins, we have concluded that all HMAs have similarities in their secondary structural elements and play a similar role in metal transport in the cell. The present paper will help the researcher understand these ATPases' role in detoxifying the toxic metals from the cells of accumulator plants.

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ID: 721

Expression of some metal transporter ATPases in *Brassıca rapa* grown under cadmium stress

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Abstract
Cadmium (Cd) is one of the toxic heavy metals not essential for the growth and development of plants and other organisms. *Brassica rapa* accumulates several heavy metals in its leaves and is reportedly suitable for phytoremediation. In this study, Cd uptake and accumulation in the leaves of *B. rapa* exposed to different cadmium levels (0, 5, 10, 20, 50, 100 µM $CdSO_4$) were anayzed; as well as the effect of Cd stress on HMA2 and HMA4 genes expression were investigated. The qRT-PCR results showed that HMA2 and HMA4 play a vital role in cadmium uptake and translocation in *B. rapa* at low Cd level (5-20 µM). However, exposure to high Cd levels (50 and 100 µM) significantly reduced the growth and biomass of *B. rapa*. Furthermore, high levels of Cd inhibit the expression of HMA2 and HMA4 genes in *B. rapa*. Our data show a multigenetic (co-acting of many transporter gene clusters) response in the signaling pathway associated with Cd accumulation and tolerance mechanism in *B. rapa*.
Keywords: *Heavy metal ATPases, HMA2, HMA4, Cd, Brassica rapa*

Kadmiyum Stresi Altinda Yetiştirilen *Brassica Rapa*'da Bazi Metal Taşiyici Atpaz'larin Anlatim

Özet
Kadmiyum (Cd), bitkilerin ve diğer organizmaların büyümesi ve gelişmesi için biyolojik olarak gerekli olmayan toksik ağır metallerden birisidir. *Brassica rapa* yapraklarında bazı ağır metalleri biriktirebilme yeteneği sergilediği ve fitoremediasyon için uygun bir bitki olduğu bildirilmiştir. Bu çalışmada, farklı kadmiyum seviyelerine (0, 5, 10, 20, 50, 100 µM $CdSO_4$) maruz kalan *B. rapa* yapraklarında Cd alımı ve birikimi analiz edilmiş; Cd stresinin HMA2 ve HMA4 genlerinin ekspresyonu üzerindeki etkisi araştırılmıştır. qRT-PCR sonuçları, HMA2 ve HMA4'ün düşük Cd seviyesinde (5-20 µM) *B. rapa*'da kadmiyum alımı ve translokasyonunda önemli bir rol oynadığını göstermiştir. Bununla birlikte, yüksek Cd seviyelerine (50 ve 100 µM) maruz kalma, *B. rapa*'nın büyümesini ve biyokütlesini önemli ölçüde azaltmıştır. Ayrıca, yüksek Cd seviyeleri, *B. rapa'*da HMA2 ve HMA4 genlerinin ekspresyonunu inhibe etmiştir. Verilerimiz, *B. rapa*'da Cd birikimi ve tolerans mekanizması ile ilişkili sinyal yolağında multigenetik (birçok taşıyıcı gen kümesinin birlikte etkisiyle) bir yanıt olduğunu göstermektedir.
Anahtar Kelimeler: *Ağır metal ATPazlar, HMA2, HMA4, Cd, Brassica rapa*

ID: 722

Evaluation of the Visual Landscape Quality of Parks: The Case of Serik/Antalya

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Abstract

The visual perception of landscapes is expressed as seeing the qualities of the landscape. For this reason, the relationship between landscape and perception is related to the level of people's perception of the landscape. This level of perception varies depending on the socio-cultural and economic structure of the people and the environment in which they live. The fact that the environment in which people live has a variable visual structure also constantly affects their landscape perception. Parks are one of the important urban landscape areas in cities. The existing structure of the parks located in the urban landscape areas affects the visual perception value of these areas on the users.

The aim of the research is to evaluate the visual landscape quality value of the parks in the city of Serik in the direction of user opinions. In this context, the photographs of the selected parks within the boundaries of the research area were taken from certain points. The questionnaire form prepared with these photographs was applied to the park users on a voluntary basis. The data obtained from the questionnaire forms were digitized and analyzed. Within the scope of the analysis, the data belonging to the socio-demographic structure of the participants and the answers they gave to the propositions about the parks were determined by descriptive analysis (frequencies and descriptives). Whether there was a statistically significant difference between the sociodemographic structure of the participants and their answers to the propositions was analyzed with parametric tests (independent sample t-test and one-way analysis of variance). At the same time, the relationship between the visual landscape quality assessment criteria of the parks was examined by Pearson Correlation Analysis. The results of the analysis show that the features of the parks due to their planning, design and maintenance affect the visual landscape quality values. In this direction, suggestions have been developed to increase the visual landscape quality value of the parks.

Key Words: *Urban, Urban Green Space, Park, Visual Landscape, Serik*

Parkların Görsel Peyzaj Kalitesinin Değerlendirilmesi: Serik/Antalya Örneği

Özet

Peyzajların görsel algısı, peyzajın sahip olduğu niteliklerin görülmesi olarak ifade edilmektedir. Bu nedenle peyzaj ile algı arasındaki ilişki insanların peyzajı algılama düzeyi ile bağlantılıdır. Bu algılama düzeyi kişilerin sosyo kültürel ve ekonomik yapısına, içerisinde yaşadığı çevreye bağlı olarak değişmektedir. Kişilerin içerisinde bulunduğu çevrenin değişken bir görsel yapıya sahip olması da onların peyzaj algısını sürekli etkilemektedir. Parklar kentler içerisinde yer alan önemli kentsel peyzaj alanlarından birisidir. Kentsel peyzaj alanları içerisinde yer alan parkların mevcut yapısı bu alanların kullanıcılar üzerindeki görsel algı değerini etkilemektedir.

Araştırmanın amacı, Serik kentindeki parkların görsel peyzaj kalite değerinin kullanıcı görüşleri doğrultusunda değerlendirilmesidir. Bu kapsamda araştırma alanı sınırları içerisinde seçilen parkların fotoğrafları belirli noktalardan çekilmiştir. Bu fotoğraflar ile hazırlanan anket formu gönüllülük esasına dayalı olarak park kullanıcılarına uygulanmıştır. Anket formlarından elde edilen veriler sayısallaştırılmış ve analiz edilmiştir. Analiz kapsamında katılımcıların sosyo demografik yapısına ait veriler ve parklara ait önermelere verdikleri cevaplar betimsel analizlerle, katılımcıların sosyodemografik yapısı ile önermelere vermiş oldukları cevaplar arasında istatistiksel olarak anlamlı bir fark olup olmadığı parametrik testlerle (bağımsız örneklem t testi ve tek yönlü varyans analizi) analiz edilmiştir. Aynı zamanda parkların görsel peyzaj kalite değerlendirme kriterleri arasındaki ilişki pearson korelasyon analizi ile incelenmiştir. Analiz sonuçları parkların planlanması, tasarımı ve bakımından kaynaklı sahip oldukları özelliklerin görsel peyzaj kalite değerlerini etkilediğini göstermektedir. Bu doğrultuda parkların görsel peyzaj kalite değerini arttırmaya yönelik öneriler geliştirilmiştir.

Anahtar Kelimeler: *Kent, Kentsel Yeşil Alan, Park, Görsel Peyzaj, Serik*

ID: 723

Atatürk Dam Lake's (Adıyaman, Türkiye) Planktonic Diatoms

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Abstract

In this study, the planktonic algae taken from stones at a station selected from Atatürk Dam Lake in Adıyaman province were investigated together with some physical and chemical parameters of the lake between March and November 2020. During this research, a total of 19 taxa belonging to the planktonic diatoms were recorded. The planktonic diatoms showed their best growth in summer when light and temperature are high.

During the study, *Cymbella* (4 taxa), *Gomphonema*, *Nitzschia* (3 taxa), *Navicula*, *Surirella* (2taxa) were the diatoms represented by the most species as well as being the most important ones in terms of the frequency of occurrence and the size of the populations they formed in the planktonik diatomic community.

Keywords: *Planktonic, Diatom, Atatürk Dam Lake, Adıyaman-Türkiye.*

ID: 724

A fundamental approach to the medicinal effects of walnut green husk (*Juglans regia* L)

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Abstract

Juglans regia L. is a tree species that has been of interest to humans since ancient times and is known as a species with important nutritional and therapeutic value. Wild stands of J. regia have been documented to occur in the temperate and semi-arid mountain areas of Central Asia, in east and south Asia, the Middle East and in the Caucasus region. Walnut was cultivated at commercial scales in 48 countries globally on a total area of 647,497 ha in 2016. China and the United States accounted for 47 and 31 percent of the total global walnut production, respectively. Further major producer countries include Chile, Iran and Ukraine. A review of recent studies shows Phenols actively partake in the physiological processes of walnut fruit growth and development, exerting various impacts on walnut fruits before and after harvest. Phenolic compounds are one of the most active antioxidant compounds total phenols essentially contribute to disease resistance. Phenolic contents vary in different parts and growth phases of the Persian walnut: total phenols increase in early and mid summe, followed by a decrease in late summer and a new increase before the harvest period. Stampar et al. (2006) identified a total of 13 phenolic compounds in walnut husks. Walnut green husks are rich in phenolic compounds such as juglone . Juglone (5-Hydroxy 1,4-naphtoquinone) is a specific phenolic compound that exists only in walnuts, especially in green walnut parts such as leaves, husks, stems and roots. Juglandin has exhibited cytotoxicity to different types of breast, lung and skin cancer cells. Vieira et al. (2020) showed the antibacterial effects of the antioxidant extract of green walnut shell againstGram-positive and Gram-negative bacteria. A growing concern for the environment, the desire to secure healthy food without synthetic chemical preservatives, as well as the increasing resistance of plant pathogens to fungicides are the main reasons for searching new effective, and more environmentally friendly plant protectors that green shell of walnut is one of the suitable candidates in this way. Research shows that green walnut skin extract had a special effect in inhibiting mycelium growth in A. alternata, P. cactorum, F. culmorum, B. cinerea and A. apis species.Walnut green husk (WGH) has been mentioned as a wound-healing agent in traditional Iranian medicine. Different parts of the Persian walnut have been used to treat a range of diseases, including skin disorders, cancer, infectious disease, diarrhea, hyperglycemia, anorexia, arthritis helminthiasis, sinusitis, eczema, asthma.5 Although different drug forms of the walnut green husk (WGH), the extract and burnt residues, were referred to as the wound-healing agents in the TIM/PM resources and previous reports indicated that the plant is a good source of phenolic compounds with high antioxidant potential. The researchers showed that the ethanol extract of WGH has the ability to heal wounds in mice, which was a promising result in this way. The obtained results are a step for the development of future applications using green walnut shell as a source of value-added compounds with bioactive potential.

Key Words: *Walnut, Husk, Juglandin, Phenolic, application*

ID: 725

A glimpse of the amazing effects of some effective medicinal plants on the skin

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Abstract

The skin is one of the sensitive parts of the body, the protection of which is effective in human beauty. Medicinal plants have less side effects than chemicals and chemical drugs, and they have effective pharmacological effects on the skin, which are widely used. For the following research, tools such as books, articles and electronic databases of Science of Web ISI, PubMed, Magiran and IranMedex were searched to determine the medicinal plants with positive effects on the skin, with an emphasis on healing and healing properties.

Some of the plants that played a role in the treatment of skin diseases and their effects were reported include avocado, thyme, *Aloe vera*, chamomile, almond, *Calendula*, olive, hofarikon, horsetail, *Eucalyptus*, rice bran, flax, tea and optional and reviewed. Therefore, many of the mentioned plants have been reported and proven to have very favorable properties either as a supplement in biochemical processes or as a coating on the skin, so the necessity of using them as much as possible is suggested.

Key Words: *Skin, Effective, Aloe, Plants, Supplement*

ID: 727

Stage Reached in Broiler Breeding Studies in Turkey: We Have to Success

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Abstract

Although broiler breeding studies in Turkey went back to the 1960s, the desired goal could not be achieved. Initial studies are based on crosses between pure breeds. In the following periods, successful results were obtained by producing ATEBRO and ERBRO genotypes in studies on the production of sire and dam parents. However, since these studies were not supported in the 1990s, the studies were completely stopped in 2004. In 2011, it was decided to start the studies again within TAGEM (General Directorate of Agricultural Research and Policies), and in 2015, at EGKTAE (Eşkişehir Transitional Zone Agricultural Research Institute) breeding studies were started with pure lines (3 dam and 2 sire lines). In these studies, commercial hybrids were produced by selection and hybridization and the material was registered as Anadolu-T in 2020.

The material has been shared with the private sector since 2018 and the field results are seen as positive. Especially nowadays, due to the capacity losses of commercial breeder companies, the reduction of the breeder amount they give to our country by 25% has increased the importance of the material.

Key Words: *Broiler breeding, Pure lines, Anadolu-T, Private sector, Performance*

Türkiye'de Etlik Piliç Islah Çalışmalarında Gelinen Aşama: Başarmak Zorundayız

Özet

Türkiye'de etlik piliç ıslah çalışmaları 1960'lı yıllara kadar gitmekle birlikte istenilen hedefe ulaşılamamıştır. İlk çalışmalar saf ırklar arasında yapılan melezlemelere dayanmaktadır. Sonraki dönemlerde ana ve baba ebeveynleri üretimine dönük çalışmalarda ATEBRO ve ERBRO genotipleri üretilerek başarılı sonuçlar alınmıştır. Ancak 1990'lı yıllarda bu çalışmalar desteklenmediği için 2004 yılında çalışmalar tamamen durdurulmuştur. 2011 yılında TAGEM (Tarımsal Araştırmalar ve Politikalar Genel Müdürlüğü) bünyesinde yeniden çalışmaların başlatılmasına karar verilmiş ve 2015 yılında EGKTAE (Eşkişehir Geçit Kuşağı Tarımsal Araştırma Enstitüsün) saf hatlarla (3 ana 2 baba hattı) ıslah çalışmaları yeniden başlatılmıştır. Bu çalışmalarda seleksiyon ve melezleme ile ticari hibritler üretilmiş ve 2020 yılında Anadolu-T olarak tescil edilmiştir.

Materyal 2018 yılından itibaren özel sektör ile paylaşılmakta ve saha sonuçları olumlu görülmektedir. Özellikle günümüzde ticari damızlık firmaların kapasite kayıpları nedeniyle ülkemize verdikleri damızlık miktarını %25 azaltmaları materyalin önemini arttırmıştır.

Anahtar Kelimeler: *Etçi ıslah, Saf hatlar, Anadolu-T, Özel sektör, Performans*

Giriş

Günümüzde tavukçuluk üretimden tüketime kadar ilgili alanların da etkisiyle bir sektör halini almıştır. Genetik, ıslah, biyoteknoloji, yem ve yem katkı maddeleri üretimi, kesimhane ve ileri işleme uygulamaları, ekipman sanayi, yumurta ürünleri endüstrisi, kuluçkacılık, sağlık koruma, ilaç ve aşı endüstrisi, pazarlama, muhafaza ile yetiştirme sistemlerindeki hızlı gelişmeler belirli bir zaman diliminde en hızlı değişen bir yapıyı oluşturmuştur. Bu gelişme ve değişimlerin aynı hızda olmasa da gelecekte de süreceği beklenmektedir. Tavukçuluktaki gelişmelerde etkin olan diğer faktörler ise hızlı nüfus artışına gıda sağlamadaki avantajları, ucuz ve kaliteli gıda üretimine imkan vermesi, üretimin kapalı bir sistemde yapılabilmesi, tüm girdilerin ve elde edilen ürünlerin kolayca taşınabilmesi ve üretimin diğer hayvan türlerine göre daha hızlı gerçekleşmesidir.

Dünyada kanatlı eti üretimindeki büyümenin büyük kısmı Asya ülkeleri kaynaklıdır. Özellikle Çin, Hindistan, Japonya, Güney Kore ve Türkiye'deki üretim artışları önemli etki yaratmıştır. Tavuk eti üretiminde Kuzey Amerika ve Avrupa, pazar paylarında düşüş yaşarken Güney Amerika'da Brezilya üretimin önemli merkezlerinden biri haline gelmiştir.

Dünyada kanatlı etinin çoğunluğu piliç etinden kaynaklanmaktadır. Kanatlı eti tüketici tercihlerindeki değişimler ve olumsuz algılara rağmen artış eğilimi yıldan yıla devam etmektedir.

Piliç eti üretiminde kıtalara göre değerlendirmelerde, Asya'da düzenli bir artış eğiliminin ortaya çıktığı görülmektedir. Amerika kıtası hala tavuk eti üretimindeki üstünlüğünü korumakla birlikte, Asya üretim artışlarıyla üretim merkezi olma yolundadır. Avrupa özellikle hayvan refahı ve üretim sistemlerine getirilen standartlar nedeniyle üretim artışının sınırlandığı kıta konumundadır. Afrika ile Okyanusya üretimde önemli artışların ortaya çıkmadığı kıtalardır.

Dünya piliç eti üretiminde 1970 yılında ilk 10 sırada olan ülkelerin sadece ikisi (Brezilya ve Çin) gelişmekte olan ülkedir. Bu dönemde ABD dünya kanatlı eti üretiminin yaklaşık %31'lik kısmını sağlamıştır. 2005 yılında ilk 10 ülkenin beşi gelişmekte olan ülkeler (Çin, Brezilya, Meksika, Hindistan, İran) olup, üç tanesi Asya'da bulunmaktadır. ABD hala lider konumunu sürdürmekle birlikte Çin ve Brezilya 2. ve 3. sıraya yerleşmiştir. Bunun yanında 2005 yılından itibaren Türkiye ve 2010 yılından itibaren Rusya ciddi üretim potansiyeli yaratan ülkelerdendir.

Tablo 1. Dünya et üretimindeki değişmeler (1000 ton)

Yıllar	Toplam et	Büyükbaş	Domuz	Küçükbaş	Kanatlı
1970	99.785	38.349	35.799	5.536	15.101
1980	134.846	45.551	52.683	5.647	25.965
1990	176.310	53.363	69.873	7.033	41.041
2000	228.996	56.951	90.095	7.759	69.191
2005	255.917	62.727	99.125	8.051	81.014
2010	294.600	67.500	109.900	13.500	98.200
2011	297.200	67.500	109.000	13.500	101.600
2012	304.200	67.000	112.400	13.700	105.400
2013	308.500	67.700	114.300	13.900	107.000
2014	315.400	68.000	116.900	13.900	111.000
2015	319.600	67.900	117.200	14.000	114.900
2016	320.700	68.400	116.400	14.100	116.200
2017	322.000	69.600	119.800	15.200	122.300
2018	337.300	71.200	120.500	15.200	124.800
2019	337.200	72.400	110.100	16.200	131.600
2020	338.100	71.600	109.800	16.200	133.400
2021	345.600	72.400	114.400	16.500	135.200

(Watt Executive Guide, 2000, 2010, 2015, 2021)

Tablo 2. Dünya piliç eti üretiminin kıtalara göre değişimi (1000 ton)

Yıllar	Afrika	Amerika	Asya	Avrupa	Okyanusya	Dünya
1970	543	4.033	1.520	3,396	80	13.140
1980	998	8.901	4.476	8.185	336	22.891
1990	1.849	14.362	8.590	10.162	454	35.416
2000	2.778	27.150	18.644	9.387	732	58.692
2010	4.507	38.917	29.220	13.688	1.050	87.382
2011	4.670	40.238	30.530	14.404	1.207	91.049
2012	4.814	40.371	32.234	15.357	1.244	94.020
2013	5.186	41.389	33.940	15.850	1.255	97.620
2014	5.353	42.640	34.354	16.692	1.314	100.353
2015	5.474	44.319	35.237	17.430	1.340	103.800
2016	5.361	44.936	37.073	17.840	1.429	107.143
2017	5.517	46.208	38.722	18.295	1.495	110.238
2018	6.192	46.798	42.154	19.041	1.469	115.629
2019	6.441	48.002	43.245	19.405	1.523	118.617
2020	6.378	48.451	43.491	19.684	1.499	119.505

(FAO, 2022)

Tablo 3. Piliç eti üretiminde ilk sıralarda yer alan ülkeler (1000 ton)

Ülkeler	1970	1980	1990	2000	2010	2015	2018	2019	2020
ABD	4.465	6.487	10.759	16.416	16.563	18.402	19.568	20.173	20.490
Çin	971	1.663	3.740	12.689	12.550	12.075	15.050	15.415	15.823
Brezilya	378	1.397	2.422	6.125	12.312	13.149	13.512	13.516	13.747
AB	3.533	5.611	6.355	8.204	9.202	11.415	10.641	10.894	11.037
Rusya	-	-	-	754	2.310	4.087	4.543	4.606	4.576
Endonezya	56	168	498	804	1.465	2.030	3.838	3.929	3.708
Meksika	192	399	750	1.825	2.822	2.962	3.338	3.477	3.579
Hindistan	81	112	361	864	2.650	3.263	4.061	4.180	3.551
Japonya	490	1.128	1.391	1.194	1.417	2.132	2.249	2.298	2.348
İran	87	211	380	803	1.666	2.053	2.154	2.186	2.219
Arjantin	177	281	322	958	1.680	1.969	2.068	2.203	2.219
Polonya	96	379	284	560	1.123	1.740	2.079	2.110	2.200
Türkiye	**97**	**240**	**402**	**643**	**1.420**	**1.909**	**2.157**	**2.138**	**2.138**
Tayland	196	287	575	1.045	1.220	1.713	1.699	1.704	1.782
Toplam	10.819	18.363	28.239	52.884	68.400	78.899	86.957	88.829	89.417
Diğerleri	2.321	4.534	7.177	5.808	18.982	24.902	29.672	29.788	30.087
Dünya	13.140	22.897	35.416	58.692	87.382	103.801	115.629	118.617	119.504

(FAO, 2022)

Avrupa Birliği Ve Türkiye Tavukçuluğu

AB ülkelerinde piliç eti üretiminde yıllar itibarı ile kısmi artışlar olmasına rağmen, özellikle büyük üretim kapasitesine sahip olan ülkelerdeki artışlar tüketim dengesi ile sınırlı olduğundan 2005 yılından itibaren artış trendinde ciddi azalmalar görülmüştür. Polonya piliç eti üretiminde AB ülkeleri içerisinde 2017 yılına kadar en yüksek üretime sahip olmakla birlikte 2018 yılında İngiltere ilk sıraya çıkmıştır. İngiltere'nin birlikten ayrılması ile Polonya yine lider ülke konumuna gelmiştir. Polonya, İspanya, Fransa, Almanya, Hollanda ve İtalya başlıca etlik piliç üretim merkezlerini oluşturmaktadır. AB ülkelerinde etlik piliç üretiminde etiketlenmiş (Label Rouge) üretim sistemiyle, önemli seviyelerde yer alan Fransa diğer ülkelerden farklı bir üretim gerçekleştirmektedir. Zaman zaman bu üretim sistemi toplam piliç eti üretiminde %30'a kadar çıkabilmektedir. Yavaş gelişen genotiplerle serbest gezinmeli (free-range) sistemde gerçekleştirilen bu üretim İngiltere başta olmak üzere diğer AB ülkelerinde de giderek etkili olmaktadır. Bu konuda hayvan refahı ile ilgili toplumsal yönlendirmeler etkili olmaktadır.

Tablo 4. AB ülkelerinde tavuk eti üretimi (1000 ton)

Ülkeler	**1970**	**1980**	**1990**	**2000**	**2010**	**2015**	**2018**	**2019**	**2020**
İngiltere[2]	495	615	790	1.214	1.376	1.521	1.750	1.726	1.784
Polonya[6]	96	379	284	560	1.123	1.740	2.080	2.111	2.200
İspanya[4]	496	750	807	965	1.116	1.203	1.346	1.412	1.401
Fransa[1]	523	852	1.049	1.242	1.024	1.160	1.131	1.121	1.130
Almanya[1]	299	472	416	462	837	1.027	1.021	1.036	1.066
Hollanda[1]	292	313	494	697	781	985	1.037	1.036	996
İtalya[1]	561	788	824	762	865	969	973	1.055	0.069
Romanya[7]	120	357	386	259	349	410	480	507	-
Belçika[1]	112	124	182	400	396	445	462	440	441
Macaristan[6]	145	281	317	281	221	313	327	336	354
Portekiz[4]	53	132	99	224	249	288	292	296	297
Yunanistan[3]	65	137	156	110	126	187	217	227	236
İsveç[5]	25	42	49	90	112	145	146	154	167
Danimarka[2]	70	88	124	187	186	145	146	157	165
Çek Cum,6	-	-	-	199	185	146	153	159	161
Avusturya[5]	44	68	75	87	107	116	109	115	125
Litvanya[6]	-	-	-	25	73	105	103	97	97
Bulgaristan[7]	92	145	182	105	86	85	87	89	87
İrlanda[2]	24	40	63	86	85	84	132	141	152
Finlandiya[5]	9	15	33	64	88	109	127	131	137
Slovakya[6]	-	-	-	61	70	57	73	70	-
Slovenya[6]	-	-	-	44	54	54	64	64	67
Hırvatistan[8]	-	-	-	25	22	37	53	54	57
Letonya[6]	-	-	-	7	23	29	33	35	35
Güney Kıbrıs[6]	9	10	21	32	28	23	25	26	26
Estonya[6]	-	-	-	7	16	19	19	20	22
Malta[6]	2	5	4	6	4	3	4	4	4
Lüksemburg[1]	-	-	-	0.6	0.2	0.2	0	0	0
AB toplam	**3.532**	**5.613**	**6.355**	**8.202**	**9.602**	**11.405**	**10.641**	**16.894**	**11.037**
Türkiye	**97**	**240**	**402**	**643**	**1.420**	**1.909**	**2.157**	**2.138**	**2.138**

[1]: Kurucu üyeler, 1952; [2]: 1973'te katılan ülkeler; [3]: 1981'de katılan ülkeler; [4]: 1986'da katılan ülkeler; [5]: 1995'te katılan ülkeler; [6]: 2004'te katılan ülkeler; [7]: 2007'de katılan ülkeler; [8]: 2013'te katılan ülkeler; [8]: son katılan ülkeler. İngiltere 2022 yılı başında birlikten ayrıldığı için 2020 yılına kadar olan veriler tabloya dahil edilmiştir (FAO, 2022).

AB piliç eti ve yumurta üretimi, aynı üretim ve ticaret şartları uygulanması koşuluyla, ülkemiz tavukçuluk sektörü açısından bir risk taşımamaktadır. Ancak tavukçuluk sektörüne rekabet gücü kazandırmak ve Türkiye tavukçuluğunun sürdürülebilir gelişmesini devam ettirmek için önlemler alınmalıdır. AB ülkeleri ile entegrasyona hazırlanmak için öncelikle tarım politikası çerçevesinde AB ülkelerininkine benzer bir politika oluşturulmalıdır. Türkiye'ye AB karşısında rekabet kazandırmak için yapılacak devlet destekleri öncelikle üretim aşamasında ve maliyetlerin düşürülmesine yönelik olmalıdır. Sektörde önemli bir girdi olan yem maliyetleri dünya fiyatlarına yaklaştırılmalıdır. Bunun sağlanabilmesi için de yem bitkileri üretimi özendirilmelidir. Buna ilave olarak üreticiler eğitilmeli ve işletmelerin modernizasyonuna devam edilmeli, pazarlama hizmetleri iyileştirilmelidir.

Avrupa Birliği'ne son katılan ülkelerin tamamında tavukçuluk ve diğer kanatlı hayvanlar üretimi Türkiye'den daha geri durumdadır. Bu ülkelerden bir kısmının ithalatçı olduğu da düşünüldüğünde Avrupa Birliği'ne katılma çalışmalarını sürdüren ülkemiz açısından önemli bir dezavantaj oluşturmadıkları düşünülmektedir. Avrupa

Birliğine katılma konusunda ortaya çıkacak olumlu sonuçlar özellikle ürünlerin dağıtımı ve pazarlama kanallarındaki bazı olumsuzlukların da ortadan kalmasına yardımcı olarak ülkemizde tüketicinin ürün kalitesi konusundaki seçeneklerini arttıracaktır. Ancak hayvan refahı konusunda ülkemizin uyum için koyduğu 2015 yılı sonuna kadar uygulanması gereken konuların süresiz olarak ertelenmesi AB ülkelerinin ihracat konusunda engel için bir alan olarak görülebilir. Ürünlerin AB ülkelerinde serbest dolaşımını sağlayabilmek için hayvan refahı uygulamaları ile ilgili AB mevzuatı en azından yeni kurulacak işletmeler için uygulamaya koyulmalıdır.

Türkiye Tavukçuluğu

Türkiye'de üretilen tavuk eti ve yumurtaya ait hibrit materyalin tamamına yakını ebeveyn veya kısmen büyük ebeveyn olarak ithal edilmektedir. Yumurta ve piliç eti üretiminde kullanılan hibritlerin üretimi amacıyla her yıl artan sayıda ebeveyn (parent stock) ve kısmen büyük ebeveyn (Grand parent stock) girişi olmaktadır. Türkiye ticari yumurta ve et tavukçuluğunda dünyada sayılı ülkeler arasında yer almasına rağmen damızlık üretiminde bugüne kadar önemli bir ilerleme sağlanamamıştır. Damızlık materyal yumurta tavukçuluğunda %95.0-97.5, et tavukçuluğunda ise %98.0 oranında yurtdışından sağlanmaktadır. Yumurtacı ıslah çalışmaları Ankara Tavukçuluk Araştırma Enstitüsünde 11 saf hat üzerinde kahverengi ve beyaz yumurtacılarla ulusal düzeyde sürdürülmektedir. Serbest gezinmeli üretim sistemlerinde yerli materyal kullanım oranı %50'lere kadar ulaşmıştır. Bu çalışmalardan elde edilen hibrit ebeveynlerinin ticarileştirilmesine çalışılmaktadır.

Etçi ebeveynlerde alternatif üretim sistemlerine yönelik yavaş gelişen etlik piliç ebeveynleri üretiminde başarılı sonuçlar alınmıştır. Ancak bunların çoğaltılarak ticarileştirilmesinde başarı sağlanamamıştır. Etlik piliç üretiminde kullanılmak üzere ebeveyn geliştirme çalışmaları Eskişehir Geçit Kuşağı Tarımsal Araştırma Enstitüsüne bağlı olarak 2015 yılında yeniden başlatılmış ve ilk ebeveyn üretimi 2018 yılında gerçekleştirilerek özel sektörle paylaşılmıştır. Bu çalışmalar halen 3 ana 2 baba hattı ile etkin olarak sürdürülmektedir. Çalışmalarda Anadolu-T olarak tescil edilen ebeveyn materyalinin 2022 yılında özel sektörle paylaşımına devam edilmektedir. Özellikle 2022 yılında damızlık firmalarının Türkiye'ye verdikleri materyali %25 azaltmaları bu materyalin ne kadar önemli olduğunu göstermektedir.

Islah Çalışmaları

Türkiye'de modern tavukçuluk Cumhuriyetin kuruluşundan sonra başlamış ve 1960'lı yıllardan sonra hızlı bir gelişme sağlanmıştır. Bugün ülkemizde yetiştiricilik başarıyla sürdürülmektedir. Piliç eti üretiminde entegre şirketlerin kurulması ve işletmelerin üretimle ilgili tüm ihtiyaçlarının karşılandığı sözleşmeli üretim modelinin gelişmesiyle 1990'lı yıllar boyunca %10'lara varan yıllık üretim artışları yaşanmıştır. Yumurta üretim ve pazarlama süreci ise piliç etinden bazı farklılıklar göstermektedir. Yumurta üretim işletmeleri, 2006 yılında yürürlüğe giren Tarımsal Üretici Birlikleri Kanunu hükümlerine göre, 'Yumurta Üreticileri Merkez Birliği (YUM-BİR) adı altında bir araya gelmişlerdir. Ancak bu birliklerin üretim aşamasında etlik piliç üretiminde olduğu gibi entegrasyonu söz konusu değildir.

Ülkemizde tavukçuluğun geliştirilmesine yönelik ilk çalışmalar 1930'lu yıllarda Ankara'da Merkez Tavukçuluk Enstitüsünün kurulmasıyla başlamıştır. Bu Enstitüde teknik bilgi ve eleman yetersizliği nedeniyle ilk 20 yıl içerisinde önemli bir ilerleme olmamıştır. Bu dönemde üretilen tavuklar, verim düzeyleri düşük yerli ırklardan ve karışık sürülerden oluşmuş, bakım besleme ise serbest sistemde "köy tavukçuluğu" olarak nitelenen şekilde gerçekleştirilmiştir. Bu yıllarda yaklaşık 20 milyon olarak belirlenen ülke tavuk varlığından hayvan başına yıllık 50-60 yumurta elde edildiği belirtilmiştir.

1952 yılında Tarım ve Orman Bakanlığı'na bağlı Merkez Tavukçuluk Komitesi ile çalışmaların daha etkin yürütülebilmesi için Ziraat İşleri Genel Müdürlüğüne bağlı Küçük Evcil Hayvancılık şubesi kurulmuştur. Bu dönemde bakanlıkta danışmanlık yapan ABD'li bir uzmanın girişimleriyle ABD'den hibe olarak 10 bin kadar Leghorn, New Hampshire ve Beyaz Plymouth Rock civcivleri getirilerek Bakanlığa bağlı kuruluşlarda üretilmeye başlanmıştır. Sonraki yıllarda yapılan ithalatlarla saf ırkların (Rhode Island Red, Cornish, Çubuklu Plymouth Rock) sayısı arttırılmış, bunlar kamu kuruluşlarında çoğaltılarak yetiştiricilere ve köylere dağıtılmıştır.

Getirilen saf ırklarda önemli bir araştırma ve ıslah çalışması yapılamamıştır. Buna rağmen üretim çalışmaları bir yandan ilgi uyandırmış, bir yandan da yeni tekniklerin gelmesini zorlamıştır. 1958 yılında Veteriner İşleri Genel Müdürlüğü bünyesinde Kümes Hayvanları Yetiştirme ve Hastalıkları Şubesi kurulmuştur. 1955-1956 yıllarında birisi İstanbul'da özel, diğeri de Ankara'da Et-Balık Kurumu bünyesinde büyük kapasiteli tavuk kesimhaneleri açılmıştır. 1956 yılında Yem Sanayi A.Ş kurularak daha sonraki yıllarda ilave fabrikalarla karma yem üretimi artırılmıştır. Tavukçuluk uzmanı yetiştirmeye önem verilmiş ve çiftçi düzeyinde kurslar düzenlenmiştir. Ancak 1960 yılına kadar Türkiye tavukçuluğunda önemli bir gelişme olmamış, tavukçuluğun bir endüstri olarak geliştiği dünyadaki gelişmeler ülkemize transfer edilememiştir.

Saf ırklar ve melezleri ile yapılan çalışmalar

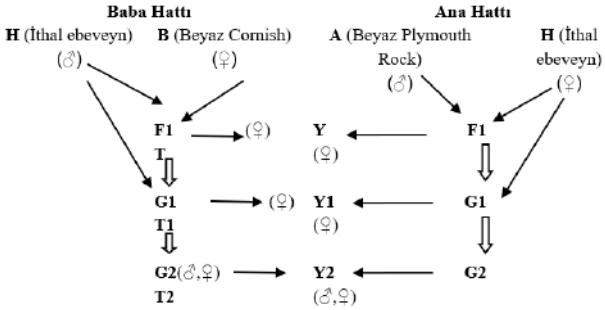
Ankara Tavukçuluk Araştırma Enstitüsüne saf ırkların getirilmesiyle dünyada tavuk eti üretimindeki uygulamalara benzer işlemlere başlanmış; kapsamlı-sürekli projeler olmasa da ıslah araştırmaları yürütülmüştür. Bu amaçla New Hampshire, Plymouth Rock, Rhode Island Red ve Beyaz Cornish ırkları ve bunların melezlerinin etlik piliç

üretiminde kullanımı amacıyla üretimi hedeflenmiştir. Irklar arası melezlemelerle et verimi düzeyi yüksek piliçler üretimi ile ilgili çalışmalar döneminde dünyadaki çalışmalarla benzerlik göstermiştir. Ancak çalışmaların etkin bir seleksiyonla desteklenmemesi nedeniyle, dünyada yapıldığı gibi hibrit üretimine geçiş sağlanamamıştır.

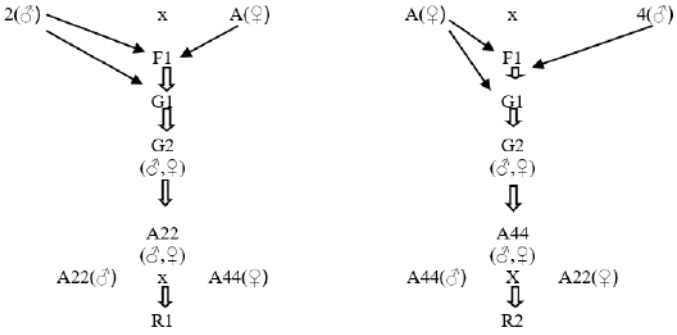
Hibrit ebeveynleri ile yapılan çalışmalar

Ülkemize 1963 yılında hibrit ebeveynlerinin ithali ile saf ırklar ve melezleri ile yürütülen çalışmalar ticari işletmeler açısından önemini kaybetmeye başlamıştır. Bu nedenle güncel teknolojilerin kullanıldığı projeler 1968 yılında Ankara Tavukçuluk Araştırma Enstitüsünde başlatılmıştır. Bu projeler, ıslah, çoğaltma ve üretimde kullanma amaçlarını ortaya koyan Ulusal Tavukçuluk Islah projesi olarak adlandırılmıştır.

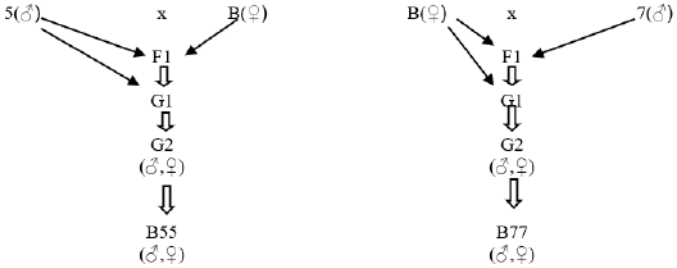
Beyaz Cornish ve Beyaz Plymouth Rock gibi ırklarda melezleme ve seleksiyonla ana ve baba hatlarının geliştirilmesi ile başlanan çalışmalar, işlemin uzun süreceği düşünülerek Beyaz Cornish ve Plymouth Rock ırklarının ithal edilen etçi ebeveynlerden Hybro, Hubbard gibi hatlarla çiftleştirilmesiyle daha hızlı sonuçlar alınacağı için bu yöne kaydırılmıştır. Bu çalışmalarda G2 generasyonuna kadar yapılan üretimle ilk yerli etçi ebeveynler üretilebilmiştir.



Çalışmalarda T2xY2 melezlerinin etlik piliç üretiminde kullanımı amaçlanmıştır. Devamında ana ve baba hatları, döllerinin performansına göre ıslah edilmeye çalışılmış ve bu materyal önce ATE-BRO, sonra da çalışmaların Erbeyli Zirai Araştırma Enstitüsüne kaydırılmasıyla ERBRO olarak adlandırılmıştır. Sonraki yıllarda Erbeyli Zirai Araştırma Enstitüsünde kapasite arttırılmaya çalışılmış, elde dilen sonuçların ülke geneline yaygınlaştırılmasına gayret edilmiştir. Bu dönemde Enstitüde ERBRO hattında seleksiyon ve yeni hatlar üretmeye yönelik çalışmalara hız verilmiştir. Ebeveynlerin kafes koşullarında yapay tohumlama ile üretimi gerçekleştirilmiş, önemli bir kapasiteye ulaşılmıştır. Bu dönemde elde edilen etçi hibritlerden işletmelere verilebilen miktar itibarıyla ülke ihtiyacını karşılama oranı ancak %1-2.5 seviyesine ulaşılabilmiştir. Enstitüde ebeveyn ve hibrit üretiminde aşağıdaki sistem esas alınmıştır.



A; ERBRO sentetik ebeveyn ana hattı, 2,4: Dış kaynaklı ebeveyn ana hattı erkekleri



B; ERBRO sentetik ebeveyn baba hattı, 5,7: Dış kaynaklı ebeveyn baba hattı erkekleri

Tablo 5. Yerli ve yabancı hibritlerin etlik piliç performansları (Düzgüneş, 1985).

Hibritler	6. hafta canlı ağırlık (g)	8. hafta canlı ağırlık (g)	Yemden yararlanma oranı (8. hafta)
ERBRO	1610	2455	2.86
Yabancı 1	1630	2475	2.82
Yabancı 2	1530	2370	3.02
Yabancı 3	1428	2235	2.96

Bu çalışmalar, Erbeyli Tavukçuluk Araştırma Enstitüsünün adının değişmesi, uygulamaya koyulan politika ve hedeflerin değişmesiyle 1987 yılından itibaren yeterince desteklenmemiştir. Özellikle tarım politikalarında üretimin teşviki yerine ithalata dayalı uygulamalara ağırlık verildiği bu dönemde araştırma çalışmaları da ciddi anlamda gerilemiştir. 1998 yılında, ciddi araştırma ve üretim seviyesine gelindiği, teknik personelde çok iyi bir deneyim ve birikim sağlandığı noktada çalışmalar durdurulmuştur.

Enstitüde 1994 yılında İsrail'den getirilen çıplak boyunlu, sıcağa toleranslı genotipler üzerinde çalışmalar yürütülmekle birlikte bu çalışmalar da 2000 yılında sona erdirilmiştir. 1995 yılında Ankara Tavukçuluk Araştırma Enstitüsüne Kanada'dan gelmiş olan saf hatlarla birlikte alınan bir etçi hat Enstitüye verilmiş, ancak bunun da muhafazası sağlanamamıştır. Bu hatta ait sonuçların verildiği bir çalışmada, materyalin ana hattına ait özellikleri taşıdığı ve elde edilen sonuçların ithal edilen birçok ebeveyn hatta ait performans değerlerini geçtiği belirtilmiştir. Enstitü İncir Araştırma Enstitüsü olarak isimlendirilmiş, bir süre organik tavukçuluk ve besleme amaçlı projelerin uygulandığı bir kurum haline gelmiştir. Zaman içerisinde bu işlevini de kaybederek tavukçuluk altyapısına rağmen, 2017 yılında tavukçuluk araştırmaları tamamen iptal edilmiştir.

İthal ebeveynlerden sentetik hat üretme çalışmaları

Baba ve ana ebeveyn olarak ticari firmalardan alınan civcivlerde cinsiyet ayrım hataları nedeniyle baba hattında dişi, ana hattında ise erkek civcivler %5-10 arasında olabilmektedir. Büyük kapasiteli işletmelerde bu sayı önemli bir miktar olarak görülmektedir. Bu materyalden yararlanılarak baba ve ana hatlarının kendi içerisinde üretilmeleri ile elde edilen sentetik hatların döl verim özellikleri ve etlik piliç performansının orijinal ebeveynlerle karşılaştırılmasından olumlu sonuçlar alınmıştır. Bu ebeveyn hatlarının ikili melez olmasına rağmen bir kuşak bunlardan üretim yapılması mümkün olabilmektedir. Benzer çalışmalar değişik ülkelerde yapılmış ve başarılı sonuçlar elde edilmiştir. Bu çalışmalar ticari bir etlik piliç damızlık şirketinde (Hatay) gerçekleştirilmiş, işletmenin 3 milyona varan kapasitesi nedeniyle cinsiyet hatası damızlık oluşturmada bir sıkıntısı olmamıştır. Çalışmada gerek ebeveyn düzeyinde gerekse hibrit düzeyinde elde edilen sonuçlar yeterli görülmüştür.

Buna karşın damızlık üretiminin ticari damızlık şirketlerin kontrolünde olması, bu tür üretimler için izin alma gerekliliği ve damızlık olarak alınan civcivlerin yılın değişik dönemlerinde üretime alınması, farklı yaşlarda küçük sürüler oluşturulmasını mecbur kılmaktadır. Bu durum damızlık işletmeler için ilave kümes, işgücü ve sağlık koruma önlemi olacağı için sürdürülmesinde zorluklar yaşanmıştır. Elde edilen sürülerin seleksiyonla verimlerinin arttırılması ise damızlık işletmelerin yapabileceği bir uygulama olamaz.

Tablo 6. Ticari etlik piliç ebeveynlerinden üretilen sentetik etlik piliçlerin performansları (Yeter, 2010).

Özellikler	Ticari Etlik Piliç	Sentetik Etlik Piliç
Civciv ağırlığı (g)	39.7	37.7
Canlı ağırlık (42. gün, erkek-dişi karışık)	2481	2375
Yem tüketimi (g)	4429	4372
Yemden yararlanma oranı (YYO)	1.79	1.80
Ölüm oranı (%)	3.26	3.50

Alternatif etlik piliç materyali üretim çalışmaları

Dünya'da tavuk eti tüketiminde entansif üretimden elde edilen piliç eti ilk sıradadır. Buna karşılık tüketici taleplerine göre üretim sistemleri ve yeni ürünlere eğilimler artmaktadır. Özellikle yarı entansif, ekstansif, serbest gezinmeli ve organik üretimden elde edilen ürünler tercih edilebilmektedir. Bu ürünlerin sağlıklı ve hayvan refahına uygun üretildiği imajı talebi artırmaktadır. Bu üretimler ile ilgili kurallar Avrupa Birliği kaynaklı olup, birliğe katılma çalışmaları olan ülkemizde değerlendirme raporlarında gündeme gelen konulardandır.

Bu amaçla yavaş gelişen, geç kesim yaşına ulaşan, düşük kaliteli yemlerle beslenen, renkli veya karışık tüylü, et tipi tavuk üretimi artmaktadır. Bu tavukların et ve deri renginin koyu olması ve tüketicilerin daha lezzetli bulması yaygınlaşmada etkendir. Yavaş gelişen tavuklar, organik ve serbest gezinmeli sistemlere daha uygundur ve 80-120 gün arasında 2.2-2.5 kg ağırlığa ulaşırlar. Organ ve kaslar dengeli geliştiğinden, ani gelişme kaynaklı metabolik bozukluklar daha az görülür. Çin'de Three Yellow (3Y) olarak bilinen bu tavuklar, yerel tavukların saf hatlarla melezlenmesi ile geliştirilmiştir. İngiltere'de "Assured chicken", Almanya'da "Qualitat und Schereit", Hollanda'da "IKB chicken", Belçika'da "Label de Qualite Wallon ve Belplume", İspanya'da "Polo corral", Fransa'da "Label Rouge" olarak bilinen piliçler bu gruptadır. Label Rouge'lar, etlik piliçlere göre iki kat yüksek fiyatla pazarlanmasına rağmen Fransa'da %30'luk bir paya ulaşmıştır. Avrupa, yavaş gelişen hibrit üretiminde etkin olup HUBBARD ve SASSO, bu konuda en çok bilinen uluslararası şirketlerdir.

Ülkemizde de son yıllarda tüketicilerin organik ürünlere talebi artmıştır. Organik ve serbest gezinmeli sistem ile kafeste etlik piliç üretiminde yavaş veya orta düzeyde gelişen, kesim yaşı 56-84 gün olan piliçler kullanılmaktadır. İhtiyaç duyulan genotiplerin ithalinden başka yol bulunmamaktadır. Daha kolay ıslah çalışmalarıyla üretilebilen yavaş gelişen genotipler, ülke ekonomisi ve araştırmalar açısından açılım sağlayacaktır. Bu amaçla bir proje kapsamında; yavaş gelişen etçi ebeveyn üretimi için Ankara Tavukçuluk Araştırma Enstitüsü'nde bulunan iki yumurtacı hat (BAR II ve RIR II) ile ROSS ebeveynlerinden yararlanılarak baba ve ana ebeveyn hatları geliştirilmiştir. Çalışmada elde edilen bazı sonuçlar Tablo 1.16'da verilmiştir.

Tablo 7. Yavaş gelişen genotiplerde elde edilen canlı ağırlıklar (Yamak ve ark., 2014).

Genotip	**Yetiştirme Sistemi**	**Yaş (hafta)**				
		8	**9**	**10**	**11**	**12**
ROSS♂ x (BARxROSS)♀	A	2443.6	2859.3	3220.7	3567.3	3651.3
	K	2565.7	3062.4	3240.1	3651.5	3717.7
	Ortalama	2504.6 b	2960.9 b	3230.4 b	3609.4 b	3684.5 b
ROSS♂ x (RIRxROSS)♀	A	2625.5	3169.0	3553.0	3689.3	3868.2
	K	2682.3	3202.6	3435.0	3702.0	4033.9
	Ortalama	2653.9 a	3185.8 a	3494.0 a	3695.7 a	3951.0 a
(ROSSxBAR)♂ x BAR♀	A	1343.5	1582.5	1776.4	1919.9	2120.1
	K	1321.2	1573.9	1792.8	1905.6	1999.0
	Ortalama	1332.2 c	1578.2 c	1784.6 c	1912.8 c	2059.6 c
(ROSSxRIR)♂ x RIR♀	A	1344.9	1599.9	1723.7	1990.4	2166.2
	K	1373.4	1607.9	1794.7	1892.1	2183.7
	Ortalama	1359.1 c	1603.9 c	1759.2 c	1941.2 c	2174.9 c
OSH		15.185	14.285	19.580	16.763	24.734
Genotip		**	**	**	**	**
Yetiştirme sistemi		ÖNSZ	ÖNSZ	ÖNSZ	ÖNSZ	ÖNSZ
Cinsiyet		**	**	**	**	**

OSH: Ortalama standart hata; A: Serbest gezinmeli, K: Kapalı sistem; E: Erkek, D: Dişi, K: Erkek-Dişi karışık.
**: P<0.01; ÖNSZ: Önemsiz; a, b, c: Duncan testi sonuçlarına göre her hafta için ayrı harfle gösterilen genotipler arasındaki farklılıklar önemlidir.

Bu veriler ebeveyn üretimi amacıyla gerçekleştirilen ikili melez grupların tamamının orta veya yavaş gelişme özelliğine sahip olabileceğini göstermektedir. Son üretim materyali olan genotip gruplarında da aynı şekilde canlı ağırlık açısından orta ve yavaş gelişme özelliğine sahip üçlü melez genotiplerin üretimi uygun görülmektedir.

Saf hatlarla yapılan çalışmalar

Dünyada damızlık etlik piliç veya yumurtacı tavuk üretimi yaparak ülkelerin ihtiyacını karşılayan az sayıda firma bulunmaktadır. Bu firmaların ürünleri tüm ülkelerde olduğu gibi ülkemizde de kullanıldığı için damızlık materyalde tam dışa bağımlılık söz konusudur. Gelecekte de bu durumun devam etmesi beklenmekle birlikte hastalık riskleri ve araştırma faaliyetleri amacıyla 2011 yılında Tarımsal Araştırmalar ve Politikalar Genel Müdürlüğü etlik piliç ebeveyn üretimi için ıslah çalışmaları başlatılmasına karar vermiştir (Sarıca ve ark., 2016). Bu araştırmalar için Eskişehir Geçit Kuşağı Tarımsal Araştırma Enstitüsünde bir araştırma birimi kurulmuş ve bir ıslah firmasından 3 ana ve 2 baba ebeveyn hattı alınarak çalışmalara başlanmıştır. Bu ebeveyn hatlarının yumurtlama dönemine ait verim özellikleri ile saf hat ve ikili melez döllerinin etlik piliç performansları olumlu bulunmuştur. Bu amaçla 2018 yılından itibaren ticari iletmelere bu materyale ait ebeveyn sürüler verilerek ebeveyn performanslarının ticari işletmelerde değerlendirilmesi amaçlanmıştır. Hatlarda canlı ağırlık, yem tüketimi ve yemden yararlanma düzeyi ile yumurta verimlerinin kabul edilebilir seviyede sürmesi için aile düzeyinde seleksiyon çalışmaları yapılmakta, bir yandan da en iyi ebeveyn ve hibrit performansı sağlayacak üretim çalışmaları devam etmektedir. 2018 yılında bu materyalden 5 firmaya 36.000, 2020 yılında 2 firmaya 25.000 damızlık ebeveyn verilmiştir. 2021 ve 2022 yıllarında damızlık paylaşımı devam etmiş, 12 firmaya 120.000 damızlık verilmesi işlemleri sürmektedir. Toplam damızlık sayısı 181.000, sağlanan katma değer 181.000 x 4.5 Avro=814.500, 14.661.000 TL). Bu hatlar ve hatlardan üretilen hibritler Anadolu-T olarak isimlendirilmiş ve test çalışmaları yapılan özellikler doğrultusunda 2019 yılında TAGEM tarafından tescil edilmiştir.

Tablo 8. Etlik piliç saf hatları, ticari hibritler (Ross-308 ve Anadolu-T) ile dörtlü melez genotiplere ait verim indeksi değerleri (Sarıca ve ark., 2021)

Genotip	Canlı ağırlık (kg)	Yaşama Gücü (%)	Yemden yararlanma	Besi süresi (gün)	Verim İndeksi 1	Verim İndeksi 2
B1B2xA1A2	2.829	97.33	1.717	42	160.4b	381.8b
B1B2xA1A3	2.743	98.67	1.667	42	162.4b	386.6b
B1B2xA2A1	2.798	96.67	1.700	42	159.1b	378.8b
B1B2xA2A3	2.800	98.67	1.677	42	164.7b	392.2b
B1B2xA3A1	2.860	97.40	1.713	42	162.6b	387.2b
B1B2xA3A2	2.783	96.00	1.677	42	159.3b	379.3b
B2B1xA1A2	2.797	94.67	1.680	42	157.6b	375.3b
B2B1xA1A3	2.659	97.33	1.693	42	152.9bc	364.0bc
B2B1xA2A1	2.780	96.00	1.660	42	160.8b	382.8b
B2B1xA2A3	2.727	100.00	1.667	42	163.6b	389.5b
B2B1xA3A1	2.796	98.67	1.677	42	164.5b	391.7b
B2B1xA3A2	2.641	98.67	1.697	42	153.6bc	365.6bc
ANADOLU-T	**2.773**	**96.67**	**1.697**	**42**	**158.0b**	**376.1b**
ROSS-308	2.961	97.33	1.520	42	189.6a	451.4a
A1	2.308	95.33	1.713	42	128.4d	305.8d
A2	2.505	93.33	1.653	42	141.4c	336.7c
A3	2.372	98.67	1.743	42	134.3cd	319.7cd
B1	2.764	95.33	1.687	42	156.2bc	371.9bc
B2	2.634	96.00	1.733	42	145.9c	347.4c

a…e: Tukey testi sonuçlarına göre her bir özellik için değişik harfle gösterilen ortalamalar arasındaki farklılıklar önemlidir (P<0.05).

Tablo 9. Etlik piliç saf hatları ve hibritlerin performans (2022) sonuçları (Sarıca ve Erensoy, 2022).

Genotip	Canlı ağırlık (g)		Yemden yararlanma oranı		Yaşama gücü (%)
	35. gün	42. gün	35. gün	42. gün	42. gün
A1	1857.8c	2492.1d	1.473a	1.607ab	97.93
A2	1815.0c	2433.1d	1.434a	1.557b	95.83
A3	1785.3c	2415.7d	1.468a	1.602ab	96.88
B1	2170.4ab	2912.8b	1.443a	1.585ab	88.55
B2	2166.1ab	2837.7bc	1.475a	1.651a	93.75
Anadolu-T	2124.0b	2775.7c	1.477a	1.597ab	93.75
Ross-308	2276.5a	3085.9a	1.263b	1.342c	96.88

a-d: Tukey HSD testi sonuçlarına göre değişik harfle gösterilen ortalamalar arasındaki farklılıklar önemlidir (P<0.05)

Ülkemize araştırma projeleri kapsamında kazandırılan bu ebeveynler ve melez döllerinin gelişme ve karkas özelliklerinin ticari hatlarla benzerlik gösterdiği görülmektedir. Mevcut seviye korunarak bu hatların çoğaltılması, ikili melez ana ve baba ebeveynlerin geliştirilmesi, dörtlü melezlemeyle hibrit üretilmesi ile daha etkin sonuçlar elde edilmektedir. 2022 yılından itibaren pedigrili üretimle ıslah çalışmalarına devam edilen saf hatlarda özellikle yemden yararlanmanın ve göğüs eti miktarının iyileştirilmesi temel ıslah hedeflerine alınmıştır.

Türkiye Tavuk Islah Çalışmaları İçin Öneriler

Dünya tavukçuluk sektörünün, başta damızlık olmak üzere birçok halkasında tekelleşme görülmektedir. Yumurta ve piliç eti üretiminde ticari nitelikli hayvanların payı, gelişmiş ülkelerde oldukça yüksektir. Gelişmekte olan ülkelerde de benzer bir yapı bulunmaktadır. Ticari üretimin yaygınlaşması ve üretimde genotip çeşitliliğinin azalması, damızlık fiyatlarının piyasa koşulları dışında belirlenmesine neden olacak, diğer yandan da tavuk populasyonları hastalık riskine açık hale gelecektir. Bu sorunlardan ikincisi çeşitli yollarla aşılsa bile, kaynak ülke ya da şirketlerin çeşitli nedenlerle hayvan satamama riski olabilecektir. Nitekim 2003, 2004, 2005 ve 2011 yıllarında çıkan Kuş Gribi, 2020 yılında ortaya çıkan Corana-19 pandemisi nedeniyle konulan kısıtlama ve yasaklamalar damızlık üretimi olmayan ülkeleri ne tür olumsuzlukların beklediğinin göstergesidir. 2014, 2015, 2016, 2017 ve 2018 yıllarında tüm dünyada kuş gribi akaları ticareti ciddi boyutlarda etkilemeye devam etmiştir. Daha kötüsü, 2022 yılında Uluslararası etlik piliç damızlık şirketlerinin ikisi, yaşanan kuş gribi vakaları nedeniyle Türkiye'ye verecekleri damızlık sayısında %25 azaltma yapmıştır. Bu yüzden tavuk ürünleri üretim potansiyeli giderek artan ülkemiz için, nitelikli damızlık yetiştirme, tanıtım ve dağıtımını yapmayı göze alacak uygulamalara girilmesi ve özel sektörle paylaşılması kaçınılmazdır.

Üretimde ticari ıslah firmaları etkinliklerini sürdürmekle birlikte, her ülkede devlet ve özel sektör katkılı araştırmalar devam etmektedir. Üretilen genotipler uluslararası şirketlerin ürünüdür. Dolayısıyla Türkiye'de kullanılanların genetik kapasitesi diğer ülkelerdekilerden farklı değildir. Bu alanda çalışan firmaların sayısı hızla azalmaktadır. Bundan 10 yıl önce 10-12 olan firma sayısı, günümüzde yumurta tavukçuluğunda 4, et tavukçuluğunda 3'e düşmüştür. Bu durum bir süre sonra, tavukçulukta da tekelleşmeye neden olacaktır. Islah firmaları büyük masraf ve emekle geliştirdikleri saf hat ve ebeveynleri, hastalıklara karşı korumak ve sürdürülebilir üretimi garanti altın almak için değişik bölgelerde yedeklerler. Yedeklenen sürüler seleksiyon yapılmadan korunabildiği gibi, ıslah firmasının uyguladığı yöntemlerin paralelinde ıslah da yapılabilir. İkinci durumda firmanın geleceğe dönük ebeveynleri de bir yanda hazır hale getirilmektedir. Her iki durumda da sürülerde çoğalmaya engel olmayacak düzeyde horoz ve tavuğun yedeklenmesine ihtiyaç vardır.

Bütün ele alınan konular tavukçuluk ıslah organizasyonunun bir parçası olup biri diğerine tercih edilemeyecek kadar önemlidir. Bu yüzden Ankara Tavukçuluk Araştırma Enstitüsü ile Eskişehir Geçit Kuşağı Tarımsal Araştırma Enstitülerinde elde edilen ebeveyn materyalin hızla özel sektör tarafından kullanımını sağlayacak teşviklerle yapılan büyük masraf ve birikimin ülke ekonomisine katkı sağlar hale getirilmesine ihtiyaç vardır. Etçi ebeveyn üretimi konusunda organik piliç eti üretiminde kullanılan yavaş gelişen genotiplerde dışa bağımlılığı önleyecek çalışmalara önem verilmelidir.

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Trend Analysis of Reference Crop Evapotranspiration in Niğde Province

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Abstract
Optimization of irrigation water is the main strategy for the adaptation to the effects of climate change in the agricultural indusrty. For the determination and efficient use of irrigation water in agriculture, it is crucial to calculate the reference crop evapotranspiration (ETo). Niğde is defined as a region where irrigated agriculture is carried out due to located in the semi-arid climate zone. In this context, the temporal changes of ETo values is extremely remarkable in terms of determining the effects of global climate change on the irrigation water requirement for Niğde Province. In this study, monthly climatic data of the Niğde were used to calculate ETo values for a period of 30 years (1992–2021) using the FAO Penman–Monteith method, and then annual ETo values were determined. Trends of ETo, temperature and precipitation data of the years and growing season (May-September) were examined using Mann-Kendall Test and Sen Method. The results show that the annual ETo values ranged from 783.6 mm to 970 mm, while the value range identified for the growing period was 511.4 mm to 642.7 mm. It has been determined that the total ETo values of both the annual and the growing season have a statistically significant tendency to increase, and that the irrigated farming activities in the region need adaptation to this increase. Additionally, it was stated that annual and seasonal average temperature values tend to increase statistically significantly, while the increasing trends in annual and seasonal total precipitation values are insignificant.
Key Words: *Reference crop evapotranspiration, Mann-Kendall, Sen test, Trend analysis*

Introduction

The hydrological cycle has been significantly impacted by the rise in greenhouse gases emitted into the atmosphere as a result of population expansion, industrialization and acceleration of urbanization. Turkey will experience drought due to global warming brought on by greenhouse gas emissions, which have a considerable influence on the climate system (Türkeş, 2012). One of the natural resources that this expected drought will have the most impact is water resources (Turan, 2018). The depletion of water sources will eventually reach levels that will make life unsustainable and have an adverse effect on the ecosystem. Water resources should be utilized in the most efficient manner possible to satisfy present and future requirements. Thus, the natural balance and sustainable development of human populations would be ensured.

The variations in temperature and precipitation parameters provide important clues for understanding the general structure of the climate. Therefore, studies on climate change have focused on trend analysis of these two parameters (Türkeş et al., 2002; Weltzin et al., 2003; Beniston, 2005; Soydan et al., 2016; Coşkun and Akbaş, 2017; Aktaş et al., 2018; Coşkun, 2020). These evaluations do not directly indicate how irrigation water requirements have changed in cultivation. In this respect, assessing the impacts of global warming or other variables on climatic parameters by reference crop evapotranspiration (ETo) values would enable us to make more direct evaluations of the variation of irrigation water requirements in agriculture. Reference crop evapotranspiration is used in the estimation of crop water consumption expresses the change in atmospheric conditions. Tabari (2010) stated that ETo shows the evaporation demand of the atmosphere and allows to make comparisons between different regions as well as different periods of the year. Yürekli et al. (2017) investigated the trend analysis of ETo values for five different regions and reported the monotonic trend for many seasons of the regions according to Holt's and Mann-Kendall methods. Anlı (2014) reported significant increasing trends for reference evapotranspiration in the arid Southeastern Anatolia region. Ünlükara et al. (2011) examined the monthly ETo changes for Konya and Karaman and determined that there were trends in some months of the year and no significant changes in some months of the year.

In this study, monthly climatic data of the Niğde were used to calculate ETo values for a period of 30 years (1992–2021) using the FAO Penman–Monteith method, and then annual ETo values were determined. Trends of ETo, temperature and precipitation data of the years and growing season (May-September) were examined using Mann-Kendall Test and Sen Method.

Materials and Methods

Niğde Province (latitude 37°57′56″ N, 34°40′45″ E; altitude 1229 m) was chosen as the research area and a semi-arid climate prevails in the region. The long-term climate data of the study area are given in Table 1 (TSMS, 2022).

Table 1. The long-term (1935-2021) climatic data of Niğde Province

	Mean temperature (ºC)	Mean relative humidity (%)	Wind speed (m/s)	Mean daily sunshine (h)	Precipitation
January	-0.3	73.1	3.5	3.7	35.9
February	1.1	68.7	3.7	4.9	33
March	5.1	61.7	3.7	5.8	35.9
April	10.6	56.3	3.7	6.9	41.3
May	15.2	55.1	3.2	8.5	48.3
June	19.2	50.2	3.1	10.3	28.2
July	22.5	42.7	3.6	11.5	5.1
August	22.3	43.6	3.4	11.1	6.7
September	18.1	47.7	3.1	9.9	10.5
October	12.5	57.2	2.9	7.3	26.2
November	6.5	66.0	3.1	5.4	31.3
December	1.8	73.0	3.3	3.7	41.3
Average/Total	*11.2*	*58.0*	*3.4*	*7.4*	*343.7*

Monthly average temperature (ºC), relative humidity (%), wind speed (m/s), sunshine duration (hours) and total precipitation (mm) data of the 30 years between 1992-2021 were used as climate data in the study. The climatic data of Niğde were obtained from the Turkish State Meteorological Service (TSMS, 2022). Evaluations were carried out annually and for the growing season covering the period between May and September. The daily ETo values for Niğde were calculated using the FAO ETo Calculator program. The ETo Calculator is use FAO Penman-Monteith method and is based on Equation 1 (Allen et al., 1998; Raes and Munoz, 2012).

$$ET_o = \frac{0.408\Delta(R_n - G) + \gamma\left(\frac{900}{T+273}\right)u_2(e_s - e_a)}{\Delta + \gamma(1 + 0.34u_2)} \quad (1)$$

Where R_n is the net radiation at the plant canopy (MJ m^{-2} day^{-1}), G is the soil heat flux density (MJ m^{-2} day^{-1}), T is the average daily air temperature at 2 m height (°C), u_2 is the wind speed (at 2 m height (m s^{-1})), e_s is the saturation vapor pressure (kPa), e_a is the actual vapor pressure (kPa), e_s–e_a is the saturation vapor pressure deficit (kPa), Δ is the slope vapor pressure curve (kPa $°C^{-1}$) and γ is the psychometric constant (kPa $°C^{-1}$).
In the study, the non-parametric Mann-Kendal test was applied to determine the trends of annual and seasonal ETo and average temperature values and annual precipitation values for the period of 30 years, and Sen's slope test was used to estimate the trend by Makesens 1.0 computer sotware (Salmi et al., 2002). The Mann-Kendall test, a particular application of Kendall's test known as Tau, is non-parametric. Instead of focusing on the volume of the data, this approach focuses on the rows. According to the H_0 hypothesis, the time-ordered (X_1, X_2....., X_n) series are time-independent and equally distributed random variables in this test. The H1 alternative hypothesis states that there is no similarity between the distribution of X_k and X_j successive data values in the series as $k \neq j$ and $n \geq k$, j (n data recording duration). The fact that this test is simple to use, relies on sequences, and avoids the impact of serial correlation is its most crucial feature. In order to assess the potential trend component of the annual and seasonal parameters as well as if there is a statistically significant rise or decrease trend, the Mann-Kendall trend test was performed to the ETo, average temperature and precipitation data of the research region (Mann, 1945). Sen's trend test is distribution independent and has a structure that is not affected by seasonal events (Van Belle and Hughes, 1984).

Results and Discussion

The annual and seasonal mean temperature variations of Niğde Province for the 30-yr period are given in Figure 1. As shown in Figure 1, the annual average temperatures varied between 8.52 ºC and 13.94 ºC- and seasonal average temperatures ranged from 17.78 ºC to 21.74 ºC. While the maximum average temperature values were determined in the year of 2010, the minimum values were in the year of 1992. The average temperatures of the 30-yr period were calculated as 11.78 ºC and 20.12 ºC for the annual and growing season, respectively.
Figure 2 shows the annual and seasonal ETo values for the years between 1992 and 2021. The range of the annual values ETo was between 783.6-970 mm and the seasonal ETo values were between 511.4 and 642.7 mm. Average ETo over 30 years was determined as 863.99 mm and the seasonal as 546.10 mm. The lowest value for the annual ETo was obtained in the year of 2002 and the highest value in 2010. Similar to the annual ETo values the lowest seasonal ETo value was calculated in the year of 2002, while the highest value was in the year of 2014.

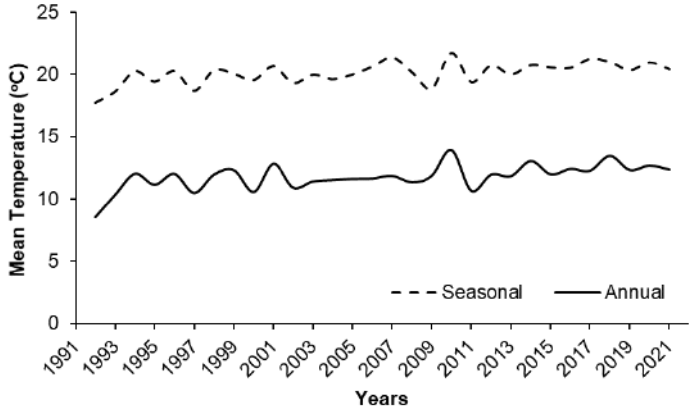

Fig. 1. Annual and seasonal mean temperature changes for the period of 1992-2021

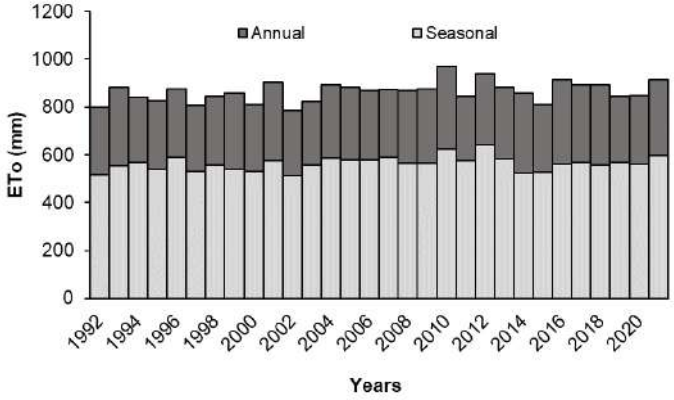

Figure 2. The annual and seasonal ETo values for the years between 1992 and 2021

Trend analysis for the annual and seasonal mean temperature results are given in Figure 3. When the temperature changes of 30 years were examined, the increase in the annual average temperatures was found to be statistically significant at the level of α=0.001. The average of the first 5 years (1992-1996) of the research years and the average of the last 5 years (2017-2021) were compared to evaluate the temperature increases in the province of Niğde over 30 years. The annual average of the first five years was determined as 10.81 ºC and the last five years as 12.68 ºC. It was concluded that the average temperature in Niğde increased by 17% (1.87 ºC) in a 30-year period. On the other hand, significant increasing trends were encountered for the seasonal average temperatures of Niğde Province (α=0.01). Temperatures around the world are changing with the effect of climate change (Karl and Trenberth, 2003). Kızılelma et al. (2015) evaluated the temperature increases in the Central Anatolia Region and determined that there were increases in the 95% confidence interval at all stations except Ürgüp. Cosun and Karabulut (2009) reported that statistically significant increases occurred in average temperatures for Kahramanmaraş and Elbistan regions. Demir et al. (2017) stated that the annual temperatures -increased in the province of Bingöl but this increase is not statistically significant. Jain and Kumar (2012) reported significant rising trends at most of the stations in India.

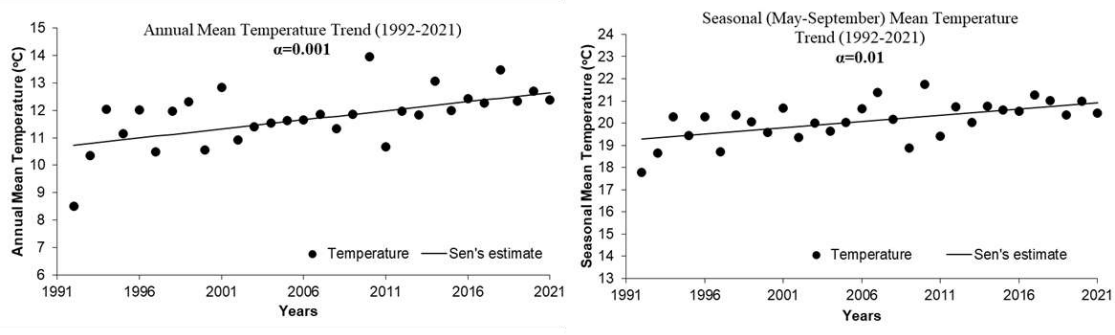

Figure 3. Trend analysis results for the annual and seasonal mean temperatures

The 30-year trends of ETo values calculated annually and seasonally are shown in Figure 4. The annual ETo tended to increase statistically at the 5% significance level (Z=2.07). The average ETo of the first five years (1992-1996) was found to be 844.58 mm and the last five years was 878.86 mm. Annual ETo values increased by an average of 34.28 mm over a 30-year period. The seasonal ETo trend also showed an increase of 5% (Z=2.00) just like the annual values. Global climate change has a considerable impact on reference crop evapotranspiration and, in turn, crop water requirements (Fan et al., (2016). Koffi and Komla (2015) reported that The Mann–Kendall test revealed significant increase in annual ETo at Tabligbo (Z = 2.89) and Sokode (Z = 2.29) and non-significant decrease at Lomé. Eser et al. (2015) reported that there were statistically significant increasing trends in reference crop evapotranspiration in summer season in Menemen Plain. Cömert et al. (2019) examined the monthly ETo series of Tokat province and reported that there were significant increases in July, August and October according to the Mann-Kendall test results. Çıtakoğlu et al. (2017) stated that as a result of the analysis of Linear Regression and Mann-Kendall methods, there was an increasing trend in Uşak and Afyonkarahisar stations in July and August months. When the results of this study are evaluated together with previous studies, the effect of increasing temperatures on climate change changes the ETo values.

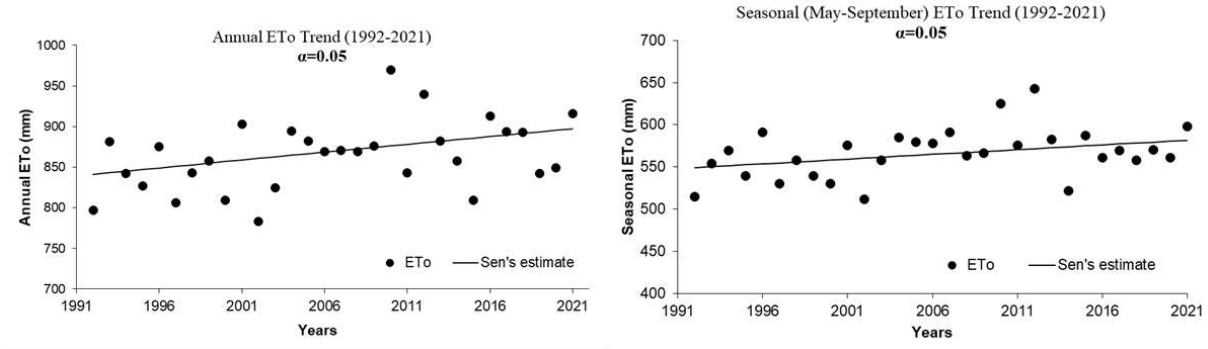

Figure 4. Trend analysis results for the annual and seasonal ETo values

The trend of precipitation was positive, but it was not statistically significant (Figure 5). It has been revealed in previous studies that the effect of climate change on precipitation makes it irregular rather than increasing or decreasing it (Givati and Rosenfeld, 2003; Berbet and Costa, 2003; Trenberth, 2011; Dai et al., 2018). Karabulut and Cosun (2009) evaluated the annual data of Kahramanmaraş and stated that despite the decrease in the amount of precipitation, there was no statistically significant positive or negative trend. Keskin et al. (2018) examined precipitation trends at 14 different stations and the changes were significant in Kars and Ardahan, but not in the other 12 provinces. Büyükyıldız and Berktay (2004) investigated the precipitation values of 25 meteorological stations in the Sakarya basin and reported that 12 of them showed statistically significant decreases, while the increases and decreases in the others were not significant. Dalkılıç (2019) stated that the annual precipitation changes of Gümüşhane, Erzincan and Bayburt provinces were not a significant trend.

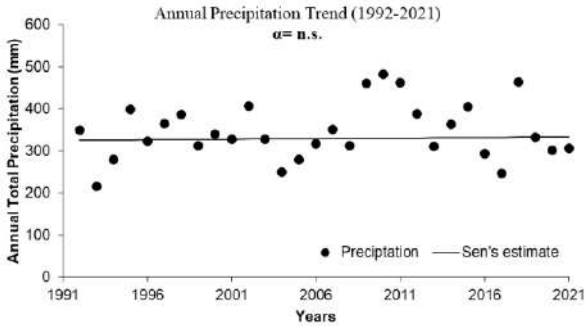

Figure 5. Trend analysis result for the annual precipitation

Conclusions

In the study, the trends of reference crop evapotranspiration, average temperature and precipitation of Niğde Province for a 30-yr period were investigated. Examining the change in ETo values is very important in terms of evaluating the effects of climate change on agriculture and water resources and contributing to water management. According to the results of the study, the annual ETo values ranged from 783.6 mm to 970 mm, while the value range identified for the growing period was 511.4 mm to 642.7 mm. It was determined that the total ETo values of both the annual and the seasonal had a statistically significant (α=0.05) tendency to increase. Similarly, annual and seasonal mean temperature changes showed statistically significant increases at α=0.001 and α=0.01 levels,

respectively, for the 30-year period. On the other hand, trend in annual total precipitation values was statistically insignificant. In the last 30 years, there has been an increase in evapotranspiration in Niğde due to the effects of climate change, and irrigated agriculture activities need adaptation to this increase. Results can be a guide for planning, investing and developing the effects of climate change for Niğde farmers, industry and decision-makers.

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Analysis of Accessibility of Primary Schools in Niğde Using GIS

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Abstract

Education is one of the most basic needs for human beings. With the child's growth, the educational environment expands according to the expansion of the environment in which he interacts. School is the place where education takes place formally. It is aimed to provide the same content and level of education to everyone included in the system within the framework of a certain plan and program. The process starts from preschool (kindergarten), primary school, secondary school, high school, associate degree, undergraduate, and graduate. Non-formal education is a system in which the person participates voluntarily. In accordance with the principle of equal opportunity in education, various measures are tried to be taken by the state in order to minimize the effect of external factors. One of them is the regulation on the distances to be considered in the construction of public buildings in settlements. One of the most important features of urban settlements is the accessibility of the places where the needs will be met, especially the public buildings. Accessibility of the places where we meet many of our needs, from hospital to market, from pharmacy to school, is one of the most important advantages that can be achieved in city life. The increasing urban population has led to the spread of urban settlements to larger areas. For this reason, it is important to know the current situation regarding the functional characteristics of the city in order to provide better service to the people living in the cities and to make better plans for the future. In this study, it is planned to make a spatial analysis of the accessibility function of a city using GIS. The main purpose of this study is to reveal the spatial accessibility of primary schools, which are among the educational institutions in the central district of Niğde province. The Spatial Plans Building Regulation was used as a criterion for accessibility. The current number of students and teachers in the schools and the number of classrooms were obtained from the Niğde Provincial Directorate of National Education, and the obtained data were analyzed by transferring them to ArcGIS software. In the study, the Zoning Plan from the Niğde Municipality, the road and housing data obtained from OpenStreetMap, the location information of the schools and the number of students obtained from the Niğde Provincial Directorate of National Education, and the population data obtained from TÜİK were used. According to the results of the study, there are problems in accessibility the primary schools in some neighborhoods in the Central district, and this problem is increasing especially in rural areas. It should not be forgotten that accessibility is important for everyone, school and settlement plans should be made with reference to the values specified in the spatial plans regulation.

Key Words: *Accessibility, Geographical Information Systems, Education, Landscape, Niğde*

Niğde Şehrinde Okullara Erişilebilirliğin CBS ile Analizi

Özet

Eğitim insanoğlunun en temel ihtiyaçlarından biridir. Örgün eğitim ailede çocuğun doğumuyla başlar ve yaşam boyu devam eder. Çocuğun büyümesiyle birlikte etkileşimde bulunduğu çevrenin genişlemesine göre eğitim ortamı da genişler. Okul, eğitimin resmi olarak gerçekleştiği yer olarak tanımlanır. Belli bir plan ve program çerçevesinde sisteme dahil olan herkese aynı içerik ve düzeyde eğitim verilmesi hedeflenir. Süreç okul öncesi (anaokulu), ilkokul, ortaokul, lise, önlisans, lisans ve yüksek lisanstan başlar. Yaygın eğitim, kişinin gönüllü olarak katıldığı bir sistemdir. Eğitimde fırsat eşitliği ilkesi gereği dış faktörlerin etkisinin en aza indirilmesi için devlet tarafından çeşitli önlemler alınmaya çalışılmaktadır. Bunlardan biri de yerleşim yerlerinde kamu binalarının yapımında dikkat edilecek mesafelere ilişkin yönetmeliktir. Kentsel yerleşimlerin en önemli özelliklerinden biri, başta kamu binaları olmak üzere, ihtiyaçların karşılanacağı yerlerin erişilebilirliğidir. Hastaneden markete, eczaneden okula birçok ihtiyacımızı karşıladığımız mekanların erişilebilirliği şehir hayatında elde edilebilecek en önemli avantajlardan biridir. Artan kentsel nüfus, kentsel yerleşimlerin daha geniş alanlara yayılmasına neden olmuştur. Bu nedenle kentlerde yaşayan insanlara daha iyi hizmet verebilmek ve geleceğe yönelik daha iyi planlar yapabilmek için kentin işlevsel özelliklerine ilişkin mevcut durumun bilinmesi önemlidir. Bu çalışmada, bir şehrin erişilebilirlik fonksiyonunun CBS kullanılarak mekansal analizinin yapılması planlanmıştır. Bu çalışmanın temel amacı, Niğde ili Merkez ilçesinde bulunan eğitim kurumları arasında yer alan ilköğretim okullarının mekânsal erişilebilirliklerini ortaya koymaktır. Erişilebilirlik kriteri olarak Mekânsal Planlar Yapı Yönetmeliği kullanılmıştır. Okullardaki mevcut öğrenci ve öğretmen sayıları ile derslik sayıları Niğde İl Milli Eğitim Müdürlüğü'nden alınmış ve elde edilen veriler ArcGIS yazılımına aktarılarak analiz edilmiştir. Çalışmada Niğde Belediyesi'nden alınan İmar Planı, OpenStreetMap'ten alınan yol ve konut verileri, Niğde İl Milli Eğitim Müdürlüğü'nden alınan okulların konum bilgileri ve öğrenci sayıları ile TÜİK'ten alınan nüfus verileri kullanılmıştır. Araştırmanın sonuçlarına göre, Merkez ilçedeki bazı mahallelerde ilköğretim okullarına erişimde sorunlar yaşandığı ve bu sorunun özellikle kırsal kesimde giderek arttığı belirlenmiştir. Erişilebilirliğin herkes için önemli olduğu unutulmamalı, okul ve yerleşim planları mekansal planlar yönetmeliğinde belirtilen değerler referans alınarak yapılmalıdır.

Anahtar Kelimeler: *Erişilebilirlik, Coğrafi Bilgi Sitemleri, Eğitim, Peyzaj, Niğde*

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Tradıtıonal Fermented Camel Milk Products

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Abstract
Camel milk which is an important protein source for people living in the arid regions of the world, also gains importance with the detected therapeutic effects. Camel milk products, which are obtained by regional camel milk production and consumed in the regions, are gradually expanding their product range. In addition to consumption as drinking milk, fermented dairy products like cheese, butter, yogurt and yoghurt as well as drinking milk are included in the first row of camel milk products. It is also possible to find products such as ice cream, milk powder and cream produced in the Middle East and North African countries from camel milk and other milks. Domiati cheese which a soft cheese like white cheese is commonly produced in Egypt, while Caravane is another camel milk cheese produced in Mauritania. While the fermentation of the butter produced from the camel milk is carried out in the goat's wool, Zabadi is consumed in various regions in Sudan. Suusac, which produced mainly by probiotic bacteria of Lactobacillus acidophilus and / or Bifidobacterium longum species, is the first beverage in fermented camel milk drinks in Kenya. Chal which is produced in Kazakhstan and Turkmenistan is consumed with the name of Shubat in some regions. A traditional dairy product Tarag, is a fermented drink which is a combination of lactic acid and alcohol fermentation. Laghsi is a camel milk drink which is made up of lactic acid bacteria and alcohol-producing yeast. Khoa is produced by darkening the camel milk and consumed by adding sugar while Kulfes is consumed with the addition of sugar and starch at a certain percentage. Khoa in other words Mawa is cured white flour in some proportions and take a other name is Jamun. In our country, although camel milk and its products don't found on the market shelves, it has a great importance with rich and nutritive composition and its therapeutic effects for the people of the region where it is produced. This study, in addition to the nutritional properties of camel milk products, it is aimed to introduce these products to the consumer audience by emphasizing their therapeutic effects. In light of the researchs done with camel milk, local producers have the mission to meet the camel with the consumer.
Key Words: *Camel milk, fermented camel milk, camel milk products*

Geleneksel Fermente Deve Sütü Ürünleri

Özet
Dünyanın kurak bölgelerinde yaşayan insanlar için önemli protein kaynağı olan deve sütü, tespit edilen teröpatik etkileri ile de önem kazanmaktadır. Bölgesel deve sütü üretimi ile elde edilen ve genellikle elde edildiği yörelerde tüketilen deve sütü ürünleri ise gün geçtikçe farklı çeşitler kazanarak ürün yelpazesini genişletmektedir. İçme sütü olarak tüketiminin yanı sıra peynir, tereyağ, yoğurt ve yoğurt benzeri fermente süt ürünleri deve sütü ürünleri içerisinde ilk sıralarda yer alırken Ortadoğu ve kuzey Afrika ülkelerinde deve sütü ve diğer sütlerin karışımlarından üretilmiş dondurma, süt tozu ve krema gibi ürünlere de rastlamak mümkündür. Beyaz peynir benzeri yumuşak bir peynir olan Domiati peyniri Mısır'da yaygın olarak üretilirken, Caravane Moritanya'da üretilen bir diğer deve sütü peyniridir. Az miktarda olsa da deve sütünden üretilen tereyağların fermentasyonu keçi tulumu içerisinde gerçekleştirilirken, Sudan'da üretilen Zabadi deve sütü yoğurdu olarak çeşitli bölgelerde tüketilmektedir. Daha çok *Lactobacillus acidophilus* ve/veya *Bifidobacterium longum* türü probiyotik bakteriler ile fermente edilerek üretilen fermente deve sütü içeceklerinin başında Kenya'da yaygın olan Suusac gelmektedir. Kazakistan ve Türkmenistan'da üretilen Chal bazı bölgelerde Shubat adı ile tüketilmektedir. Geleneksel süt ürünlerinden Tarag, laktik asit ve alkol fermantasyonunun bir arada gerçekleştiği fermente bir içecektir. Laghsi ise, laktik asit bakterileri ve alkol üreten mayalar tarafından yayık altının fermente edilmesi ile üretilen bir deve sütü içeceğidir. Khoa, deve sütünün koyulaştırılması ile üretilip içerisine şeker ilave edilerek tüketilirken, Kulfes deve sütünün yarı yarıya koyulaştırılıp belli oranlarda şeker ve nişasta ilavesi ile tüketilmektedir. Khoa ya da bir diğer adı ile Mawa'nın beyaz un ile belli oranlarda koylaştırılmış haline ise Jamun adı verilmektedir. Ülkemizde deve sütü ve ürünleri market raflarında bulunmasa da üretildiği bölge halkı için hem zengin ve besleyici bileşimi hem de teröpatik etkileri ile büyük öneme sahiptir. Bu çalışmada deve sütü ürünlerinin besleyici özelliğinin yanı sıra teröpatik etkileri vurgulanarak tüketici kitlesine bu ürünlerin tanıtılması hedeflenmiştir. Deve sütü ile yapılan çalışmaların ışığında deve sütünün tüketici ile buluşması konusunda yerel üreticilere büyük görev düşmektedir.
Anahtar Kelimeler: *Deve sütü, fermente deve sütü, deve sütü ürünleri*

Giriş

Yeterli ve dengeli beslenmenin temelinde yer alan süt ve süt ürünleri, yediden yetmişe her yaşta birey için sağlıklı beslenmeyi destekleyen gıdalar olarak karşımıza çıkmaktadır. Bebeklikte anne sütü ile başlayan süt tüketim alışkanlığı ilerleyen dönemlerde süt şekeri olan laktozun intoleransı gibi sebepler ile yerini fermente süt ürünleri tüketim alışkanlığına bırakmak durumunda kalabilmektedir. Ülkemizde fermente süt ürünlerinin başında yoğurt, ayran, kefir gelirken uluslararası literatürde fermente süt ürünlerinin farklı tip sütlerden üretimine yönelik pek çok çalışma bulunmaktadır. Koyun, keçi, deve ve/veya at sütünün fermentasyonu ile elde edilen fermente süt ürünleri de sağlıklı beslenme olgusuna destek veren ürünler grubunda literatürde yerini almaktadır. Bu süt çeşitleri arasında deve sütü ile üretilen ürünlerin Dünya genelinde farklı isimlerle anılan çeşitleri olmasına rağmen ülkemiz için endüstriyel boyutta bir deve sütü ürünü üretiminden bahsetmek mümkün değildir. Ancak yerel olarak üretilen deve sütü yoğurdu, peyniri, dondurması gibi ürünler Aydın, Çanakkale ve İzmir başta olmak üzere kıyı şehirlerde rastlanan ürünler arasında sıralanabilir.

Deve Sütü ve Önemi

Deve sütü, kendine has kokuya sahip opak beyaz renginde ve hafif tuzlu tadı ile özgün bir bileşime sahiptir. Toplam % 9.85-11.45 kuru madde içeriği ile diğer süt çeşitleri arasında yerini almaktadır (Tablo 1).

Tablo 1. Deve, inek ve insan sütü bileşimi (Konuspayeva 2020; Ho ve ark., 2022)

Süt tipi	Bileşimi (%)			
	Protein	Yağ	Laktoz	Kül
Deve sütü	3,27±0,58	3,61±0,90	4,44±0,66	0,77±0,70
İnek sütü	3,20-3,80	3,70-4,40	4,80-4,90	0,70-0,80
İnsan sütü	1,10-1,30	3,30-4,70	6,80-6,90	0,20-0,30

Bileşiminde yer alan enzimler, serbest yağ asitleri, vitaminler ve mineraller deve sütünü diğer sütlerden ayıran önemli bileşenler olarak ifade edilmektedir. Yüksek konsantrasyonda immünoglobülin ve insülin içeriği, vitamin (A, B_2, C ve E) açısından zengin bileşimi, minereller (Na, K, Zn, Cu, Mg ve Fe) ve düşük laktoz ve kolesterol miktarı ile diğer sütler arasında farklı tanımlanmaktadır (Omer ve Eltinay, 2009; Al-Humaid ve ark., 2010; Saygılı ve Karagözlü, 2017). Deve sütü ayrıca yüksek vitamin ve mineral içeriği ile anti-kanser, anti-diyabetik ve antibakteriyel özelliklere sahip birçok koruyucu protein (örneğin immünoglobulinler, laktoferrin, lizozim ve laktoperoksidaz) içerir (Barłowska ve ark., 2011; Konuspayeva ve ark., 2009; Zou ve ark., 2021a, 2021b).
Ülkemizde süt ve süt ürünleri üretiminde inek, koyun ve keçi sütü üretimine ait rakamlar belirleyici olurken, deve yetiştiriciliğinin yapıldığı bazı bölgelerde deve sütü üretimi ve deve sütü ürünleri yerel halk tarafından tüketilmektedir. Ülkemizde endüstriyel üretime henüz dahil olmayan deve sütü ve ürünleri için sağlık destekleyici özelliklerini vurgulayan bilimsel araştırma sayısı gün geçtikçe artmaktadır.

Geleneksel Deve Sütü Ürünleri ve Teröpatik Etkileri

Dünya genelinde pek çok amaca yönelik tercih edilen develer daha çok süt verimi açısından önemli görülmekte ve özellikle göçebe halkların beslenme ihtiyacının büyük kısmını karşılamaktadır. Dünya deve varlığı hakkındaki veriler sınırlı kalıyor olmasına rağmen sayıca sürekli artış olan ülkeler Ortadoğu ve Afrika ülkeleri belirtilmektedir (Faye ve Bonnet, 2012).
Mısır'da yaygın olarak tüketilen hafif tuzlu bir beyaz peynir çeşidi olan Domiati birçok Ortadoğu ülkesinde tercih edilmektedir. Standart peynir üretim metodundan farklı olarak süte peynir mayası ilave edilmeden tuz ilavesi ile üretiliyor olması en temel özelliğidir. İnek, manda, keçi ve deve sütü gibi çeşitleri de bulunan peynir üretiminde yine bu sütlerin karışımları da kullanılmaktadır.
Afrika kıtasının batısında yer alan Moritanya'da yerel bir üretici tarafından deve sütüne bitkisel enzim ilavesi ile Caravane peyniri üretilmektedir. Hafif tuzlu, yumuşak dışı beyaz kabuklu bir yapıda olan peynir görsel olarak Camembert peynirine benzerliği ile anılmakta ve markası olan Caravane adı ile tanınmaktadır. Yerel halk tarafından severek tüketilen peynir, kremsi yapısı ile keklerde, soslarda, meze ve salata çeşitlerinde sıklıkla tercih edilmektedir.
Sudan'da deve sütünden üretilen bir yoğurt çeşidi olan Zabadi, laktik asit fermentasyonu ürünüdür. Yerel halkın severek tükettiği Zabadi farklı süt çeşitlerinden de üretilebilmektedir.
Deve sütü ve fermente deve sütü ürünleri Kenya'da yaygın olarak tercih edilen ürünler arasındadır. Fermente deve sütü üretiminde dumanla işlenerek üretilen Suusac için son üründe belirgin duman kokusu tüketen bireylerce buruk tat şeklinde tanımlanmaktadır.
Taze süte ekşitilmiş süt ilavesi ile üretilen Chal (Shubat), ekşi tada sahip köpüklü yapısı ile sevilerek tüketilen fermente süt ürünleri arasında yerini alır. Chal üretiminde seramik kavanozlarda 3-4 gün kadar fermentasyona devam eden süte her gün yeni süt eklenerek ekşimesi sağlanmaktadır. Son üründe başlangıç miktarının yaklaşık 5 katına kadar ulaşan fermente süt ekşiliği ile tanınan bir deve sütü ürünüdür.

Fermente deve sütü ürünleri arasında Tarag Moğolistan'da üretilen önemli bir ürün iken Laghsi yağı azaltılmış su içeriği daha yüksek bir fermente süt ürünü olarak bilinir. Bileşiminde laktik asit bakterilerinin yanı sıra mayaların da yer alıyor olması laktik asit fermentasyonuna ek olarak alkol fermentasyonunun da gerçekleştiğini göstermektedir. Bu şekilde son üründe artan CO_2 seviyesi daha ferahlatıcı bir lezzet sunmaktadır.
Sütün düşük sıcaklıkta ısıtılarak koyulaştırılması şeklinde elde edilen bir ürün de Khoa'dır. Kurumadde oranı % 65-70'e ulaşıncaya kadar suyu uzaklaştırılarak üretilen süt ürünü, Hint tatlılarının en temel bileşeni olarak kullanılmaktadır.
Deve sütü ve ürünleri üzerine sağlık destekleyici özelliklerini vurgulayan çalışma sayısı gün geçtikçe artmaktadır. Yüksek oranda çinko içeriği ile bağışıklık sistemini destekleyici özelliği yanı sıra bileşimindeki antimikrobiyal bileşenler ve antioksidan kapasitesi ile deve sütü her geçen gün bir adım daha öne çıkmaktadır. Diğer memeli canlılar arasında bileşimindeki yüksek demir konsantrasyonu ile anemi bireylere teröpatik etkisi ile alternatif olarak sunulmaktadır (Sakandar ve ark., 2018).
Djangabilov ve ark. (2000) tarafından fermente deve sütü ürünü olan Shubat tüketiminin akut ve kronik gastrointestinal sindirim sistemi rahatsızlıklarının tedavisinde olumlu yönde etkili olduğu bildirilmiştir.
Diyabetli hastalarda deve sütü tüketimine yönelik yapılan araştırmalar insülin tedavisinde deve sütünün alternatif bir ajan olarak kullanımına yönelik bulguları ortaya koymaktadır. Bileşimindeki yüksek insülin miktarının gastrointestinal sistemde korunduğu ve diyabet bireylerde tedavi destekleyici olması nedeni ile deve sütü ve deve sütü ürünlerinin tüketimi dikkat çekmektedir (Mohammad ve ark., 2009; Saygılı ve Karagözlü, 2017). Agrawal ve ark. (2007) tarafından yapılan araştırmada Tip 1 diyabet bireylerde çiğ deve sütü tüketimi ile günlük insülin gereksiminde %30-40 oranında azalma sağlandığı bildirilmiştir. Diyabet tedavisinde deve sütünün potansiyel kullanımı Ashraf ve ark., (2021) tarafından ortaya konmuştur. Çalışmada daha önceleri birçok araştırmada ortaya konan deve sütünün antidiyabet özelliğine ait moleküler temelin açıklanarak etkili olan aktif ajanlar ifade edilmiştir. Böylece deve sütünün antidiyabet özelliğini ortaya koyan bileşenlere ışık tutulmuştur.
Sudan'da fermente deve sütü ürünleri arasında severek tüketilen bir içecek olan Gariss ile yapılan bir araştırma in vivo ortamda gerçekleştirilmiştir. Çalışmada etki mekanizması tam olarak açıklanamamış olmasına rağmen deve sütünün zengin biyoaktif peptid içeriği ile hipokolesterolemik etki gösterdiği bildirilmiştir (Elayan ve ark., 2008). Halen sayıca az olmasına rağmen bilimsel çalışmalar deve sütü ve ürünleri tüketiminin tüberküloz, mide rahatsızlıkları ve çeşitli kanser türleri üzerine olumlu etkileri olduğunu bildirmektedir. Hesham ve ark., (2012) deve sütü ve inek sütünün insan kanser hücrelerinin çoğalması üzerine etkisini incelendikleri araştırmada deve sütünün kanser hücrelerin çoğalmasını önemli ölçüde inhibe ettiği rapor edilmiştir. Araştırma bulguları insanlar için potansiyel klinik öneme sahip veriler olup deve sütü ile yapılan daha fazla in vivo çalışmaya ihtiyaç olduğunu göstermektedir.
Farklı *Lactobacillus* spp. probiyotik suşlar ile fermente edilen deve sütünün antikanser aktivite, antioksidan, ADE inhibisyon aktivitesi ve proteolitik aktivitesi incelenmiştir. Araştırmada fermente deve sütünden elde edilen ekstraktların özellikle antioksidan, ACE-inhibisyonu ve antiproliferatif aktivitesinin sağlığı geliştirici faydalarının, fermente sığır sütünden elde edilenlerden belirgin şekilde daha yüksek olduğunu göstermiştir (Ayyash ve ark., 2018). Benzer şekilde fermente deve sütü ürünlerinin sağlık destekleyici özelliklerini vurgulayan çalışmaların sayısı gün geçtikçe artmaktadır.
Dharmisthaben ve ark., 2021 tarafından yapılan çalışmada *L. plantarum* ile fermente edilen deve sütünün umut verici antioksidan aktivite ve anti-inflamatuar aktivite sergilediği bildirilmiştir. Çalışmada elde edilen veriler ışığında laktik asit bakterileri içeren fermente deve sütünün sağlığa faydalarını belirlemek ve fermente deve sütünden tanımlanan peptitlerin diğer biyolojik aktivitelerinin gösterilmesi amacı ile gelecekte klinik çalışmalara ihtiyaç olduğu ifade edilmiştir.
Deve sütünün sığır sütünden daha üstün ve insan sütüne benzer bir besin içeriğine sahip olması sebebi ile anne sütü alımının sınırlı olduğu durumlarda alternatif olarak kabul edilebileceği bildirilmiştir. Bunun yanı sıra deve sütü, insan diyetleri için tatmin edici bir esansiyel amino asit dengesine sahip olması, yüksek oranda β-kazein içermesi ve hassas bireylerde alerjiye neden olan β-laktoglobulince yoksun olması sebebi ile alternatif bir süt çeşidi olarak bildirilmiştir (El-Agamy, 2009; Hinz et al., 2012; Ho ve ark., 2022).

Sonuç

Teröpatik özelliklerine her geçen gün bir yenisi eklenen ve sayıca desteklenen deve sütü ürünlerine yönelik çalışmalar bölgesel düzeyde devam etmektedir. Deve sütü ve fermente deve sütü ürünleri ülkemiz de dahil Dünya'nın pek çok ülkesinde yerel halk tarafından tüketilmektedir. Endüstriyel boyutta üretimin kısıtlı kalması, geleneksel fermente deve sütü ürünlerinin zengin bileşimi ve sağlık destekleyici özellikleri üzerine gölge düşürmemelidir. Deve yetiştiriciliği ve bakıcılığının yoğun olduğu bölgelerde yerel işletmelere destek sağlanması deve sütünün fermente ürünlere işlenmesini ve daha fazla tüketiciye ulaştırılmasını sağlayacaktır.

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Detection of Burned Areas by Remote Sensing Techniques: Antalya Manavgat Forest fire case study

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Abstract

Forests are the protectors of earth's ecological balance. Unfortunately, the forest fire is usually only observed when it has already spread over a large area, making its control and stoppage arduous and even impossible at times. The result is devastating loss and irreparable damage to the environment and atmosphere in addition to irreparable damage to the ecology. Among other terrible consequences of forest fires are long-term disastrous effects such as impacts on local weather patterns, global warming, and extinction of rare species of the flora and fauna. The problem with forest fires is that the forests are usually remote, abandoned/unmanaged areas filled with trees, dry and parching wood, leaves, and so forth that act as a fuel source. These elements form a highly combustible material and represent the perfect context for initial-fire ignition and act as fuel for later stages of the fire. The fire ignition may be caused through human actions like smoking or barbeque parties or by natural reasons such as high temperature in a hot summer day or a broken glass working as a collective lens focusing the sun light on a small spot for a length of time thus leading to fire-ignition.Fire is recognized as one of the most important ecosystem dis turbances, as it contributes to determining vegetation structure, biodi versity and carbon balance. In the Turkey, fires burn extensive areas annually, and account for a large proportion of the global extent of burned areas. In addition, fires in Turkey are driven by factors such as rainfall, tree cover and population density. Therefore, accurate mapping of burned areas in fires is crucial for social and environmental applications. Remote sensing plays a key role in monitoring burned area at regional and global scales. Due to the high temporal resolution and large spatial coverage, the current burned area products rely on coarse spatial resolution satellite data. In this study, the forest fire that occurred in Manavgat district of Antalya province on 28 July 2021 and lasted for 15 days was analyzed by remote sensing techniques using Landsat 5-7 satellite images. The difference obtained by using the Normalized Burned Ratio-NBR and Normalized Vegetation Index (NDVI) indices and the differences of these indices by taking images of the study region dated July 2021 before the forest fire and August 2021 after the forest fire. By using Normalized Burned Intensity (Difference Normalized Burned Ratio-Dnbr) and Difference Normalized Vegetation Indices, areas destroyed by fire were determined. The maximum similarity algorithm of pixel-based controlled classification was also applied to the data set. The area destroyed by burning after the forest fire was tried to be calculated with these two indexes. It was investigated whether the results of three different methods were compatible and consistent with the results of the General Directorate of Forestry. Although there are differences between the results, it was determined that the selected method and the materials used were suitable for such studies.

Key Words: *Fire, Forest Fire, Remote Sensing, Forests, Antalya*

Uzaktan Algılama Teknikleri ile Yanmış Alanların Tespiti: Antalya Manavgat Orman Yangını Örneği

Özet

Ormanlar, dünyanın ekolojik dengesinin koruyucularıdır. Ne yazık ki, orman yangını genellikle sadece geniş bir alana yayıldığında görülür, bu da kontrolünü ve durdurulmasını zor ve hatta zaman zaman imkansız hale getirir. Sonuç, ekolojiye onarılamaz hasara ek olarak, çevreye ve atmosfere yönelik yıkıcı kayıplar ve onarılamaz hasarlardır. Orman yangınlarının diğer korkunç sonuçları arasında yerel hava düzenlerini etkiler, küresel ısınma ve flora ve faunanın nadir türlerinin neslinin tükenmesi gibi uzun vadeli onarılmaz etkileri vardır. Orman yangınlarıyla ilgili sorun, ormanların genellikle uzak, terk edilmiş/yönetilmeyen ağaçlarla, kuru odunlarla, yapraklarla ve yakıt kaynağı görevi gören benzerleriyle dolu olmasıdır. Bu elementler oldukça yanıcı bir malzeme oluşturur ve ilk ateşleme için mükemmel bağlamı temsil eder ve yangının sonraki aşamaları için yakıt görevi görür. Yangının tutuşması, sigara içmek gibi insani eylemlerden veya sıcak bir yaz gününde yüksek sıcaklık veya güneş ışığını küçük bir noktaya uzun süre odaklayan toplu bir mercek gibi çalışan kırık bir cam gibi doğal sebeplerden kaynaklanabilir. Yangın, bitki örtüsü yapısının, biyolojik çeşitliliğin ve karbon dengesinin belirlenmesine katkı sağladığı için en önemli ekosistem rahatsızlıklarından biri olarak kabul edilmektedir. Türkiye'de yangınlar her yıl geniş alanları yakar ve küresel yanan alanların büyük bir bölümünü oluşturur. Ayrıca Türkiye'deki yangınlar yağış, ağaç örtüsü ve nüfus yoğunluğu gibi faktörlerden kaynaklanmaktadır. Bu nedenle, yangınlarda yanan alanların doğru bir şekilde haritalanması, sosyal ve çevresel uygulamalar için çok önemlidir. Uzaktan algılama, bölgesel ve küresel ölçekte yanan alanın izlenmesinde önemli bir rol oynamaktadır. Yüksek zamansal çözünürlük ve geniş uzamsal kapsama nedeniyle, mevcut yanmış alan ürünleri kaba uzamsal çözünürlüklü uydu verilerine dayanmaktadır.Bu çalışmada 28 Temmuz 2021 tarihinde Antalya ili Manavgat ilçesinde meydana gelen ve 15 gün süren orman yangını, Landsat 5-7 uydu görüntüleri kullanılarak uzaktan algılama teknikleri ile analiz edilmiştir. Çalışma bölgesine ait orman yangını öncesi Temmuz 2021 ve orman yangını sonrası Ağustos 2021 tarihli görüntüler alınarak Normalize Edilmiş Yanma Şiddeti (Normalized Burned Ratio-NBR) ve Normalize Edilmiş Vejetasyon İndeksi (Normalized Differenced Vegetation Index - NDVI) indeksleri ile bu indekslerin farkları kullanılarak elde edilen Fark Normalize Edilmiş Yanma Şiddeti (Difference Normalized Burned Ratio-Dnbr) ve Fark Normalize Edilmiş Vejetasyon İndeksleri kullanılarak yanarak tahrip olmuş alanlar tespit edilmiştir. Veri setine ayrıca piksel tabanlı kontrollü sınıflandırmanın maksimum benzerlik algoritması uygulanmıştır. Orman yangını sonrası yanarak tahrip olan alan belirlenen bu iki indeks ile hesaplanmaya çalışılmıştır. Üç farklı yöntemin sonuçlarının Orman Genel Müdürlüğü sonuçları ile uyumlu ve tutarlı olup olmadığı araştırılmıştır. Sonuçlar arasında farklılıklar olmasına rağmen, seçilen yöntem ve kullanılan materyallerin bu tür çalışmalar açısından uygun olduğu belirlenmiştir.

Anahtar Kelimeler: *Yangın, Orman Yangını, Uzaktan Algılama, Orman, Antalya*

ID: 732

Redesigning Landscape Equipment's with Parametric Design: The Case of Konyaaltı Expo 2016 Park

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Abstract
Parametric design is a process based on algorithmic thinking that allows the expression of parameters and rules that together define, encode, and explain the relationship between design intent and design response. It is the production process of a parametric model based on certain variables, and the variables involved in this process can be; size, quantity or geometry. This means that different inputs produce different designs in the parametric design process. There are parameters, constraints and relationships that make up the parametric model. Parametric modeling concepts range from a simple box of parameters (length, width, and height) and constraints to a complex architecture with thousands of variables, including parameters and geometries. Today, parametric design methods and software have started to become widespread, studies on the parametric design method, especially on facade system solutions, form-geometry searches, the relationship of land and design, different geometry building productions and conceptual relations are widely carried out. It is thought that it is one of the most up-to-date methods that can be used in design and that it is more aesthetic, functional, appropriate, and acceptable than traditional reinforcement elements. Within the scope of this study, it is aimed to redesign some of the landscape equipment of Konyaaltı Expo 2016 Park with a parametric design approach and to compare the park with the existing ones. For this purpose, the landscape equipment's in Konyaaltı Expo 2016 Park, which was determined as the study material, were photographed, and analyzed. Using these data, opinions were taken from a group of 10 experts, and it was determined which equipment should be redesigned. By targeting the redesigns to be made within the scope of the study, a literature search was made on the concept of Parametric Design and the examples made with parametric design were examined. Models of the new reinforcement elements proposed for Konyaaltı Expo 2016 Park were prepared with the Grasshopper tool and rendered images taken with the help of Lumion software. The evaluation of these designs in terms of aesthetics, economics and functionality, their suitability and how acceptable they are, was determined by asking the experts through a questionnaire. In line with the results of the survey, existing reinforcement elements and parametric design reinforcement elements were compared, and the possibilities and possible restrictions were examined.
Key Words: *Parametric Design, Landscape Design, Redesign, Landscape Equipment*

Parametrik Tasarımla Donatı Elemanlarının Yeniden Tasarlanması: Konyaaltı Expo 2016 Parkı Örneği

Özet
Parametrik tasarım, tasarım amacı ve tasarım yanıtı arasındaki ilişkiyi birlikte tanımlayan, kodlayan ve açıklayan parametrelerin ve kuralların ifadesine izin veren algoritmik düşünceye dayalı bir süreçtir. Belirli değişkenlere dayalı bir parametrik modelin üretim sürecidir ve bu sürece dâhil olan değişkenler; boyut, miktar veya geometridir. Bu, parametrik tasarım sürecinde farklı girdilerin farklı tasarımlar ürettiği anlamına gelir. Parametrik modeli oluşturan parametreler, kısıtlamalar ve ilişkiler vardır. Parametrik modelleme kavramları, basit bir parametre kutusundan (uzunluk, genişlik ve yükseklik) ve kısıtlamalardan, parametreler ve geometriler dâhil binlerce değişkenli karmaşık bir mimariye kadar uzanır. Günümüzde parametrik tasarım yöntemleri ve yazılımları yaygınlaşmaya başlamış, parametrik tasarım yöntemi başta olmak üzere cephe sistem çözümleri, form-geometri arayışları, arazi ve tasarım ilişkisi, farklı geometrili yapı üretimleri ve kavramsal ilişkiler üzerine çalışmalar yaygın olarak yapılmaktadır. Tasarımda kullanılabilecek en güncel yöntemlerden biri olduğu ve geleneksel donatı elemanlarına göre daha estetik, işlevsel, uygun ve kabul edilebilir olduğu düşünülmektedir. Bu çalışma kapsamında Konyaaltı Expo 2016 Parkı'nın bazı peyzaj elemanlarının parametrik bir tasarım yaklaşımıyla yeniden tasarlanması ve parkın mevcut olanlarla karşılaştırılması amaçlanmaktadır. Bu amaçla çalışma materyali olarak belirlenen Konyaaltı Expo 2016 Parkı'ndaki peyzaj elemanları fotoğraflanmış ve analiz edilmiştir. Bu veriler kullanılarak 10 kişilik uzman bir gruptan görüş alınmış ve hangi ekipmanların yeniden tasarlanması gerektiği belirlenmiştir. Çalışma kapsamında yapılacak yeniden tasarımlar hedeflenerek Parametrik Tasarım kavramı üzerine literatür taraması yapılmış ve parametrik tasarım ile yapılan örnekler incelenmiştir. Konyaaltı Expo 2016 Parkı için önerilen yeni donatı elemanlarının modelleri Grasshopper aracı ile hazırlanmış ve Lumion yazılımı yardımıyla render görüntüleri oluşturulmuştur. Bu tasarımların estetik, ekonomik ve fonksiyonel açıdan değerlendirilmesi, uygunluğu ve ne kadar kabul edilebilir olduğu uzmanlara sorulan bir anketle belirlenmiştir. Anket sonuçları doğrultusunda mevcut donatı elemanları ile parametrik tasarım donatı elemanları karşılaştırılmış, olasılıklar ve olası kısıtlamalar incelenmiştir.
Anahtar Kelimeler: *Parametrik Tasarım, Peyzaj Tasarımı, Revizyon, Donatı Elemanı.*

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Determination of Hay Yield and Quality of Different Alfalfa (*Medicago sativa* L.) Varieties in Bilecik Ecological Conditions

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Abstract
This research was conducted to determine hay yield and some quality properties of different alfalfa (*Medicago sativa* L.) cultivars during two years between 2020-2022 in Bilecik ecological conditions. In the experiment, 23 alfalfa varieties ranging from 3 to 8 in the dormancy group were used as material. The experiment was arranged in randomized blocks design with three replications. In the study, the cleaning cutting was made in the first year, and the observations were taken over 3 cutting in the second year. Plant height, hay yield, protein yield, ADF, NDF, and mineral content (Ca, Mg, P, K) were determined in cultivars. According to the average of the cutting, plant height and hay yield ranged between 61.07-78.37 cm and 504.77-1066.5 kg/da, respectively. The Ca, Mg, P, and K contents of alfalfa varieties were sufficient for animal nutrition. According to the results obtained from the research; It has been determined that varieties with dormancy group between 5 and 8 can be grown successfully in Bilecik ecological conditions.
Key Words: *Alfalfa, hay yield, ADF, NDF, mineral nutrition.*

Bilecik Ekolojik Koşullarinda Farklı Yonca (*Medicago Sativa* L.) Çeşitlerinin Ot Verimi ve Kalite Özelliklerinin Belirlenmesi

Özet
Bu araştırma, Bilecik ekolojik koşullarında farklı yonca (*Medicago sativa* L.) çeşitlerinin kuru ot verimi ve bazı kalite özelliklerini belirlemek amacıyla 2020-2022 yılları arasında iki yıl süreyle yürütülmüştür. Denemede dormasi grubu 3 ile 8 arasında değişen 23 adet yonca çeşidi materyal olarak kullanılmıştır. Araştırma Tesadüf Blokları Deneme Desenine göre 3 tekerrürlü olarak yürütülmüştür. Çalışmada ilk yıl temizleme biçimi yapılmış olup, gözlemler ikinci yılda ve 3 biçim üzerinden alınmıştır. Çeşitlerde bitki boyu, kuru ot verimi, protein verimi, ADF, NDF ve mineral madde içerikleri (Ca, Mg, P, K) belirlenmiştir. Biçimler ortalamasına göre bitki boyu ve kuru ot verimi sırasıyla 61.07-78.37 cm ve 504.77-1066.5 kg/da arasında değişmiştir. Yonca çeşitlerinin Ca, Mg, P, K içerikleri hayvan besleme açısından yeterli seviyede olduğu tespit edilmiştir. Araştırmadan elde edilen sonuçlara göre; dormansi grubu 5-8 arasında olan çeşitlerin Bilecik ekolojik koşullarında başarı ile yetiştirilebileceği tespit edilmiştir.
Anahtar Kelimeler: *Yonca, kuru ot verimi, ADF, NDF, mineral madde*

Giriş

Türkiye‟nin hemen her bölgesinde doğal olarak görülen yoncanın tarımı son yıllarda giderek artmaktadır. Bu durum mevcut yonca çeşitlerine ek olarak ülkemize ve bölgemize uygun yeni çeşitlerin araştırılması ve adaptasyonlarının sağlanmasını zorunlu hale getirmektedir. Ayrıca bu durum bölge meralarının ıslahında kullanılabilecek mera tipi yoncaların ortaya konulması açısından da büyük önem arz etmektedir (Kır ve Soya, 2008).

Yonca kendisinden sonra ekilen bitkiler için organik madde sağlarken, aynı zamanda azotça zengin iyi bir tarla toprağı bırakır. Yoncanın hem ilkbahar hem de sonbaharda ekimi yapılabilmektedir. Kışları sert geçen yerlerde ilkbahar, ılıman bölgelerde ise sonbahar aylarında ekim yapılabilir. İlkbaharda ekilen yoncadan ilk yıl fazla ürün alınamazken, sonbahar ekilenden ise bir sonraki yaz başından itibaren ürün alınabilmektedir. Yoncadan en yüksek verim üçüncü yılda alınmakta olup, daha sonra verim düşmektedir. Ot verimi, toprağın verimi ile birlikte çeşit ve uygulanan kültürel işlemlere göre değişmekle beraber sulanan koşullarda bir yonca tesisinden yılda 1200-1800 kg/da arasında kuru ot alınabilmektedir (Engin, 2016).

Bilecik'te 430.700 ha toplam arazinin; %53.09'unu orman alanları, %29.04'ünü ise tarım alanları oluşturmaktadır. Çayır-mera alanları ise 6.342 ha ile toplam arazinin %1.47'sini oluşturmaktadır. İlde toplam tarım alanının içerisinde Keleme alan olarak geçen %32,73 oranında boş alan yer almaktadır. Bilecik'te işlenebilir tarım alanları içerisindeki yem bitkileri ekim oranı %5.29 olup, yonca, fiğ, yulaf, korunga ve silajlık mısır en fazla tarımı yapılan yem bitkileridir.

Bu çalışma, Bilecik ekolojik koşullarında farklı yonca çeşitlerinin verim ve bazı kalite özelliklerinin belirlenerek bölgemize uygun yonca çeşitlerinin belirlenmesi amacıyla yürütülmüştür.

Materyal ve Metot

Araştırma, Bilecik ili Merkez ilçesinde yer alan Bilecik Şeyh Edebali Üniversitesi Tarımsal Uygulama ve Araştırma Merkezine ait deneme alanında 2 yıl süreyle (2020-2012) yürütülmüştür.

Denemede materyal olarak dormansi gurubu 3 ila 8 arasında yer alan 23 adet yonca çeşidi (Ranger, Savaş, Toros, Blue Moon, SW 6330, Frigos, Galaxie, Timbale, Prosomenti, Kalender, Nimet, Özpınar, Queen, Planet, Gea, Safkan, Alphil, Verdor, Gözlü 1, Artemis, Tomris, Selta ve Azura) kullanılmıştır.

Deneme alanı toprağı, killi tınlı, hafif alkali (7.68), orta seviyede kireçli (%7.23) ve hafif tuzlu (%0.031) bir yapıya sahiptir. Deneme toprağının fosfor içeriği (23.67 kg/da) ve potasyum değeri fazla olup (113.5 kg/da), organik madde miktarı ise az (%1.61) olarak belirlenmiştir. Çalışmanın yürütüldüğü Bilecik lokasyonunda vejetasyon süresince, uzun yıllar yağış toplamı 459.3 mm, 2021 yılında 478.5 mm ve 2022 yılı ilk sekiz aylık dönemde 311.5 mm olmuştur. İlin uzun yıllar sıcaklık ortalaması 12.5 ^{O}C, 2021 yılında 13.28 ^{O}C ve 2022 yılında ise 13.04 ^{O}C olmuştur. Uzun yıllara ait ortalama nispi nem % 67.0 iken, deneme yıllarına ait ortalama nispi nem sırası ile % 67.1 ve % 67.2 olarak tespit edilmiştir.

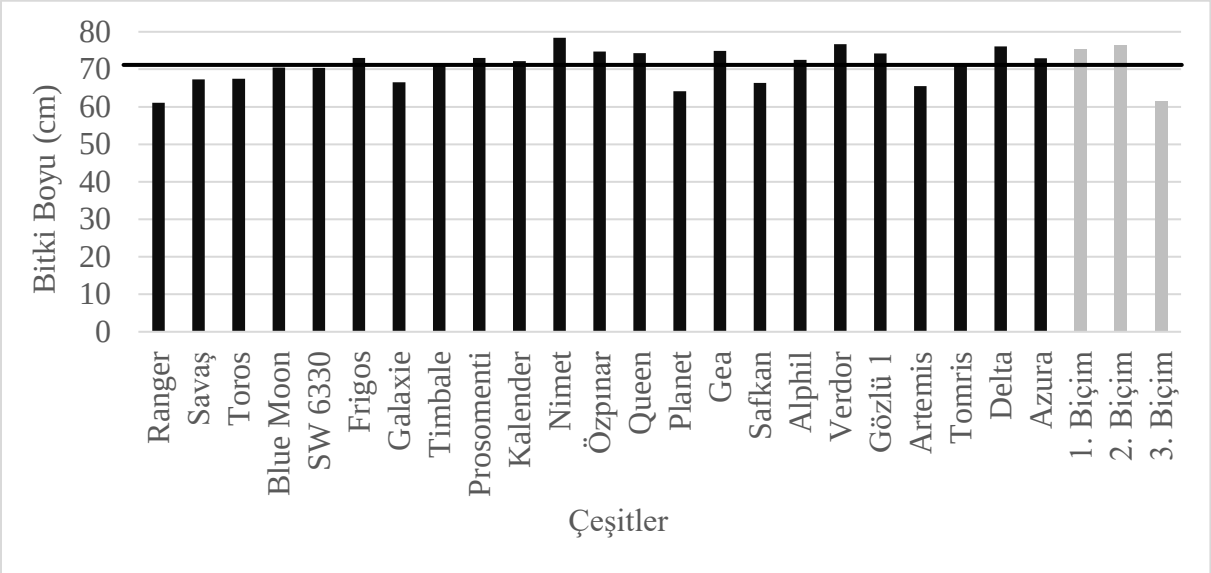
Deneme, Tesadüf Blokları Deneme Desenine göre 3 tekrarlamalı olarak kurulmuştur. Denemede parsel boyu 5 m ve sıra arası 20 cm olacak şekilde 6 sıra ekim yapılmıştır. Ekimler sonbaharda 12.11.2020 tarihinde dekara 2 kg tohum olacak şekilde el ile yapılmıştır. Ekimden önce deneme yerlerinin toprak analizleri yapılmış ve dekara 5 kg N ve 8 kg P_2O_5 olacak şekilde ekimle birlikte gübreleme yapılmıştır. Fosfor kaynağı olarak DAP, azot kaynağı olarak Amonyum Sülfat gübresi kullanılmıştır.

Çalışmada biçimler bitkilerin % 10 çiçeklendiği dönemde yapılmıştır. İlk yıl ekimden sonra, temizleme biçimi takiben ve ikinci yıl da ise her biçimden sonra sulama yapılmıştır. Denemenin tesis yılında temizleme biçim yapılmış olup veriler ikinci yılda alınmıştır. Çalışmada bitki boyu, kuru ot verimi, protein verimi, ADF, NDF, Fosfor ve Kalsiyum Oranları belirlenmiştir. Bitki boyu her hasattan önce cetvelle ölçülerek yapılmıştır. Hasatta kenar tesiri çıkarıldıktan sonra geri kalan alandan elde edilen yeşil ot verimleri kullanılarak dekara yeşil ot verimi belirlenmiştir. Parsellerden alınan örnekler etüvde kurutulduktan sonra elde edilen kuru madde oranlarından yararlanılarak örneklerin dekara kuru ot verimleri, kuru ot verimleri ile protein oranları çarpılarak ise dekara protein verimleri hesaplanmıştır. Kurutulan ve öğütülen örneklerde Foss NIR Systems Model 6500 Win ISI II v1.5 cihazında IC-0904FE kalibrasyon programı kullanılarak protein, ADF, NDF, Fosfor ve Potasyum oranları belirlenmiştir.

Elde edilen sonuçlar Tesadüf Blokları Deneme Desenine göre istatistiki analize tabi tutulmuştur. Aralarında farklılık belirlenen işlemlerin ortalamaları Duncan çoklu karşılaştırma testine göre değerlendirilerek gruplandırma yapılmıştır.

Bulgular ve Tartışma

Bilecik koşullarında 23 farklı yonca çeşidi ile yürütülen bu çalışmada, bitki boyu bakımından çeşitler arasında ve biçimler arasında istatistiksel olarak farklılık belirlenmemiştir. Çalışmada üç biçimin ortalamasında bitki boyu değerleri 61.07 (Ranger) ile 78.37 cm (Nimet) arasında değişim göstermiştir. Frigos, Timbale, Prosomenti, Kalender, Nimet, Özpınar, Queen, Gea, Alphil, Verdor, Gözlü 1, Delta ve Azura çeşitlerinde belirlenen bitki boyu değerleri, üç biçimin ve çeşitlerin ortalaması olarak belirlenen ortalama bitki boyu değeri olan 71.07 cmden yüksek olmuştur (Grafik 1). Töngel ve Ayan (2010) Samsun ekololojik koşullarında farklı yonca çeşitlerinin bitki boyunun, 60.21-77.98 cm arasında değiştiğini bildirmiştir.



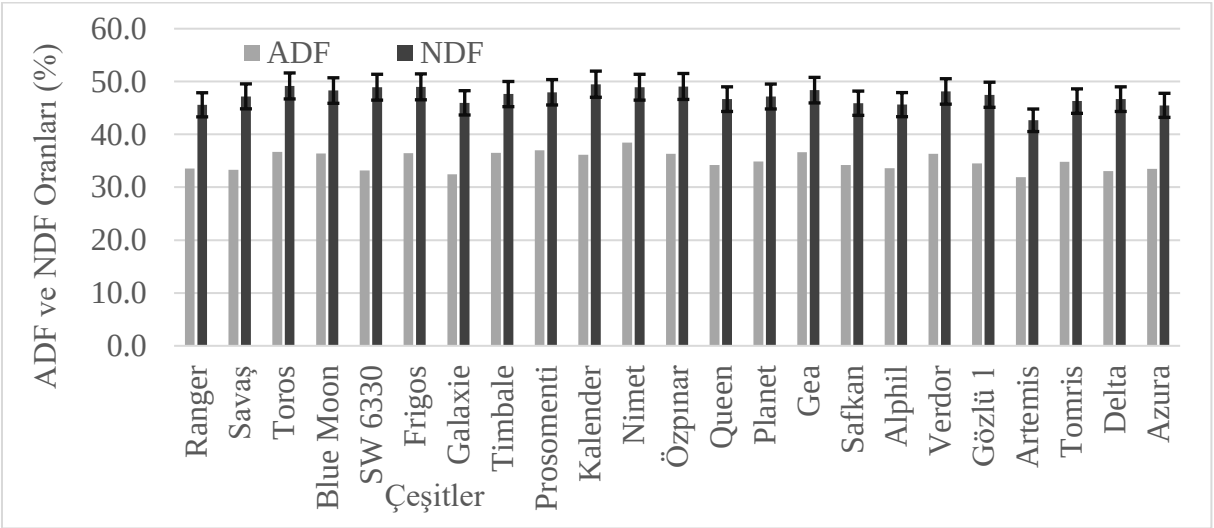
Grafik 1. Çalışmada ele alınan yonca çeşitlerinde belirlenen ortalama bitki boyu değerleri (cm).

Tablo 1. Çalışmada ele alınan yonca çeşitlerinde belirlenen kuru ot ve protein verimleri (kg/da).

Çeşitler	Kuru ot verimi (kg/da)				Protein verimi (kg/da)			
	1B	2B**	3B	Toplam**	1B	2B**	3B	Toplam**
Ranger	266.9	218.2 c-ı	264.8	749.9 c-f	53.4	50.60 c-e	68.5	172.50 a-f
Savaş	264.3	87.7 j	152.8	504.8 g	47.9	18.07 f	37.8	103.73 g
Toros	272.8	264.3 c-ı	223.8	761.0 c-f	51.8	49.37 c-e	54.0	155.23 d-f
Blue Moon	263.1	292.7 c-h	235.8	791.1 b-f	54.8	56.83 b-e	48.6	160.17 c-f
SW 6330	268.3	341.8 a-d	297.2	907.3 a-e	47.2	69.80 a-d	62.8	179.77 a-f
Frigos	252.6	371.7 a-d	346.7	970.9 a-b	43.4	67.37 a-d	80.6	191.33 a-d
Galaxie	275.8	227.3 e-ı	254.0	757.3 c-f	48.0	46.03 de	55.8	149.87 d-f
Timbale	270.4	312.7 c-f	216.2	799.3 b-f	49.8	62.70 a-e	53.4	166.00 a-f
Prosomenti	230.6	364.0 a-d	313.5	908.1 a-e	42.5	71.97 a-c	62.3	176.73 a-f
Kalender	243.7	330.3 b-e	317.0	891.0 a-e	41.9	654.67 a-d	74.4	181.93 a-f
Nimet	271.9	445.0 a	349.7	1066.6 a	45.7	84.30 a	73.0	203.00 a-c
Özpınar	257.9	422.7 a-b	366.8	1047.4 a	41.1	81.67 ab	83.4	206.00 ab
Queen	261.3	373.2 a-c	304.5	939.0 a-c	46.7	76.77 ab	71.2	194.67 a-d
Planet	273.9	296.2 c-g	207.7	777.7 b-e	49.5	63.27 a-e	49.2	162.07 b-f
Gea	281.0	310.0 c-f	298.3	889.3 a-e	50.5	59.40 a-e	66.2	176.10 a-f
Safkan	274.9	287.8 c-ı	281.8	844.6 b-e	48.6	57.97 b-e	70.9	177.53 a-f
Alphil	254.8	376.5 a-c	303.3	934.7 a-c	54.0	82.03 ab	74.8	210.80 a
Verdor	271.2	387.5 a-c	275.3	934.1 a-c	45.7	81.73 ab	64.3	191.67 a-d
Gözlü 1	281.6	330.0 b-e	311.3	922.9 a-d	52.7	67.73 a-d	71.8	192.20 a-d
Artemis	253.9	185.8 h-j	192.7	632.4 f-g	46.2	45.73 de	48.7	140.53 g
Tomris	285.0	180.7 ı-j	247.0	712.7 e-f	46.3	39.57 ef	56.9	142.73 e-g
Delta	269.8	189.3 g-j	266.8	726.0 d-f	50.4	38.07 ef	64.3	152.87 d-f
Azura	254.1	338.5 a-d	300.7	893.3 a-e	41.0	74.33 a-c	70.4	185.73 a-e
Ortalama	***265.2***	***301.45***	***275.12***		***47.79***	***61.35***	***63.62***	

**Aynı harflerle gösterilen ortalamalar arasında p<0.01 düzeyinde farklılık yoktur. B: Biçim.

Tablo 1'de farklı yonca çeşitlerinin kuru ot ve ham protein verimleri görülmektedir. Buna göre her iki özellik bakımından 2. biçimde ve biçimler toplamında çeşitler arasında çok önemli (P<0.01) farklılık olmuştur. Toplam verimlere göre en yüksek kuru ot ve protein verimi sırasıyla 504.8-1066.6 ve 103.73-210.80 kg/da arasında değişmiştir. Farklı yonca çeşitleri üzerinde yapılan çalışmalarda kuru ot ve protein verimi 787-4330.5 kg/da (Gülcan veAnlarsal, 1992; Şengül ve ark., 1992; Şılbır ve ark., 1994; Engin ve Mut, 2017) ve 37.2-590.6 kg/da (Kır, 2010; Töngel ve Ayan, 2010; Turan, 2010; Engin, 2016) arasında değişmiştir.



Grafik 2. Çalışmada ele alınan yonca çeşitlerinde belirlenen ortalama ADF ve NDF oranları (%).

Tablo 2. Çalışmada ele alınan yonca çeşitlerinde belirlenen fosfor ve potasyum oranları (%)

Çeşitler	Fosfor Oranı (%)				Potasyum Oranı (%)			
	1B	2B	3B	Ortalama*	1B	2B	3B	Ortalama
Ranger	0.340	0.390	0.337	0.356 a-d	2.65	2.76	2.36	2.59
Savaş	0.350	0.343	0.357	0.350 a-f	2.74	2.42	2.61	2.59
Toros	0.323	0.323	0.347	0.331 ef	2.88	2.44	2.50	2.61
Blue Moon	0.323	0.337	0.333	0.331 ef	2.68	2.54	2.47	2.56
SW 6330	0.317	0.353	0.333	0.334 def	2.81	2.42	2.58	2.60
Frigos	0.337	0.323	0.327	0.329 f	3.02	2.45	2.46	2.64
Galaxie	0.347	0.360	0.357	0.354 a-e	2.76	2.59	2.50	2.62
Timbale	0.327	0.363	0.340	0.343 c-f	3.01	2.74	2.55	2.76
Prosomenti	0.323	0.357	0.370	0.350 a-f	2.92	2.68	2.68	2.76
Kalender	0.313	0.363	0.337	0.338 def	2.67	2.69	2.51	2.62
Nimet	0.320	0.320	0.370	0.337 def	2.83	2.36	2.75	2.65
Özpınar	0.320	0.340	0.360	0.340 c-f	2.80	2.54	2.60	2.65
Queen	0.317	0.353	0.360	0.343 c-f	2.74	2.52	2.48	2.58
Planet	0.360	0.367	0.360	0.362 abc	3.11	2.67	2.62	2.80
Gea	0.323	0.337	0.353	0.338 def	2.84	2.61	2.66	2.70
Safkan	0.307	0.363	0.367	0.346 b-f	2.79	2.72	2.55	2.69
Alphil	0.323	0.367	0.370	0.353 a-e	2.92	2.55	2.52	2.66
Verdor	0.343	0.373	0.350	0.356 a-d	3.05	2.72	2.52	2.77
Gözlü 1	0.333	0.353	0.360	0.349 a-f	2.91	2.78	2.49	2.73
Artemis	0.360	0.380	0.370	0.370 a	3.01	2.47	2.54	2.67
Tomris	0.333	0.383	0.333	0.350 a-f	2.83	2.75	2.34	2.64
Delta	0.360	0.350	0.363	0.358 a-d	2.99	2.57	2.57	2.71
Azura	0.337	0.393	0.373	0.368 ab	2.89	2.83	2.70	2.80
Ortalama	***0.33***	***0.36***	***0.35***		***2.86***	***2.60***	***2.55***	

*Aynı harfle gösterilen ortalamalar arasında p<0.05 düzeyinde farklılık yoktur; B: Biçim

ADF yemin sindirilebilirliğini, NDF ise hayvanlar tarafından alınabilirliğini ifade etmektedir (Markovic ve ark., 2007; Ateş, 2012; Öztürk ve ark., 2020). Yem içerisinde lif miktarı fazla ise yemin sindirilebilirliği ve alınabilirliğini zorlaştmaktadır. Buna göre, yem içerisinde söz konusu her iki içeriğin de düşük olması istenen bir durumdur. Çalışmada yonca çeşitlerinin ADF ve NDF içerikleri sırasıyla %31.90-36.97 ve %42.67-49.50 arasında olmuştur (Grafik 2). Isparta ekolojik koşullarda farklı yonca çeşitlerinde en düşük ADF ve NDF oranı sırasıyla %30.32 ve %42.27 olmuştur (Yılmaz, 2011).

Yonca çeştilerinin P ve K içerikleri Tablo 2'de verilmiştir. Biçim ortalamalarına göre çeşitlerin P ve K içerikleri sırasıyla %0.329-0.370 ve % 2.59-2.80 arasında değişmiştir. Hayvan beslenmesinde en önemli makro besin elementlerinin başında gelen P ve K hayvanların sağlığı açısından çok önemlidirler. Dua ve Care (1999) fosforun hayvanların iskelet yapısında ve döl veriminde etkili olduğunu, Başbağ ve ark. (2011) ile Gürsoy ve Macit (2017) ise potasyumun vücudun asit-baz dengesini sağladığını bildirmişlerdir. Yem içerisinde P oranının en az %0.21, K oranının ise %0.8 olması gerekmektedir (Kidambi ve ark., 1989) Çalışmada yonca çeşitlerinin P ve K içerikleri söz konusu değerlerin üzerinde olmuştur (Tablo 2). Van ekolojik koşullarında bazı yonca çeşitlerinin adaptasyonu üzerine yapılan çalışmada çeşitlerin P ve K içerikleri sırasıyla %0.11-0.17 ve %2.01-2.08 arasında değişmiştir (Turan, 2010).

Sonuç

Yem bitkileri arasında en önemli bitkilerin başında yonca gelmektedir. Gerek içermiş olduğu protein ve besin elementleri gerekse toprağa kazandırmış olduğu organik madde içeriği bakımından bitki ön plana çıkmaktadır. Diğer taraftan yonca ülke ve bölgemizin kaliteli kaba yem açığının kapatılmasında önem teşkil etmektedir. Özellikle ilimizde yer alan keleme alanlarının değerlendirilmesinde başarıyla kullanılabilir. Buna göre Bilecik ekolojik kouşullarında farklı yonca çeşitlerinin verim ve kalite özelliklerinin belirlenmesi amacıyla yürütülen çalışma sonucunda, dormansi grubu 5-8 arasında olan çeşitlerin başarı ile yetiştirilebileceği tespit edilmiştir.

Teşekkür
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Özet

Türkiye'de 2 milyon ha yem bitkileri ile 14 milyon ha çayır ve mera alanlarından toplam 33 milyon ton kaliteli kaba yem üretimi sağlanmaktadır. Ülkede 19 milyon büyükbaş hayvan birimi (BBHB) bulunmakta olup, bu hayvan varlığının ise yıllık 86 milyon ton kaliteli kaba yem ihtiyacı olduğu düşünüldüğünde, yıllık 53 milyon ton kaliteli kaba yem açığı göze çarpmaktadır. Türkiye ile Avrupa ülkeleri kıyaslandığında mevcut hayvan varlığımızın kaliteli kaba yem ile beslenememelerinden dolayı verim ve kaliteleri düşüktür. Avrupa ülkelerinde 278 kg civarında olan karkas ağırlığı, Türkiye'de 183 kg civarındadır. Buna göre, mevcut yem açığının kapatılması ve hayvansal verimin iyileştirilmesi için tarımı yapılan yem bitkilerine ilaveten alternatif kaba yem kaynaklarının da rasyonlara dâhil edilmesi yadsınamaz bir gerçektir. Türkiye'de yılda atmosfere 506.1 milyon ton kadar CO2 salınımı mevcuttur. Toplam sera gazı emisyonlarında en büyük payı ise %72 ile enerji kaynaklı emisyonlar alırken, bunu sırasıyla %13.4 ile tarım ve %11.2 ile endüstriyel işlemler ve %3.4 ile atık sektörü takip etmektedir. Küresel ısınmaya neden olan tarımsal faaliyetler arasında ruminantların sindirim sisteminden salınan metan gazının oranı ise %32'dir. Bazı bitkiler bünyelerinde kondanse tanen ve saponin olarak adlandırılan ikincil bileşikler barındırmaktadır. Bu bileşikler rumende bazı hidrojen üreten protozoolar ve doğrudan hidrojen kullanan metan üretici organizmaları engelleyerek sera gazı salınımını azaltmaktadır. Ayrıca söz öz konusu bileşikler antihelmintik etki göstererek hayvan iç parazitlerini azaltmakta ve hayvanlarda verim artışı sağlamaktadır.
Bu derlemede hayvan beslemede kullanılabilecek bitkiler ve bu bitkilerin küresel ısınmaya olan etkileri hakkında bilgiler verilmesi amaçlanmıştır.
Anahtar Kelimeler: *Hayvan besleme, kaba yem, kondanse tanen, saponin, küresel ısınma.*

Global Warming and Forage Crops

Abstract

In Turkey, a total of 33 million tons of quality roughage is produced from 2 million ha of forage crops and 14 million ha of meadow and pasture areas. There are 19 million bovine animal units (BBHB) in the country, and when it is considered that this animal population needs 86 million tons of quality roughage annually, there is an annual deficit of 53 million tons of quality roughage. When Turkey and European countries are compared, the yield and quality of our existing animal is low due to the fact that they cannot be fed with high quality roughage. Carcass weight, which is around 278 kg in European countries, is around 183 kg in Turkey. Accordingly, it is an undeniable fact that alternative roughage sources should be included in the rations in addition to the forage crops cultivated in order to close the current feed deficit and improve animal productivity.In Turkey, there are 506.1 million tons of CO2 emissions to the atmosphere annually. The biggest share in total greenhouse gas emissions is energy-based emissions with 72%, followed by agriculture with 13.4%, industrial processes with 11.2%, and waste sector with 3.4%. . Among the agricultural activities that cause global warming, the rate of methane gas released from the digestive system of ruminants is 32%. Some plants contains a secondary compound called condensed tannin and saponin. This compound reduce greenhouse gas emissions by inhibiting some hydrogen-producing protozoans and methane-producing organisms that use hydrogen directly in the rumen. Besides, these compounds show an anthelmintic effect, reduce animal internal parasites and increase productivity in animals.
In this review, it is aimed to give information about the plants that can be used in animal nutrition and their contribution to global warming.
Key Words: *Animal nutrition, roughage, condensed tannin, saponin, global warming.*

Giriş

Geride bıraktığımız yüzyılda ve özellikle 1950'li yıllardan sonra tarımsal alanda bilimsel gelişmeler ve mekanizasyonun yaygınlaşmasına paralel olarak önemli düzeyde üretim artışı sağlanmıştır. Ancak, bütün bu gelişmelere rağmen gelecekte gıda arzı konusunda sorunlar yaşanması beklenmektedir. Son yıllarda tüm dünyada meydana gelen iklim değişikliği, tarım alanlarının azalmasına, üretim maliyetlerinin artmasına, sosyo-kültürel değişimlere ve kırsaldan kente göçün artmasına neden olurken, tarımsal üretimin de sürdürülebilirliğini tehdit altına almaktadır. Bu sürecin orta ve uzun dönemde tüm insanlığı tehdit etmesi kaçınılmazdır. Ancak, özellikle geri kalmış ve gelişmekte olan ülkelerde yeterli gıdaya ulaşım günümüzde dahi ciddi bir sorun halindedir.

Yeterli düzeyde ve dengeli bir şekilde beslenebilmek için bitkisel ve hayvansal proteinler çok önemlidir. Nitekim sağlıklı bir birey günlük 70 gram protein tüketmesi gerekmekte olup, bu miktarın yarısı hayvansal diğer yarsının da bitkisel gıdalardan karşılanması gerekmektedir. Bitkisel kökenli aminoasitler hayvansal kökenlilere oranla daha zor sindirilmektedir. Bu nedenle hayvansal gıdalar bitkisel gıdalara göre daha önemlidir (Gündüz, 2010). Türkiye kişi başına tüketilen günlük protein miktarı bakımından dünya ve gelişmekte olan ülkeler ile aynı seviyededir (Ergün ve Bayram, 2021). Ancak, ülkemizde bitkisel kökenli proteinler hayvansal kökenlilere oranla daha çok tüketilmektedir. Bu nedenle, toplumun çoğunda hayvansal ürünlerin yetersiz tüketiminden kaynaklı Ca ve Fe gibi besin elementi ile A vitamini eksikliklerinin olduğu bilinmektedir (Gürer, 2010).

Son 140 yılda küresel iklimde en belirgin değişim hava sıcaklıklarında meydana gelmiştir. Meteorolojik kayıtlar küresel hava sıcaklıklarının 2020 yılında Sanayi Devrimi öncesine (1880-1900) göre 1.23 °C arttığını gösterirken, 2025'e kadar 1.5 °C daha artacağı söylemektedir. En fazla ısınan yerler kutuplar ve Türkiye'nin içinde yer aldığı Akdeniz Havzası'dır. Atmosferin yanı sıra yeryüzünün %71'ini kaplayan okyanus/deniz suları da ısınmaktadır. Bu ısınma eğilimi kar/buz örtüsünün erimesine, küresel ölçekte deniz seviyesinin yükselmesine, aşırı hava olaylarının görülme sıklığının değişmesine, okyanus sularının asitleşmesine yol açmıştır (Anonim, 2022a).

Hayvancılık faaliyetler, tarımsal kimyasallar, çeltik tarımı, tarımda kullanılan makinalar ve anız yakma gibi bazı tarımsal faaliyetler önemli düzeyde sera gazı salınımına neden olmaktadır. Dünya genelinde antropojenik CH_4 salınımının yaklaşık % 21-25'i hayvan sindirim sisteminde üretilmektedir (Lascano ve Cardenas, 2010). Bu sera gazları sindirim sistemi fermantasyonu (enterik fermantasyon), hayvan dışkı ve idrarı, solunum ve diğer faaliyetler sonucu oluşmaktadır (Hristov ve ark., 2013). Örneğin Kanada'da 1 kg karkas sığır eti üretimi için C ayak izinin 22 kg CO_2 -eq olduğu ve bunun %63'ünün sindirim sisteminde üretilen metandan, %27'sinin de gübreden ve topraktan atmosfere geçen N_2O'dan kaynaklandığı tahmin edilmiştir (Beauchemin ve ark., 2010). Bazı yem bitkileri bünyelerinde biyaoaktif bileşenler (tanen, fenolik, saponin, vb.) barındırmaktadır. Bu bileşenler hayvan sağlığı, verimi ve kalitesinde iyileştirme sağlarken, sindirim sisteminde metan gazı oluşumunu ve dolayısıyla da salınımını azaltmaktadır.

Bu derleme ile alternatif olarak kullanılabilecek yem bitkileri ile bu bitkilerin küresel ısınma üzerindeki etkileri hakkında bilgiler verilerek, ulusal literatüre katkı sağlanması amaçlanmıştır.

Türkiye'de Yem Bitkileri

Türkiye'de toplam işlenebilir tarım alanı 23.185 milyon hektardır. Tahıllar ve diğer bitkisel ürünler toplam işlenen tarım alanların %66'sını (15.421 milyon ha), nadas alanları ise %15'ini (3.513 milyon ha) oluşturmaktadır. Çayır-mera alanları 14.167 milyon ha iken, yem bitkileri üretim alanı ise 2 milyon ha civarındadır (Acar ve ark., 2020). Türkiye'de son verilere göre tarla tarımından (18 milyon ton) ve çayır meralardan (15 milyon ton) elde edilen kaliteli kaba yem miktarı 33 milyon tondur. Ülkede 19 milyon büyükbaş hayvan birimi (BBHB) bulunmakta olup, bu hayvan birimi için ihtiyaç duyulan kaliteli kaba yem miktarı 86 milyon, kaliteli kaba yem açığı ise 53 milyon tondur (Anonim, 2022b). Diğer taraftan sap, saman gibi tarla bitkileri atıkları 30 milyon tondur. Bu hesaplamaya göre toplam kaba yem ihtiyacı 23 milyon ton olarak karşımıza çıkmaktadır (Çomaklı ve Tufan, 2022)

Türkiye'de hayvan sayısı yeterli olmasına rağmen, verimleri oldukça düşüktür. Avrupa ülkelerinde 278 kg civarında olan karkas ağırlığı, Türkiye'de 183 kg civarındadır (Kale, 2008). Hayvanların canlı ağırlıklarının bu derece düşük olmasının sebebi ise rasyonlarda kaliteli kaba yemin yeterince bulunmamasından kaynaklanmaktadır.

Küresel Isınma

Sanayi devriminden sonra artan fosil yakıt kullanımı, fabrikalardan doğaya bırakılan atıklar, nüfus artışı, kentleşme ve bilinçsiz tarımsal üretim çevresel sorunları beraberinde getirmiştir. Bu sorunların en önemlisi ise küresel ısınmadır.

Küresel ısınmanın olumsuz etkisi en çok iklim değişikliği üzerine olmuştur. Nitekim sıcaklıkların artması buzulların erimesine ve deniz suyu seviyesinin yükselmesine neden olmuştur. Küresel ısınma Dünyanın farklı bölgelerinde etkisini aynı zamanda kuraklık, soğuk ve aşırı yağışlar şeklinde de göstermektedir. Bu durumlar doğal afetleri (sel, fırtına, kasırga gibi) meydana getirmektedir. Diğer taraftan küresel ısınma farklı hastalık türlerinin ortaya çıkmasına da neden olmaktadır (Şanlı ve ark., 2017; Temur, 2017).

İnsanoğlunun neden olduğu küresel ısınma yine insan hayatında ekonomik, çevresel ve sosyal alanlarda çok fazla zarara neden olmuştur. Bunları Temur (2017) şöyle sıralamıştır;

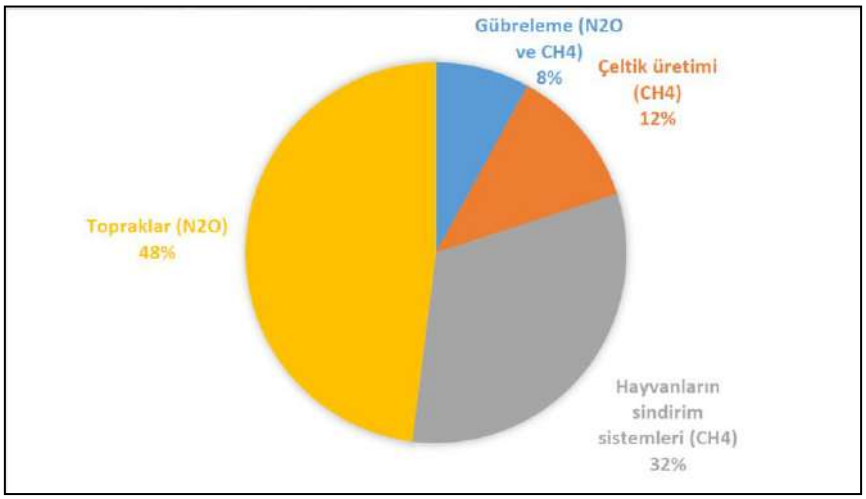
- Gece ve gündüz sıcaklık arasında farklar azalmaya başlamıştır.
- Tarımsal ve orman alanlarında azalmalar meydana gelmiştir.
- Sıcaklık artışı ile yağışlar azalırken, kuraklık ve çölleşme meydana gelmiştir.
- Turizm alanları özelliklerini yitirmeye başlamıştır.
- Hava olaylarındaki aşırı değişimler canlıların mutasyona uğramasına ve kalıtımsal yapılarının değişmesine neden olur.
- Kutuplarda eriyen buzullar deniz seviyesinde yükselmelere neden olmuştur.
- Sıcak hava, yeryüzü ve okyanusların ısınmasına ve dolayısıyla da buralarda yaşayan canlıların (hayvan, bitki vb) ölmelerinde neden olmuştur.

- Çeşitli doğal afetler (heyelan, erozyon ve asit yağmurları, vb) meydana gelmiştir.
- Ekonomik alanda olumsuz etkilere neden olmuştur.
- Artan sıcaklıklar gerek insan gerekse hayvan göçlerine neden olmuştur.

Tarımsal Üretimin Küresel Isınma Üzerindeki Etkisi

Tarımsal üretim insanoğlunun gıda ihtiyaçlarını karşılaması nedeni ile vazgeçilmez bir sektördür. Gelişmekte olan ülkelerin Gayrisafi millî hasılası (GSMH) içinde tarım sektörünün payı çok fazladır. 1950'li yıllardan sonra kimyasal gübre ve tarımsal ilaçların yoğun bir şekilde kullanılması ve sulamanın arttırılması ile tarımsal üretimde verim artışı yaşanmıştır. Ancak bu durumun bazı olumsuz etkileri de olmuştur. Özellikle 1970'li yıllardan sonra yoğun gübre, ilaç ve sulama tüm çevresel sorunları ilgilendiren bir konu haline gelmiştir. Tarım alanlarının üretkenliği düşerken, yer altı sularının da kirlenmesine neden olmuştur. Bu durum çevre için daha az sorun teşkil eden tarımsal üretim tekniklerinin geliştirmesini zorunlu hale getirse de, artan nüfus ile birlikte üretimde verim artışının amaçlanması, üreticileri daha yoğun ve bilinçsiz girdi kullanımına itmiştir. Dolayısıyla da atmosfere tarım sektörü vasıtası ile salınan sera gazlarının oranı daha da artmıştır.

Tarımsal üretimin neden olduğu küresel ısınmada en fazla payı %48 ile toprak içerisinde mikroorganizmalar tarafından üretilen diazot oksit (N_2O) oluşturmaktadır. Bunu sırasıyla %32 ile ruminantların sindirim sisteminden çıkan metan gazı (CH_4) ve %12 ile çeltik üretimi takip etmektedir. Gübreleme faaliyetlerinin sonucunda ortaya çıkan diazot oksit (N_2O) ve metan (CH4) gazları ise tarımsal kaynaklı küresel ısınma içerisinde %8'lik paya sahiptir (Şekil 1).



Şekil 1. Tarımsal üretimin neden olduğu küresel ısınma emisyonları (Anonim 2022c)

Hayvnasal Kaynaklı Üretimde Küresel Isınma

Nüfusun artması et, süt ve yumurta gibi hayvansal ürünlere olan taleplerin de artmasına neden olmuştur. Özellikle de ülkemiz için büyük bir sorun haline gelen köyden kente göç hayvanlar için yem kaynağı olan çayır-meralar ile yem bitkileri alanlarının azalmasına neden olmuştur. Bu durum ise endüstriye dayalı hayvancılığın artışına neden olmuştur. Dolayısıyla işletme masraflarının %70'ini oluşturan yem maliyetlerinin ve küresel ısınmanın artması kaçınılmaz olmuştur. Verge ve ark. (2007) endüstriyel hayvancığın sera gazı salınımının kaba yem üretim sistemlerine göre 2 kat, mera bazlı üretim yapan sistemlere göre ise 6 kat daha fazla olduğunu bildirmişlerdir.

Küresel ısınmaya neden olan hayvansal kaynaklı gazlardan en etkili olanlar metan (CH4) ve diazot oksittir (N2O). Bu gazların küresel sınmaya 2 farklı şekilde etkileri bulunmaktadır. Bunlardan birincisi sindirim sürecindeki etkileridir ve yemin öğütülmesi sürecinde otaya çıkmaktadır. Şahin ve Onurbaş Avcıoğlu (2016) ruminantların sindirim sırasında ortaya çıkardıkları metan gazının yıllık 1 milyon ton olduğunu bildirmişlerdir. İkinci etki ise hayvan atıklarıdır. Hayvan gübrelerinin çürümesi sırasında gerçekleşen gaz çıkışı küresel ısınmayı tetiklemektedir (Demir ve Cevger, 2007). Scheehle (2002) Çiftlik hayvanlarının gübrelerinden çıkan metan gazının yıllık 9.3 milyon ton olduğunu, bunun da toplam metan salınımının %5'ine denk geldiğini bildirmiştir.

Açığa çıkan metan ve azot oksit hayvansal kaynaklı ürünlerin verim ve kalitesini düşürmektedir. Diğer bir deyişle hayvansal ürünlerin verim ve kalitesinin artması ya da azalması açığa çıkan metan ve diazot oksite bağlıdır. Çünkü açığa çıkan metan ve azot oksit üretime (et, süt vb.) dönüşmeyen enerji anlamına gelmektedir. Johnson ve Johnson (1995) ile Hristov ve ark. (1997) biyoaktif bileşen içermeyen bitkiler ile beslenen hayvanların rumende anaerobik fermentasyon sırasında %2-12 arasında metan (CH4) ürettiğini, bunun da hayvanlarda yaklaşık olarak 77 brüt enerji kaybına denk geldiğini açıklamışlardır. Ruminantların rasyonlarına baklagiller ile biyoaktif bileşen (sekonder metabolit) içeren bitkilerin katılması verim potansiyelini artırmanın yanı sıra, et ve süt üretiminde amonyak ve azot oksit salınımını düşürerek karbon tutumunu artırmaktadır (Undi ve ark., 2016).

Küresel ısınmaya etkileri bakımından hayvan türleri arasında da farklılık bulunmaktadır. Buna göre, sığırlar toplam emisyonun yaklaşık %65'ini, mandalar %9'unu, koyun ve keçiler %6.5'ini oluşturmaktadır. Tavuklar ve domuzlar ise sırasıyla salınan CO_2'in %8 ve %9'unu oluşturmaktadırlar.

Yem Bitkilerinin Küresel Isınma Üzerindeki Etkileri

Hayvansal kaynaklı metan gazı salınımın azaltılmasının en etkili yöntemlerinin başında kaba yem kalitesinin iyileştirilmesi gelmektedir (Chung ve ark., 2013). Örneğin buğdaygiller baklagillere nazaran daha zor sindirilmektedir. Bu durum hayvandan yemin daha uzun sürede atılması ve hayvanın daha fazla enerji harcaması anlamına gelmektedir. Beslenme süresi ne kadar kısa olursa, sindirim sistemi de daha az çalışmakta ve daha az gaz çıkışı yaşanmaktadır. Dolaysıyla baklagiller hayvansal üretimin iyileştirilmesine katkıda bulunmaktadırlar (Hristov ve ark., 2013). Iwaasa ve Lemke (2014) hayvanın sindireceği lif oranın azalması ile sindirim hızının artacağını, rumen fermantasyonun daha çok propiyonik asit üreteceğini dolayısıyla da gaz salınımının azalacağını bildirmişlerdir.

Bazı bitkiler yapılarında çözünebilir bir enzim olan Polifenol Oksidaz bulundurmaktadır. Polifenol Oksidaz hem substrat hem de proteazlar proteinleri ile birleşerek, rumende yavaş parçalanan bir yapı meydana getirmektedir. Baklagiller (gazal boynuzu, taç otu) ile alternatif (karahindiba) yem bitkileri bünyelerinde kondanse tanen ve saponin bulundurmaktadırlar. Bu bileşikler proteaz ve substrat proteinlerine bağlanarak rumende zor parçalanan bir yapı oluşturmaktadırlar (Archimede ve ark., 2011). Böylece sindirim sisteminde üretilen metan miktarı da azalmaktadır. Waghorn ve Woodward, (2006) yaptıkları çalışmada, sadece çok yıllık çimle beslenen hayvanlara oranla, çok yıllık çimle birlikte kondanse tanen içeren gazal boynuzu ve İspanyol korungası karışımı ile beslenen sığırların, tüketilen her kg kuru madde için %13-25 daha az metan çıkardıklarını saptamışlardır. İnce bağırsaklardan parçalanmadan geçen azot, tanenlerin etkisiyle, idrara değil dışkıya yönlendirilmektedir. İdrardaki N hızlı bir şekilde sera gazları olan amonyak ve azot oksite dönüşerek atmosfere geçmektedir. Dışkıdaki N ise toprak organik maddesine dönüşmektedir. Tanenlerin ayrıca, rumende bazı hidrojen üreten protozoolar ve/veya doğrudan hidrojen kullanan metan üretici organizmaları engellediği tahmin edilmektedir (Martin ve ark., 2016). Böylece, hem sera gazı salınımı azalmakta, hem de hayvansal verimlilik artmaktadır.

Kondanse Tanen ve Saponin İçeren Bitkiler

Tablo 1'de bazı bitkiler ve içermiş oldukları kondanse tanen içerikleri verilmiştir. Bitkiler aksamları itibariye kondanse tanen içeriği bakımından farklılık gösterebilmektedir. Tabloda en yüksek kondanse tanen içeriği %3.85 ile korunga bitkisinde olduğu görülmektedir. Baklagillerin kondanse tanen içeriği bakımından zengin olduğu bilinmektedir. Ancak diğer diğer familyalara ait kondanse tanen içeriği yüksek olabilmektedir. Bu durum hayvan beslemede alternatif türler açısından önem teşkil etmektedir. Kondanse tanen metan gazı salınımını azaltırken hayvan sağlığı açısından da önem teşkil etmektedir. Ancak bu içeriğin belli bir düzeyde olması gerekmektedir. Bary (1987) düşük tanen içeriğine (% 2-3) sahip bitkilerin rumendeki protein bozulmasını azalttığı için yararlı bir etkiye sahip olduğunu bildirirken, Kumar ve Singh (1984) ise yüksek miktardaki tanenin protein sindirimi ile mikrobiyal ve enzim faaliyetlerini olumsuz şekilde etkilediğini belirtmektedir.

Tablo 1. Yem bitkisi olarak kullanılacak bazı bitkilerin kondanse tanen içerikleri

Bitki isimleri		**Kondanse tanen içeriği (%)**	**Bitki aksamı**
Latince	**Türkçe**		
Viscum album	Ökse otu	%0.98	Yaprak
Melilotus alba Desr.	Aktaş yoncası	%0.61	Tüm bitki
Lathyrus sativus L.	Mürdümük	%0.55	Tohum
Brassica rapa L.	Yem şalgamı	%2.17	Tüm bitki
Hordeum vulgare L.	Arpa	%2.84	Tüm bitki
Triticum aestivum L.	Buğday	%2.80	Tüm bitki
Avena sativa L.	Yulaf	%.2.70	Tüm bitki
Lotus corniculatus	Gazalboynuzu	%0.70	Tüm bitki
Chichorium intybus	Hindiba	%0.14	Tüm bitki
Sangiosorba minor	Küçük çayırdüğmesi	%0.10	Tüm bitki
Coronilla varia	Alaca taçotu	%1.60	Tüm bitki
Onobrychis sativa	Korunga	%3.85	Yaprak

Son yıllarda yapılan araştırmalar saponinlerin metan emisyonunu baskılayıcı özelliklere sahip olduğunu göstermiştir. (Santoso ve ark., 2006; Holtshausen ve ark., 2007). Tablo 2'de saponin içeren bitkiler yer almaktadır. Baklagillerin söz konusu içerik bakımından daha zengin olduğu görülmektedir.

Tablo 2. Saponin içeren bazı yem bitkileri

Bitki isimleri		Bitki isimleri	
Latince	**Türkçe**	**Latince**	**Türkçe**
Beta vulgaris	Şeker pancarı	*Trifolium repens*	Ak üçgül
Lupinus spp.	Acı bakla	*Trifolium pratense*	Çayır üçgülü
Medicago sativa	Yaygın yonca	*Avena sativa*	Yulaf
Melilotus alba	Aktaş yoncası	*Trigonella foenum*	Çemen

(Önal Aşçı ve Acar, 2018)'den yararlanılmıştır.

Sonuç

Gerek dünyada gerekse ülkemizde hayvanların kaliteli kaba yem ile beslenememeleri hayvan sağlığı, verim ve kalitesi açısından önem teşkil etmektedir. Bu durum kaliteli kaba yemlerin üretiminin arttırılması ve rasyonlara dahil edilmesini kaçınılmaz kılmaktadır. Sekonder metabolit içeriğine sahip bitkilerin hayvan verimi ve kalitesini artırdığı bilinen bir gerçektir. Ancak bu bitkiler ile yapılan son dönemdeki araştırmalar sekonder metabolitlerin hayvan hastalıklarının tedavisinde alternatif bir rol üstlendiğini göstermiştir. Bitkiler sahip oldukları sekonder metabolitler sayesinde süt ineklerinin anti-oksidatif yanıtını geliştirirken, stres altındaki koyunlarda da tüm vücut protein sentezini geliştirerek insülin aktivitelerini etkilediği belirlenmiştir. Diğer taraftan sekonder metabolitler hayvansal kaynaklı metan gazı salınımını azaltılmasına katkı sağlamaktadır. Sonuç olarak biyoaktif bileşen içeren bitkilerin hayvanların beslenmelerinde kullanılması hem hayvan sağlığı, hem verimi hem de metan gazı salınımını azaltacağını göstermektedir. Hayvansal metan emisyonunu azaltmak için alınması gereken diğer tedbirleri Naqvi ve Sejian (2011) ile Koyuncu ve Akgün (2018) şu şekilde sıralamıştır;

- Genetik seleksiyonda düşük metan üreten hayvanlar geliştirmek.
- Hayvan beslemenin kaliteli ve stratejik temel besin maddeleri takviyesiyle iyileştirilmek
- Mera yönetimi ve kullanımını geliştirmek
- Hayvanlara uygun bakım ve sağlık koşulları sağlamak
- Rasyonda amonyak ve melas yönünde yapılan değişikliklerle metan üretimini azaltmak
- Rumende protozoonların yok edilmesi ve rumene mikrobiyel müdahale etmek
- Rekombinant ve bağışıklık teknolojileri geliştirmek
- Hayvanlarda verimliliğin artırılarak hayvan sayısının azaltmak
- Uçucu yağlar gibi ikincil bitki komponentlerinin hayvan beslemede kullanmak
- Rasyona bitkisel yağları eklemek
- Metanojen mikroorganizmaları baskılayacak ve onla yarışabilecek probiyotikleri kullanmak.

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Reproductive Characteristics of the Common Cuttlefish (*Sepia officinalis*, Linnaeus, 1758) Population Distributed in the Antalya Bay

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Abstract

Cuttlefish are members of the cephalopod class, that die en masse following a single breeding season (monocyclic spawning). In line with changes of environmental factors, they spent their live in coastal areas at a depth range of 0-200 m. Although adults prefer deep areas before breeding season, they migrate to coastal areas again for breeding activity and die as a result of natural factors at the end of the breeding period. Knowledge on the life cycle and especially reproduction phase of their life is a crucial information to be able to sustainably exploit these species. Even through the coastline of Turkey, due to the variations of the environmental conditions its known that there are differences in reproductive characteristics among the subpopulations of the species.

In order to determine reproductive characteristics of Antalya Bay sub population of the species, total of 490 individuals (244 male and 246 female individuals) were examined. Mantle length of the examined individuals were range between 45 – 177 mm. By using the morphologic characters 4 stages of sexual maturity could be observed for both sexes. Within the scope of our study, the relationship between height and weight, gonad development status (sexual maturity indices) and the number of eggs in female individuals with biometric characters were determined for the population in the sampling area.

Key Words: *Cephalopoda, Invertebrates, Gonad histology, Sexual development*

Antalya Körfezi'nde Dağılım Gösteren Mürekkep Balığı (*Sepia officinalis,* Linnaeus, 1758) Türü Popülasyonunu Üreme Özellikleri

Özet

Mürekkepbalıkları tek bir üreme dönemi sonrasında kitlesel olarak ölen (monosiklik yumurtlama) kafadan bacaklı sınıfı mensubu banlılardır. Çevresel faktörler doğrultusunda şekillenen yaşam süreleri boyunca 0-200 m derinlik aralığında genellikle sahil kesimlerinde yaşamlarını sürdürdükleri bilenmektedir. Ergin bireyler üreme dönemleri öncesine derin alanları tercih etseler de üreme faaliyeti için yeniden sahil bölgelerine göç yapmakta ve üreme dönemi sonunda da doğal etkenler neticesinde ölmektedir. Ekonomik olarak önem taşıyan ve zengin bir gıda olan bu canlıların sürdürülebilir şekilde avcılığının yapılabilmesi için yaşam döngülerinin bilinmesi önem taşımaktadır. Ülkemizde dağılım gösterdiği farklı coğrafyalarda var olan çevresel koşullar altında yaşamını sürdüren türün alt popülasyonları arasında üreme karakterinde değişim olduğu düşünülmektedir.

Gerçekleştirilen bu çalışma kapsamında, türün Antalya Körfezi'nde dağılım gösteren popülasyona ait toplamda 490 birey (244 Erkek ve 246 dişi birey) üreme özelliklerinin tespiti amacıyla değerlendirilmişidir. İncelenen bireyler 45 – 177 mm manto boyu aralığında dağılmaktadır. İncelenen numunelerde her iki cinsiyet için de 4'er eşeysel olgunluk safhasını gözlemlenebilmiştir. Çalışmamız kapsamında örnekleme alanındaki popülasyona dair boy-ağırlık ilişkisi, gonad gelişim durumu (eşeysel olgunluk indeksleri) ve dişi bireylerde yumurta sayısının biyometrik karakterlerle ilişkisi tespit edilmiştir.

Anahtar Kelimeler: *Kafadan bacaklılar, Omurgasızlar, Gonat histolojisi, Eşeysel gelişim*

ID: 738

Quality Parameters of Honey an Important Bee Product

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Abstract
Honey, which is an apitherapy product; It is a valuable food rich in vitamins and minerals, obtained by collecting the nectar formed on the plant by insects, and containing substances of great importance for human health. Different colors, tastes and compositions can be observed in honey obtained from different plants. Honey, which is among the most consumed bee products in Turkey, is among the foods that are mixed with honey. At the same time, fake honey is produced by adding some substances such as sugar syrup and starch adulteration to honey, and it is reported that the production of GMO honey, which also puts consumers at risk, has increased all over the world. In order to prevent this situation, it is stated in the Turkish Food Codex Honey Communiqué that honey should be free from additives (including food additives) and free from organic and/or inorganic substances that are not in its natural composition. As stated in the honey communiqué, there are some quality criteria for honey in order to produce honey. These criteria are the chemical content of honey (phenolic compounds, fructose / glucose ratio, humidity, ash, pH value, Hydroxymethyl furfural, etc.), factors affecting the raw material of honey (i.e. nectar), temperature values during honey heat treatment, raw and fresh honey. specified as the quality criteria of honey. In this study, the effects of the compounds in the chemical structure of honey according to the Turkish Food Codex, the heat treatment application and the nectar structure of honey on the quality were prepared as a review.
***Keywords**: Apitherapy, quality criteria of honey, bee product*

Önemli Bir Arı Ürünü Olan Balın Kalite Parametreleri

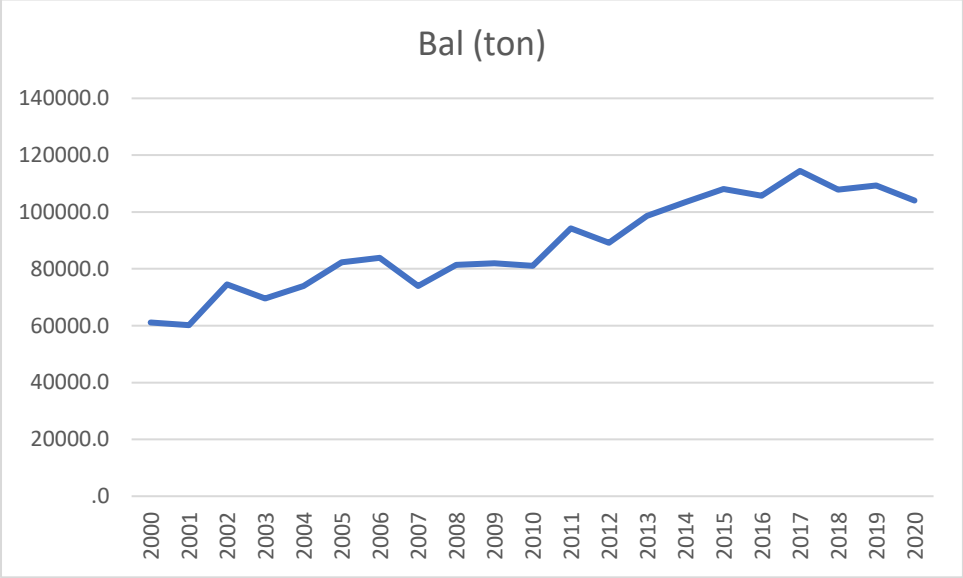
Özet
Bir apiterapi ürünü olan bal ise; vitamin ve mineral bakımından zengin, böcekler tarafından bitki üzerinde oluşturulan nektarı toplayarak elde edilen, insan sağlığı açısından büyük önem ihtiva eden maddeleri içeren değerli bir besindir. Farklı bitkilerden elde edilen ballarda farklı renk, tat ve kompozisyonlar gözlenebilmektedir. Türkiye'de en çok tüketilen arı ürünleri arasında yer alan balda hillendirilen gıdaların arasında yer almaktadır. Aynı zamanda bala şeker şurubu, nişasta tağşişi gibi bazı maddelerin katılması ile sahte bal üretimi gerçekleştirilmekte olup, tüketicileri de tehlikeye sokan GDO'lu balların üretiminin de dünya üzerinde artış gösterdiği bildirilmektedir. Bu durum önüne geçmek adına ise Türk Gıda Kodeksi Bal Tebliği'nde balın katkı maddelerinden uzak (gıda katkı maddeleri dahil olmak üzere), doğal bileşiminde bulunmayan organik ve/veya inorganik maddelerden ari olması gerektiği belirtilmiştir. Bal tebliğinde belirtildiği gibi bal üretimi yapabilmek içinde balın bazı kalite kriterleri mevcuttur. Bu kriterler ise balın kimyasal içeriği (fenolik bileşikler, fruktoz / glikoz oranı, rutubeti, kül, ph değeri, Hidroksimetil furfural gibi), balın hammaddesine (yani nektarı) etki eden faktörler, bala ısıl işlem uygulanması sırasındaki sıcaklık değerleri, balın çiğ ve taze olması balın kalite kriterleri olarak belirtilmiştir. Bu çalışmada, balın kimyasal yapısında bulunan bileşiklerin Türk Gıda Kodeksi' ne göre bulunma oranlarının, ısıl işlem uygulanmasının ve balın nektar yapısının kalite üzerine etkileri derleme olarak hazırlanmıştır.
***Anahtar Kelimeler:** Apiterapi, balın kalite kriterleri, arı ürünü*

Giriş

Türkiye, en çok bitki türü barındıran ülkedir. Avrupa Kıtası, Türkiye'nin yaklaşık 15 katı büyüklüğüne sahip olmasına rağmen, tüm Avrupa Kıtası'nda yaklaşık 12.000 bitki türü yer alırken Türkiye'de 12.000'den fazla bitki türü bulunmaktadır. Bu kadar bitki türünü içinde barındıran ülkemizde arıcık faaliyetlerine oldukça elverişlidir. Son yıllarda ise dünya genelinde arıcılık konusunda üst sıralarda yer aldığı bildirilmektedir (Anonim,2016).
2020 yılında dünyada yaklaşık 1,8 milyon ton bal üretimi gerçekleştirilmiştir. 2020 yılı dünya bal üretiminde %25,9'luk paya sahip olan Çin, 458 bin ton üretimi ile ilk sırada yer alırken, bal üretiminde %5,9'luk paya sahip Türkiye 104 bin ton ile ikinci, %4,5'lik pay ile İran ise 80 bin ton üretimi ile üçüncü sırada yer almaktadır (Anonim,2022). Türkiye 2020 yılında bal üretimi 104 ton olarak gerçekleştirilmiştir. 2019 yılı bal üretimine bakıldığında ise 109 bin ton bal üretimi gerçekleştirilmiş olup 2020 yılında bal üretiminde %4,8'lik bir azalma meydana gelmiştir (Şekil 1). 2000 yıllarından bal üretimi ülkemizde 6.091 ton iken 2020 yılında üretim 104.077 tona ulaşmıştır. Yıllar bazında üretimde bir dalgalanma mevcuttur. Ülkemizde bal üretimi bakımından, Ordu ilinin yaklaşık 16278 ton ile birinci sıra olduğu, bunu daha sonra Muğla, Adana ve Aydın illerinin izlediği görülmektedir (Çizelge 2).

Çizelge 1:Ülkeler bazında bal üretimi (ton)

Ülkeler	*2016*	*2017*	*2018*	*2019*	*2020*
Çin	555,000	542,544	446,879	444,054	458,100
Türkiye	105,727	114,471	107,920	109,330	104,077
İran	67,783	67302	77,388	77,973	79,955
Arjantin	68,123	76379	79,468	78,844	74,403
Ukrayna	59,294	66,231	71,279	69,937	68,028
Abd	73,429	67,596	69,857	71,179	66,948
Rusya	69,764	65,167	65,006	63,526	66,368
Hindistan	61,853	62,138	62,197	62,063	62,132
Meksika	55,358	51,066	64,253	61,986	54,165
Brezilya	39,677	41,696	42,268	45,801	51,508
Diğer	715,390	727,889	764,777	681,727	684,435
Dünya	1.871.398	1.882.479	1.851.292	1.766.420	1.770.119



Şekil 1:Türkiye bal üretimi

Çizelge 2:İller bazında Türkiye'de bal üretimi (Ton)

	Adana	Aydın	Balıkesir	Erzurum	Mersin	Muğla	Ordu	Siirt	Sivas	İzmir	Şanlıurfa
2004	2.742	2.112	1.330	1.364	2.949	9.878	10.196	265	2.608	2.130	448
2005	4.091	2.858	1.819	1.468	2.641	14.418	8.906	540	2.689	2.212	476
2006	6.022	3.547	1.692	1.151	3.045	12.072	9.584	861	2.805	2.272	265
2007	5.887	2.208	1.517	1.317	3.067	4.225	9.818	592	2.502	1.254	286
2008	5.859	3.348	1.513	1.429	2.739	9.422	9.203	601	2.531	1.464	301
2009	5.321	3.527	2.016	1.520	2.676	11.012	9.645	377	2.557	1.989	304
2010	6.694	2.849	1.976	2.048	2.522	6.488	10.380	461	2.749	2.382	1.079
2011	7.437	2.984	2.418	2.104	2.714	11.116	11.820	1.319	3.841	2.521	1.222
2012	8.321	2.907	2.485	1.186	3.159	10.765	11.458	1.350	2.364	2.873	1.281
2013	9.601	3.162	2.582	1.328	2.886	10.901	12.865	1.779	3.309	2.801	1.342
2014	9.715	3.447	2.638	1.244	2.884	15.282	15.039	2.026	3.039	2.877	1.400
2015	9.763	4.007	3.213	1.473	3.493	15.206	16.601	1.061	3.327	2.810	1.502
2016	9.477	3.958	3.105	1.610	3.252	15.875	16.278	1.122	2.861	2.742	1.818
2017	10.729	4.357	3.261	1.289	3.864	15.867	16.799	1.786	3.715	2.836	1.876
2018	10.941	4.227	2.618	1.537	2.416	14.777	16.994	711	5.048	2.777	1.909
2019	11.077	3.693	2.480	1.207	2.352	14.688	17.057	663	5.029	3.007	1.931
2020	12.172	3.643	2.657	2.160	2.150	6.104	17.213	2.401	5.471	1.493	2.120

2020 yılında Ordu ili üretimini bir önceki yıla göre %0,9 oranında arttırmıştır. Adana ili ise bal üretimini bir önceki yıla göre %9,9 oranında arttırmış olup Muğla ili ise bir önceki yıla göre üretimin de %58,4 oranında azalma olmuştur (Burucu,2021).

Arıcılık faaliyetleri sonucu, insan sağlığı açısından önemli ürünler üretilmektedir. Arıcılık ürünlerinin tedavi amacıyla kullanılması çok eski zamanlara dayanmakta olup bu konuda araştırmaların yapılması ve apiterapi merkezlerinin kurulmasıyla günümüzde de güncelliğini korumaktadır. Dünyada özellikle Çin'de "Apiterapi" adi verilen arı ürünleri ile tedavi yöntemleri hızlı bir gelişme göstermiştir. Ülkemizde ise arı ürünlerinin tıbbi

araştırmaları yapılmaktadır. Bal, polen, propolis, arı sütü, ari zehri gibi arıcılık ürünleri çeşitli hastalıkların tedavisinde kullanılmaktadır (Şahinler,2000;Aslan ve ark.2007;Soylu ve ark.2008).Arı ürünlerinden olan ve apiterapide de kullan bal ise şöyle tanımlanabilir: Bitki nektarlarının, bitkilerin canlı kısımlarının salgılarının veya canlı kısımları üzerinde yaşayan bitki emici böceklerin salgılarının bal arısı *Apis mellifera* tarafından toplandıktan sonra bal arısının kendine özgü maddelerle birleştirerek değişikliğe uğrattığı, su içeriğini düşürdüğü ve petekte depolayarak olgunlaştırdığı doğal bir üründür (Karadal ve Yıldırım,2012; Şahinler ve ark.2004;).İşlem görmeden insanlar tarafından tüketilebilmesi, besleyici özelliği ve sağladığı tıbbi yararlar yönünden üstün bir gıda maddesi olarak değerlendirilir (Aydın ve ark.,2008).

Üretilen ballara kaynak teşkil eden ballı bitkiler arasında; kırmızı üçgül, beyaz üçgül, ayçiçeği, yonca, adaçayı, kekik, peygamber çiçeği, geven, engerek otu, sığırdili, uyuz otu, karabaş otu, erik otu, adaçayı, hindiba, ballıbaba, korunga, lavanta, muhabbet çiçeği, nane ve fiğ gibi doğada kendiliğinden yetişen türler en yoğun olanlarıdır. Bunlar dışında akasya, ıhlamur, okaliptus, çam, funda, çeşitli meyve ağaçları, söğüt, yalancı akasya, akça ağaç, böğürtlen, muz, kestane, koca yemiş, püren, erguvan ve meşe bal arılarının üretimde yararlandıkları nektarlı ağaçlardır (Gül,2008).

1.Balın Yapısı

Balların bileşimi arının özünü topladığı bitkilerin türüne, çevresel ve iklimsel koşullara göre değişim göstermektedir (Anklam, 1998). Balın şifa niteliği taşıması açısından önemi ve tüketimi son zamanlarda artış göstermiştir , bileşiminde yaklaşık 200 bileşiğin bulunduğu ve balın bileşiminin çeşitlilik gösterdiği bildirilmiştir (White,1979). Normal bir bal ortalama %20 oranında nem, %76 oranında şeker, %0,18 oranında kül ve %1 oranında polifenol, protein gibi bileşenlerin yanı sıra koruyucu olarak askorbik asit, α-tokoferol, flavonoidler ve diğer fenolikler, katalaz, glukoz oksidaz ve peroksidazgibi ptiyalinleri içermektedir (White,1979).Balın temel yapısının aslında karbonhidrattan oluşmakta, ayrıca sakkaroz, maltoz, isomaltoz, melezitoz ve laktoz gibi şekerler bulunmaktadır. Balın yapısında karbonhidratlardan başka organik asitler, amino asitler (lisin, histidin, arginin, aspartik asit, serin, glutamik asit, prolin, glisin, alanin, valin, metionin, lösin, izolösin, triosin, fenilalanin, triptofan), mineral maddeler (potasyum, sodyum, kalsiyum, magnezyum, demir, bakır, mangan, klor, fosfor, kükürt, kükürt dioksit, iyot) vitaminler (riboflavin, pantotenik asit, niasin, tiamin, piridoksin, askorbik asit), Enzimler (amilaz, sakkaroz, invertaz, fosfotaz, katalaz, glukozoksidaz) ve aroma maddeleri bulunmaktadır (Crane, 1975; YanivandRudich, 1996; Sunay ve Ark. 2003; Şahinler ve ark, 2004;Şahinler ve ark, 2001).Ayrıca asidik bir yapıya sahip olup,PH'ı 3.5-5.5 arasında değişir. Yapısında en fazla glukonik asit bulundurur. Asetik asit ise muhafaza sırasında mayalar, bazı bakteriler tarafından üretilir ve balda asitlik derecesinin yükselmesine neden olur (Anonim,1990). Ayrıca balda diyastaz sayısının fazla olmasının da asitlik artışı ile sonuçlandığı bildirilmektedir. (Tolon,1999).

Çizelge 3. Süzme ve salgı balının bileşimi

Bileşenler	**Çiçek Balı**			**Salgı balı**		
	Ortalama	**En az**	**En çok**	**Ortalama**	**En az**	**En çok**
Su (%)	17.2	13.4	22.9	16.3	12.2	18.2
Fruktoz (%)	38.19	27.25	44.26	31.80	23.91	38.12
Glikoz (%)	31.28	22.03	40.75	26.08	19.23	31.86
Sakkaroz (%)	1.31	0.25	7.57	0.80	0.44	1.14
Maltoz (%)	7.31	2.74	15.98	8.80	5.11	12.48
Yüksek Şekerler (%)	1.50	0.13	8.49	4.70	1.28	11.50
pH	3.91	3.42	6.10	4.45	3.90	4.88
Serbest Asitlik	22.03	6.75	47.19	49.07	30.29	66.02
Lakton	7.11	0	18.76	5.80	0.36	14.09
Toplam Asitlik	29.12	8.68	59.49	54.88	34.62	76.49
Kül Miktarı (%)	0.169	0.02	1.028	0.73	0.212	1.185
Azot (%)	0.041	0	0.133	0.1	0.047	0.223
Diyastaz	20.8	2.1	61.2	31.9	6.7	48.4
Bilinmeyen maddeler (%)	3.1	0	13.2	10.1	2.7	22.4

Kaynak : Crane, 1975

2. Balın Kalite Kriterleri

İnsan sağlığının ön plana çıkmasıyla, ithalat ve ihracata konu olan balların gerek üretim, gerekse hasat ve depolama döneminde kontamine olmuş zararlı bileşikler ve katkıların kalite testlerinin yapılmasını da zorunlu kılmaktadır. Bitkisel üretimde kullanılan bazı pestisitler ile bal arılarının (*Apismellifera*L.) sağlığı için kullanılan bazı veteriner ilaçları Dünyada arı ürünlerinin ve özellikle balın tüketimi ve ihracatında büyük sorunlar teşkil etmektedir. Bu doğrultuda yapılan bilimsel çalışmalarda da ilaç kalıntılarının önemi ortaya konulmuştur (Tolon ve Wallner, 1999;

Kalpaklıoğlu, 2000; Sunay ve ark., 2003; SzerleticsTuri ve SzalaiMatray, 2003; Posyniak ve ark., 2003; Kumova, 2005).

Ülkemiz çok çeşitli bir bitki örtüsüne sahiptir, bu sebepledir ki her balın farklı renk, tat kompozisyonları ve kalite kriterleri vardır (Karadal ve Yıldırım,2012). Bunu belirleyen farklı kriterler ise balın kimyasal içeriği (fenolik bileşikler, fruktoz / glikoz oranı, rutubeti, kül, ph değeri, Hidroksimetil furfural gibi), balın hammaddesine (yani nektarı) etki eden faktörler, balın ısıtılması işlemindeki sıcaklık değerleri, balın taze olması kalite kriterleri olarak belirtilmiştir.

TSE ye görede balın kalitesi içerdiği nem, toplam şeker, invert şeker, hidroksimetil furfural (HMF), diastaz sayısı (DA), kül gibi parametreler ile ticari şeker miktarları tayin edilmektedir. Ancak bu parametreler balın gerçek kalitesinden daha çok tazeliği, kristallenme yapıp yapmadığı, arılara ticari şeker yedirilip yedirilmediği gibi işlemleri göstermektedir. Oysa balın esas kalitesini belirleyen faktör balın biyolojik değeri olup bundan sorumlu bileşikler ise balda ancak %1–2 oranında bulunabilen, ikincil metabolit ürünler olarak adlandırılan çeşitli uçucu bileşenler ile fenolik maddelerdir (Ateş,2014). Balda kalite kriterini belirlerken dikkat edilecek parametreler ise şöyle sıralanabilir;

Renk

Balın normal rengi, açık sarıdan koyu esmere kadar değişiklik göstermektedir (Şahinler,2000).Bu renk değişimi balın içinde bulunan mineralden kaynaklıdır. Yani bakıldığında koyu renkli balların açık renkli ballardan daha fazla mineral madde içeriğine sahip ve asidik yapıya sahiptir. Yine yapısında yer alan özle görülebilen aralıktaki ışığı absorbe edebilen polifenoller, flavonoidler, terpenler ve karotenoidler gibi bileşiklerden kaynaklı olarak renk değişimleri gözlenmektedir .Birde tüketiciler açısından istenmeyen bir özellik olan esmerleşme olarak da bilinen Maillard reaksiyonu da balın rengine etki etmektedir. Bu reaksiyon da ise, amino asitlerin amino grupları ile indirgen şekerler arasında oluşur ve bal muhafazasının yaygın bir yan etkisidir (Türkmen ve ark.,2006). Yapılan bir araştırmada ise balın 37 °C (90 Gün) 35- 40 °C'de (4 yıl) muhafaza edildiği muhafaza süresinin artışına bağlı olarak renkte koyulaşma gözlemlendiği bildirilmiştir (Brudzynski ve ark.,2011). Başka bir araştırmada ise muhafaza edilen balların renginin koyulaştığı ve UV absorbe eden bileşiklerin yanısıra melanoidinlerin miktarının arttığı bildirilmiştir (Nombre ve ark.,2010). Bileşimi alındığı kaynağın cinsine, -üretim dönemine ve üretim yöntemine göre farklılık gösterebilir (Genç, 1993; White, 1984). Balın rengi ise Türk Gıda kodeksi bal tebliğine göre su beyazından koyu amber renge kadar değişebilir. Salgı balının renginin pfund skalasına göre en az 60 olması gerektiği bildirilmiştir.

Birde bu renk farklılığının kül miktarı ile ilişkisi vardır.Balın külünün fazlalığı renginin koyuluğu ile doğru orantılıdır. Oranı ise Çiçek balında %0,6'dan fazla; salgı balında ise %1,2'den fazla kül seviyesi bulunması uygun değildir (Anonim 2002).

Elektriksel İletkenlik

Balın fiziksel parametreleri arasında yer alan elektriksel iletkenlik bal da ki mineral ve asit içeriğine göre değişiklik göstermektedir. Mineral madde konsantrasyonları yüksek olan ballarından elektriksel iletkenlikleri yüksektir (Solayman ve ark. 2016).

Türk Gıda Kodeksi Bal Tebliğine göre ballarda bulunması gereken elektiriksel iletkenlik oranları ise en fazla 0,8 mS/cm olarak belirlenmiştir Anonim,2020).

Viskozite

Viskozite ballarda akmaya karşı direnci demektedir. Yani akıcılığı yüksek olan ballar viskozite düşük iken akıcılığı alçak olan ballarda viskozite yüksektir (Çapar,2010). Balın viskozite özelliği ise balın kompozisyonun, yapısında yer alan hava kabarcığı miktarına,nem miktarına,içerdiği küçük kristallere bağlı olrak değişiklik göstermektedir.Viskozitenin önemi ise kullanılan ekipmanların dizayn edilmesinde ve kullanılmasında göz önünde bulundurulur (Karadal ve Yıldırım,2012).

Asitlik ve ph

Asitlik oluşumu balda istenmeyen bir özellik olan fermantasyonun bir sonucu olarak meydana gelir (Esti ve Ark., 1997). Kaliteli ballarda fermantasyon ya da gaz oluşumu başlamamış olmalıdır (Ruof ve Bagdonow,2004). Bal da asitliği ise serbest asitlerin, laktonların ve esterlerin toplamı belirlemektedir. Balın asitliği ise glukonik asit, eşitli organik asitlerden ve fosfat ve klorid gibi inorganik iyonlardan kaynaklandığı bildirilmiştir (Cavia ve ark.,2007). Balda bulunana serbest asitlerin miktarının artması ise balın fermente olduğunun bir göstergesidir. Bu durumda ise bal da ki şeker ve alkoller balda yer alan mayalar tarafından asitlere dönüştürülmektedir (Kahraman ve ark.,2010; Mandal ve Mandal,2011). Kaliteli bir bal da ise Türk Gıda Kodeksi Bal tebliğine göre serbest asitlerin miktarının 1000 g balda 50 meq'dan fazla olmamalıdır (Anonim,2020). Yapılan çalışmalar, serbest asit ve lakton miktarı açısından balın açılmadan önce, oda sıcaklığında 20 ay muhafaza edilebileceğini göstermektedir.

Balda fermantasyonu önlemek içinde işlenmesi sırasında, balı kritalizasyon ve fermantasyondan korumak, ekstraksiyon ve filtrasyonu kolaylaştırmak, balın viskozitesini arttırmak için ısıl işlem uygulanması gerekmektedir. Balın kalitesini yüksek tutmak için ısıl işleminin süresi ve derecesi kontrol edilmelidir. Isıl işlem baldaki enzimlerin kaybına ve HMF miktarının artmasına, dolayısıyla balın tazeliğini kaybetmesine sebep olmaktadır (Falico ve Ark.,2004).HMF miktarı artmış bir bal tazeliğini yitirmiş düşük kaliteli bir ürün olur.

Balın pH'sı ise yapısında ki iyonize asitlere ve mineral maddelere bağlıdır.Hayvansal kökenli patojen bakterilerin ve daha birçok bakterinin oluşumunu engellemede pH değerinin düşük olması etkilidir. Keza yaklaşık olarak %15-25 arasında su içermesi, mikroorganizmaların hemen hepsinin üreme yeteneğini kısıtlar. (Aydın ve ark.,2008;Estupinan ve Sanjuan,1998). Balın pH'sı 3.9 (3.5- 5.5 arasında) 'dur (Karadal ve yıldırım;2012).

Nem

Kovandaki balın doğal nemi nektardan kaynaklanmaktadır. Balda yer alan nektarı miktarı iklim koşulları, üretim yılı ve mevsimi gibi etkenlere göre değişkenlik gösterirken, nektarın salgılanma hızı, koloni büyüklüğü gibi olgunlaşma üzerine etkili faktörler ile balın işlenmesi sırasında uygulanan sıcaklık ve depolama koşulları balın nem miktarı üzerinde etkili olmaktadır (Kahraman,2012).Nem içeriği, kalitesinin değerlendirilmesinde bir gösterge olup raf ömrünü etkileyen önemli bir parametredir (Bogdanov ve ark., 2004; Gómez-Díaz ve ark., 2005). Nem değerinin düşük olması balın uzun süre korunması ve pazarlaması için uygun olduğunu göstermektedir. Balın hasat zamanıyla ilişkili olan nem değerlerinin Türk Gıda Kodeksi Bal Tebliğine göre nem miktarı Çiçek ve salgı ballarında en fazla %20 oranında olmalıdır. (Çizelge 4; Anonim,2020)

Çizelge 4: Türk Gıda Kodeksi Bal Tebliği Nem Değerleri

Nem değeri En fazla	Çiçek Balı	Salgı Balı	Çiçek ve Salgı Balı Karışımı	Fırıncılık Balı
	%20	%20	%20	%23
	%23 Püren*(Calluna vulgaris)* ve Funda*(Erica spp.)*ballarında			%25 Püren ve Funda kaynaklı fırıncılık balı

Kaynak; Anonim,2020

HMF düzeyi

HMF(hidroksimetilfurfural), düzeyi balın kalitesini belirlemek için yıllardır kullanılmaktadır. HMF pişirme ya da sterilizasyon esnasında gıdalara uygulanan ısı işlem sonucu, indirgen şekerlerin aminoasitlerle oluşturduğu, enzimatik olmayan esmerleşme (Maillard) reaksiyonu ya da heksozların asit katalizörlüğünde dehidrasyonu sonucunda oluşmaktadır (Karadal ve Yıldırım,2012). Balda pastarizasyon ve kristalizasyonun önlemek için bala uygulanan sıcaklık işlemi sonucu bu değerde yükselmeler meydana gelmektedir. Uygulanan sıcaklığın süresine bağlı olrak da balın yapısında ki besin değerlerin, ve diastaz enziminin aktivitesi azaltarak, HMF değerinin yükselmesine neden olmaktadır (Tosi ve ark. 2002). Yapılan bir araştırmada ise başlangıçta serbest asit ve lakton miktarı fazla olan ballarda ısı işlemi ve muhafaza sonrası daha fazla HMF oluştuğu, başlangıç protein, prolin ve katalaz miktarı ile diastaz sayısı yüksek olan ballarda ısıl işlemi ve muhafaza sonrası daha az HMF oluştuğu bildirilmiştir (Karadal ve Yıldırım,2012;Tosi 2002). Ayrıca HMF taze ballarda çok az miktarda bulunur ve balda yüksek miktarlarda bulunması istenen bir kalite kriteri değildir (Yıldız ve ark. 2010). Türk gıda kodeksi bal tebliğine göre ise HMF değeri 40 mg/kg 'dan fazla olmamalıdır(Anonim,2020).

Şeker Profili

Su aktivitesi, orijin, muhafaza süresi ve muhafaza şartlarının yanında içerdiği glikoz miktarı, balın raf ömrü ve kristalleşme durumu üzerine son derece etkilidir. Balda sakkaroz miktarının yüksek olması, arıların sakkarozla beslendiğini veya bala direkt sakkaroz katıldığını gösterir (Aydın ve ark,2008).

Bal da en fazla olarak glikoz ve fruktoz bulunur ve bu monosakkaritlerin tadının oluşmasında etkilidir. Sakkarozun invertaz enzimi ile inversiyona uğraması neticesinde meydana gelirler. Balın bazı özelliklerini veren (tadı, viskozite, enerji değeri gibi) bu iki monosakkarit aynı zamanda balın şeker profili hakkında bilgi verirken, şeker profili analizi ile belirlenen melezitoz ve erloz gibi oligosakkaritlerin miktarı salgı balını çiçek balından ayırt etmek amacıyla kullanılmaktadır (Şahinler ve ark.,2009; Turan,2012).

Kristalizasyon

Balın kalitesini belirlemede ki önemli fiziksel kriterlerdendir. Balın içindeki glikozun sudan ayrılıp balın içindeki diğer partiküller ile birleşerek küçük kristaller halinde akışkan özelliğini kısmen kaybederek çökmesidir. Halk arasında şekerlenme olarak da bilinir (Ateş,2014). Diğer bir deyişle ise balın fruktoz oranın düşerek glikoz oranın artması kristalizasyonunda artmasıdır.

Kristalizayona etki eden faktörler ise: Balın nem ve dekstrin içeriği, su aktivitesi, bal içinde mikrokristallerin varlığı, muhafaza sıcaklığı ve önceden uygulanan ısı işlemleri, Süzme sırasında bal içerisinde kalan partiküller ve hava kabarcıkları, Glukoz/su oranı ve fruktoz/glukoz oran olarak sıralanabilir (Doğaroğlu 2009, Çınar 2010).

Doğal kristalizasyon, bal tekstüründe bozulmaya yol açtığı için tüketiciler tarafından istenmeyen bir durumdur. Ayrıca şekerden ayrılmış zayıf likit faz, fermentasyonu başlatabilir. Arıcılarımız tarafından dikkat edilmesi gerekecek noktalardan biri ise balın hasat edilmesi sırasında ise petek yüzeyinin sırlama oranıdır. Bal hasadın da balın petek yüzeylerinin 1/2-2/3'ünün sırlanmasından sonra, yani balın yeterince olgunlaşmadan erken hasat

edilmesi sonucunda bal içermesi gerekenden fazla su içerdiği bildirilmiştir. Fazla su içeriği ise balın erken kristalleşmesine ve depolama esnasında erken fermantasyona uğramasına neden olmaktadır (Ferek,2016).
Kristalize olmuş ballara ise ısıl işlem uygulaması yapılmaktadır. Bu ısıl işlemler su banyosunda ısıtma, hava ile ısıtma, elektrikli tabakalar ile ısıtma, pastörizasyon: 70-78 °c'de kısa sürede ısıtıp hemen soğutma, ultrason dalgaların kullanılması, mikrodalga fırınlarda ısıtma, infrared fırınlarda ısıtma olarak sıralanabilir.

Veteriner kalıntı ilaç kalıntı sınırları
Türk Gıda Kodeksi Hayvansal Gıdalarda BulunabilecekFarmakolojik Aktif Maddelerin Sınıflandırılması ve maksimum Kalıntı Limitleri tebliğine göre balda Fluvalinate ve Naphtalene bulunmamalıdır, ayrıca balda Amitraz 200 ppb, Coumaphos 100 ppb kalıntı limitleri içinde olmalıdır (Anonim,2017).

Çizelge 5:Türk Gıda Kodeksi Bal Standardı İçin Belirlenen Veteriner ilaçlar Maksimum Kalıntı Limitleri (Anonim,2017)

Veteriner ilaçlar maksimum kalıntı limitleri (MRL) µg/kg	TürkGıdaKodeksi
Amitraz	200
Coumaphos	100
Fluvalinate	Bulunmamalı
Naphtalene	Bulunmamalı
Sulfamethazin	10
Kaumafos	100
Tetracycline	10
Streptomycin	20

Prolin Değeri
Bal arıları tarafından toplanılan nektarın bala dönüşmesi sırasında, balın yapısına katılan aminoasite prolin denilmektedir. Balın yapısında yer alan aminositlerin yaklaşık olarak %50-85 'ni prolin oluşturmaktadır. Yani balın protein içeriğini prolin miktarı olarak belirlenmektedir(Çınar,2010,;Bayrambaş, 2012). Prolin miktarı balın saflığının bir parametresidir. Piyasada bulunana tağşiş balların analizleri gerçekleştirildiğinde bu ballarda prolin değeri daha düşük çıkmaktadır. Türk Gıda Kodeksi Bal Tebliğin TEBLİĞ NO: 2020/7 göre salgı ve çiçek ballarında bulunması gereken miktar 300 mg/kg olarak belirtilmiştir (Anonim,2020).

	Çiçek Balı	Salgı balı	Çiçek ve Salgı Balı Karışımı	Fırıncılık Balı
Prolin değeri En az	300 mg/kg	300 mg/kg	300 mg/kg	180 mg/kg
	180 mg/kg Kanola, ıhlamur, narenciye, lavanta, okaliptus			
	120 mg/kg Biberiye, akasya ballarında			
	500 mg/kg Kestane ballarında			

Kaynak;Anonim,2020

Sonuç
Ülkemiz nektarlı bitkiler bakımından oldukça zengin bir bitki örtüsüne sahiptir. Bu sebepledir ki arıcılığa uygun ülkelerden biridir. Yapısında bulunan özel bileşikler ve doğallığı ile sağlık üzerine de faydaları göz ardı edilemez. Yara ve yanıkları tedavisinde, sindirim sistemi rahatsızlıklarında, ağız enfeksiyonu ve bronşial rahatsızlıklarda, cildi besleyici ürün olarak kullanılması vb. balın apiterapi ürünü olarak yaygınlaştığının göstergesidir.
Arılarda elde ettiğimiz bu muhteşem ürünün bizim sofralarımıza gelene kadar geçirdiği aşamalar vardır. Bu aşamalar kovan ve bal çıkarma, çerçeveli balın taşınması, kapağın açılması ,yerleştirmesi, filtrasyon, depolama ,doluma hazırlık ve dolum aşamaları olarak ayrılır. Bu aşamalarda bal bir çok tehlikeye maruz kalır. Bu aşamalarda da gerekli kontrol ve düzenleyici faaliyetler yapılmalıdır. Kovan ve bal işlemlerinde toprak ve bikri maddeleri, koruyucular, haşereler, boya maddeleri gibi tehlikeler oluşabilir. Eğer elde edilen ürün bunlardan birine maruz kaldıysa yakma işlemi uygulanarak bal imha dilmelidir.Bu ürünler ambalajlanırken son kontrolleri dikkatli yapılmalıdır. Kavonuzu çatlamış kırılmış ürünler kullanılmamalı, ısı uygulamaları bal tebliğine göre yapılmalı, depolama aşamasında su çekme ihtimaline karşı refraktometre ile ölçümleri yapılmalıdır.

Kaliteli bir bal için ısı uygulamalarına oldukça dikkat edilmelidir fazla bir ısıya maruz bırakılarak fermantasyona sebebiyet verilir. Eğer uygun olmayan şartlarda bu işlem gerçekleştirilirse balda kristalizasyona neden olabilir. Pazarlama kalitesini arttırmak amacıyla balların fermantasyona uğramaması ve uzun süre kristalleşmeden muhafaza edilebilmesi için fabrikalarda uygulanan yüksek ve uzun süreli sıcaklık işlemi ile kontrolsüz şekilde arttığı bilinmektedir. Yapılan bu işlem balların başlangıç HMF değerlerini yükseltip diastaz enzimlerini yıkılmayarak uygun olmayan muhafaza koşullarının da etkisiyle kalite kaybına ve besin değerinin azalmasına neden olmaktadır.

Balın uzun süre depolanması da kalite düşüklüğüne sebep olur. Bal yapısı gereği kokuları çekebilir ve korozyona dayalı kaplarda saklaması gerçekleştirilmelidir. Yine uzun süre depolama ,balın ısıya ve ışığa maruz kalması HMF miktarının artmasına sebep verebilir. HMF miktarı ne kadar az bulunursa bu miktar balın kalitesini o kadar yükseltir.

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The Impact of the Surrounding Land Uses on Water Quality of Some Selected Cascade and Perennial Tanks in Anuradhapura District, Sri Lanka

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Abstract

The present study was conducted to evaluate the water quality of the inlet, irrigation outlet, and edges linked to Nuwarawewa reservoir, Mahakanadarawa reservoir, Hurulu wewa reservoir, Sangilikandarawa reservoir, and Nachchaduwa perennial reservoir in Anuradhapura, Sri Lanka. Water samples were taken from a designated position of each inlet, irrigation output, and edges in the second inter-monsoon, northeast monsoon, and first inter-monsoon seasons. Water quality indicators such as pH, electrical conductivity (EC), total dissolved solids (TDS), Na, K, Ca, Mg, Sodium Adsorption Ratio (SAR), NO_3^- -N, NH_4^+-N, dissolved reactive phosphorus (DRP), and heavy metals (Cd, As, Pb, and Hg) concentrations were measured in each water sample. Data was analyzed using SPSS statistica software. Considerable temporal fluctuations in water quality indicators were detected in inlets, irrigation outflows, and edges over the research period. The findings revealed that NO_3^- -N, NH_4^+-N, and DRP in Sangilikandarawa reservoir during the northeast monsoon were close but not above the FAO maximum levels guidelines for irrigation water. pH, EC, TDS, and heavy metals (Cd, As, Pb, and Hg) in all the other tanks were within permitted values according to WHO drinking water quality standards and FAO guidelines for irrigation water. This finding further demonstrated that the consequences of surrounding land use on water pollution in inlet water canals linked to Sangilikandarawa and Nuwarawewa are greater. It could be concluded that a pollution management plan needs to be implemented in order to stop further pollution.

Key words: *Anuradhapura reservoirs, Heavy metal, Temporal variation, Water pollution*

ID: 740

Importance for Queen Bee and Colony

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Abstract
Bees are social creatures that live in colonies. The individuals forming the colony are one queen, 1000-2000 drones in the swarming season, and between 80,000 and 20,000 worker bees, the numbers of which vary according to the season. All individuals in the colony carry out all the work necessary for the continuity of the colony by sharing regularly. Many genetic characteristics of the colony, such as being calm or aggressive, being resistant to diseases or being susceptible to diseases, depend on the queen and the drone mating with the queen. The presence of the queen bee in the colony is important thanks to the pheromones secreted by the worker bees in fulfilling their duties. For this reason, it is important to replace the queen bee every two years, if possible, if possible, for the productivity of the colony. Since the queen bee bred with technical methods cannot meet the needs of our country, producers continue to produce with poor quality queens produced by natural methods. In order to increase honey yield per colony in our country, it is important for the queen to continue production with quality queens, which is one of the most important factors. For an efficient beekeeping, the importance of the queen and the queen in the colony should not be ignored.
Keywords: *Honey Bee, queen Bee, quality, honey bee colony*

Ana Arı ve Koloni İçin Önemi

Özet
Arılar Koloniler halinde yaşayan sosyal canlılardır. Koloniyi oluşturan bireyler ise bir tane ana arı, oğul sezonunda 1000-2000 erkek arı ve sayıları mevsime göre değişen 80.000 ile 20.000 arasında işçi arı bulunmaktadır. Kolonide yer alan tüm bireyler kolonininin sürekliliği için gerekli olan tüm işleri düzenli bir şekilde paylaşarak yerine getirmektedirler. Kolonininin verimliliği, sakin veya hırçın oluşu, hastalıklara dayanıklı veya duyarlı olması gibi birçok genetik özelliği ana arı ve ana arı ile çiftleşen erkek arıya bağlıdır. İşçi arıların görevlerini yerine getirmede salgıladığı feromonlar sayesinde ana arının kolonide varlığı önem taşımaktadır. Bu nedenle de kolonininin verimliliği için ana arının mümkünse her yıl değilse en fazla iki yılda bir ana arının değiştirilmesi önemlidir. Teknik yöntemler ile yetiştirilen ana arı ülkemizin ihtiyacını karşılayamadığı için üreticiler doğal yöntemlerle üretilen kalitesiz ana arılar ile üretime devam edilmektedir. Ülkemizde koloni başına bal verimini artırmak için, ana arının en önemli faktörlerden biri olan kaliteli ana arılar ile üretime devam etmeleri önemlidir. Verimli bir arıcılık için de ana arı ve ana arının kolonideki öneminin göz ardı edilmemesi gerekmektedir.
Anahtar Kelimeler: *Bal Arısı, ana arı,kalite, bal arısı kolonisi*

Giriş

Bal arısı kolonisini; bir adet ana arı; on binlerce işçi arı ve yüzlerce işçi erkek arılar oluşturmaktadır. Kolonideki işçi arı sayısı kış aylarında 10.000-15.000 arasında değişirken; ilkbahara doğru sayıları daha da azalır. Baharın ilerleyen dönemlerinde sayıları giderek artar ve yaz aylarında çeşitli faktörlere bağlı olarak, bir kolonide 60.000-80.000 adet işçi arı bulunabilir. Yani işçi arı sayısı mevsime, ana arının yumurtlama kapasitesine, nektar ve polen kaynaklarının zenginliğine, stres faktörlerine, kolonide hastalık ve zararlı bulunma durumuna göre değişiklik göstermektedir (Önder,2006). Koloniyi oluşturan Erkek arılar haploid (n=16) olan yumurtalardan gelişirler ve kolonininin en iri birey grubunu oluştururlar. Dölsüz yumurtalardan geliştikleri için sadece ana arının kromozomlarını taşırlar. Bu nedenle kolonininin babasız bireyleridirler. Ana arı; arı ailesinin en önemli ferdidir. Özel durumlar dışında her kovanda bir tane bulunur. Koloniyi oluşturan bu bireyler kolonininin sürekliliği için koloni içerisinde çeşitli görevleri bir düzen içerisinde paylaşarak sağlamaktadırlar (Korkmaz ve Öztürk, 2004; Doğaroğlu ve Doğaroğlu, 2015).

Koloni bireyleriden olan ana arı döllenmiş (2n=32) diploid yumurtalardan gelişir. İşçi arılarla aynı kalıtsal materyale sahiptir. İşçi arılarla arasındaki farklılık besleme döneminde meydana gelmektedir. İşçi arılar 3 günlük larval dönemin sonunda bal ve polenle beslenirken ana arılar tüm larval dönemde arı sütü ile beslenirler. Bu farklı besleme sonucunda işçi arılarla aynı genotipik yapıya sahip olmalarına rağmen ana arılar meydana gelmektedir. Ana arının vücut yapısı ince ve uzun, rengi diğer bireylere göre daha açık, canlı ve parlaktır. Özellikle kolonide yavru yetiştirme aktivitesinin yüksek olduğu dönemlerde karın çok uzundur. Vücudu işçi arılardan daha geniş ve erkek arılardan daha uzundur(Özbakır;2013).

Kanatları vücut uzunluğuna oranla işçi ve erkek arıların kanatlarına göre kısa görünür; fakat gerçekte işçi arıların kanatlarından daha uzundur. Ancak kanatları kendi vücut uzunluğuna oranla kısa olduğundan uçma yetenekleri

fazla değildir. Ana arı genellikle kendisini çevreleyen temizliği ve beslenmesi ile ilgilenen bir gurup işçi arı arasında görülür. Yaşamı süresince sadece çiftleşme ve oğul verme amacıyla koloniden dışarı çıkar. Kendi kendine beslenemez. Beslenmeleri bakıcı arıların ağızdan arı sütü vermeleri şeklinde olur (Koç ve Karacaoğlu,2005; Karataş ve Canverdi,2019).

Bir arı kolonisinin performansı, sağlıklı ve kaliteli ana arının varlığına, genetik kapasitesi ise ana arısının ve çiftleştiği erkek arıların çeşitli özelliklerine bağlıdır (Ruttner 1988; Öztürk,2012).Ana arısı olmayan bir koloninin varlığından söz edilemez. Çünkü kolonide tek olan bu bireyin çiftleşmesi ile çiftleştiği erkek arılardan aldığı kalıtsal özellikler sayesinde koloninin; sakinliği, nektar ve polen toplama yeteneği ilkbahar gelişme hızı, kışlama kabiliyeti, ,oğul eğilimi, hastalık ve zararlılara karşı dayanıklılığı gibi özelliklerini belirlemektedirler (Köseoğlu ve ark.,2017).Bu nedenle, arıcının bir koloniden sağlayacağı kazanç bu koloniyi yöneten ana arının görevini yerine getirip getirmediği ile ilişiklidir (Laidlaw ve Eckert, 1962; Morse, 1982; Delaney ve ark., 2011).

Bir ana arı koloninin birliğinin sağlanması için gerekli olan bütün işlerde rol üstlenir. Yumurta, larva ve pupa dönemlerini 16 günde tamamlayarak ergin hale gelen bu canlılar kovanın denge unsurlarıdır(Öztürk,2014).Ana arı mevcut anatomik yapıları, fizyolojik özellikleri, davranışsal özellikleri, kolonide sağladığı işlevsel özellikleri ile koloni bireyleri arasında ki en önemli bireydir (Lee ve ark.,2019). Kolonin üreme performansı olan tek dişisi, tek yumurta üreten arısıdır. Ana arı döllenmiş (2n=32) diploid yumurtalardan gelişir. İşçi arılarla aynı kalıtsal materyale sahiptir. İşçi arılar 3 günlük larval dönemin sonunda bal ve polenle beslenirken ana arılar tüm larval dönemde arı sütü ile beslenirler. Bu farklı besleme sonucunda işçi arılarla aynı genotipik yapıya sahip olmalarına rağmen ana arılar meydana gelmektedir (Güneşdoğdu ve Şekeroğlu,2020).

Ana arının salgıladığı iki önemli feromon bulunmaktadır. Bu feromonlar iki doymamış yağ asidi olan 9-oxodec-trans-2-enoic asit [CH3CO-(CH2)O5- CH=CHCO-OH] ile 9-hydroxydec-trans-2-enoic asittir [CH3-CHOH-(CH2)5=CH-COOH]. Ana arının mandibulaları üzerinde,her iki yanağın altında, hafif sarkık torba şeklinde iki salgı bezi bulunur. Mandibular bezden salgılanan bu salgı cinsiyet feromonudur. Mandibular bezden salgılanan bu feromonlar anten, vücut teması ve beslenme yolu ile işçi arılara aktarılmaktadır(Koç ve Karacaoğlu,2017).

Ana arı feromonu da denen bu salgı, Çiftleşme uçuşu esnasında erkek arıyı cinsel yönden kendine çeker, işçi arılardan yalancı ana oluşumunu engeller ve kendisine yönelmesini sağlar. Kolonide huzur ve iş birliğini temin eder, arıların gerektiğinde sıkı bir salkım oluşturmasını sağladığı bildirilmektedir (Korkmaz ve Öztürk,2016).

Yapılan araştırmalara bakıldığında ana arının baş, göğüs ve karın bölgesinden dört bileşiğin daha salgılandığı bildirilmiştir. Salgılanan bu dört bileşik ise (metiloleat,koniferil alkol,palmitil alkol,lineolik asit)önceden belirlenen beş bileşik ile sinerjik etkiye sahip olduğu ve toplamda 9 bileşiğin ana arıda maiyet feromonlarını oluşturduğu bildirilmiştir. Bu maiyet feromonları ise işçi arıların yumurtalık gelişimlerini baskıladığını ve işçi arıların ana arıların etrafında toplanmasına neden olduğu vurgulanmıştır. Yani Bu feromon ve bileşenler ile kolonide yeni bir ana arı oluşumunu engellemektedir (Keeling ve ark.,2003;Hoover ve ark;2003).Ancak bu bileşenlerin miktarının ana arı yaşına (Rhodes vd., 2004), genotipe,mevsime (DeGrandi-Hoffman vd., 2007) göre değiştiği bildirilmiştir.

Ana arının yapısında bulunan feromonlar sayesinde kovanda varlığı diğer arılar tarafından hissedilebilmektedir. Dolayısı ile ana arının kovan içinde yokluğunda ise işçi arılar kovan içinde huzursuzluk çıkartır ve görevlerinde aksaklıklar yaşanmaya başlar. Ana arısı bulunmayan bu koloniler ise anasız koloniler olarak adlandırılır ve analı kolonilere göre kovanda farklı davranışlar gözlenir (Öztürk ve Korkmaz,2006;Köseoğlu ve ark.,2017).

Ana arının kolonideki en önemli görevi ise yumurtlamaktır. Bu görevi ile kolonideki bireylerin sürekliliğini sağlamaktadır. Kolonide bir ana olmasına rağmen analık içgüdünden yoksun olan bu canlılar yavrularına bakmazlar aynı zamanda salgı bezi ve larva besinini salgılayan bezlerden yoksundurlar. Bu nedenle bu görevleri kolonide işçi arılar üstlenmiştir (Önder,1997;Öztürk,2014)

Ana arılarılar da yumurta verimi ve feromon üretimleri yaşına bağlı olarak değişiklik göstermektedir. Ana arının ortalama yaşam süreleri 3-5 yıl hatta 7 yıla kadar uzayabilmektedir. Artan yaş ile ana arılar daha az yumurtlarlar ve yüksek oranda dölsüz yumurta bırakırlar. (Kaftanoğlu,1987). Ancak sağlıklı, güçlü koloniler için ise ana arıların her yıl değiştirilmesi gerekmektedir. Eğer bu durum mümkün değilse iki yılda bir yenilenmesi uygundur. Türkiye çapında yetiştirilen bütün kovanlar göz önüne alındığında 2-2,5milyon ana arının üretimine ihtiyaç vardır (Kaftanoğlu,1988; Öztürk,2012). Bu nedenle arıcılara yeni yapılan düzenlemelerle devlet anaarı yetiştiriciliğini teşvik etmesi, yetiştiriciliği yapan özel kuruluş ve arıcılara denetimli kredi, girdi ve eğitim olanakları sağlaması, anaarı ihtiyacının karşılanmasına destekler sağlamaktadır. Bu gibi destekler ülke arıcılığının gelişmesine ve bal üretiminin artmasına büyük katkılar sağlayacaktır (Çevik,2003; Karaca ve Karaman,2018).

Sonuç

Ana arı kolonin üreme yeteneğine sahip tek dişi bireyidir. Koloni için en önemli görevi yumurtlamaktadır. Diğer önemli görevi ise salgıladığı feromonlar ile kovan içinde düzeni sağlamaktadır. Bir kolonin verimin yüksek olması ana arı ile ilişkilidir. Kovanda ana arının yokluğunda kovan içi düzen bozulmakta ev kovanlar sönmektedir. Bu nedenle kolonide kullanılacak ana arıların kaliteli ana arılardan seçilmesi önemlidir. Ülkemizde arıcılığın temel sorunlarından biride kalitesiz ana arı kullanımıdır. Türkiye de arıcılığında ana arıların büyük çoğunluğu doğal yöntemlerle üretilmektedir. Oysa doğal yöntemle ana arı üretiminde ana arının kalitesi düşmektedir. Bunun

yanında bu yöntemde ana arıların larva döneminde yeteri kadar beslenememesi ana arı üretimi için çok fazla işçi arı kullanılması, yetiştirilecek ana arının yumurtaya başlayıncaya kadar kolonide kuluçka faaliyetinin durması olumsuzluklar söz konusu olabilmektedir. Bunun yanında ıslah programları üretilen, kontrollü ana arı üretim yöntemleri kullanılarak yetiştirilen ana arıların verim ve kalitesinin daha yüksek olduğu unutulmamalıdır.

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Aspects related to the implementation of European instruments, programs and policies for the protection of the environment in the Romanian space

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Abstract
Sustainable development means maintaining the possibilities and living conditions for future generations, renewable natural resources at least at the level of those existing for the current generation, and redressing the environmental factors affected by pollution.
Environmental management aims at the responsible use of natural, economic and human resources so that the environment is protected and improved. The Environmental Management System (EMS) is a mechanism that addresses major ecological themes by allocating resources, assigning responsibilities, and a continuous evaluation of practices, procedures and processes, which are organized in a systematic manner. Thus, EMS distinguishes itself as a powerful tool that allows the organization to achieve and control the level of environmental performance it establishes. becoming an integral part of the management system of an organization and it needs to be coordinated with the efforts of the management systems in other fields.
EMAS - The European Eco-Management Commission and the Audit System is a voluntary scheme for industry introduced by the European Commission (EC), which aims to promote continuous improvements in the environmental performance of companies and to provide environmental information to the public, because environmental issues have come from the unconsciousness of some to affect the whole of humanity.
Romania has implemented standards (ISO 14001) that refer to the environmental management system, with the general declared purpose of supporting environmental protection and preventing pollution, in balance with socio-economic needs.
The specific purpose of ISO1400 standards is to provide organizations with: all the necessary elements for the effective construction of an environmental management system, which can be integrated into the overall management of the organization and which allows the achievement of the environmental and economic objectives set.
The key to the success of international measures to protect the environment lies in the wider participation of the global community, in cooperation on technical issues and in the functional implementation of funding mechanisms to support developing countries. Similarly, the key to the success of measures at local level depends on the wider participation of citizens, in particular the involvement of non-governmental organisations, to support local initiatives to protect the environment.
The research methodology used includes qualitative methods (meta-analysis of specialized literature) and observations and logical deductions on the impact of environmental policies.
Keywords: *environmental management system; environmental management standards; EMAS sustainable economic development; improvement of environmental quality; ISO 14001 environmental management systems*

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Investigation of Agricultural Mechanization Situation in İzmir Province and Districts

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Abstract

Izmir Province is the third most populous city in Turkey in terms of population with 30 districts and is in the Aegean Region. The change in the level of agricultural mechanization of Izmir province and districts between 2004 and 2021 was examined using statistical data on crop production areas and agricultural tractors. To determine the level of agricultural mechanization, the number of tractors, the distribution of tractor engine power and the change in agricultural production areas were considered. In determining and evaluating the level of agricultural mechanization; agricultural area per tractor (ha tractor^{-1}), number of tractors per 1000 hectares of agricultural area (tractor 1000 ha^{-1}), tractor power per unit area (kW ha^{-1}) and average tractor power (kW) data were used. It has been determined that the agricultural mechanization level and the number of agricultural tractors of İzmir province and districts have improved. Within the province of Izmir, the production of agricultural products is carried out intensively in the districts of Ödemiş, Bergama, Tire, Menderes, Torbalı, Bayındır, Menemen, Kiraz, Kemalpaşa, Kınık, Selçuk and Dikili, respectively. The data on the level of agricultural mechanization in 2021 for the province of Izmir in general and the change rates in 17 years are respectively; the agricultural area per tractor was calculated as 8.16 ha tractor^{-1} (-28.5%), the number of tractors per 1000 hectares of agricultural area as 122.58 units (39.8%), the tractor power per unit area as 3.08 kW ha^{-1} (27.0%), and the average tractor power as 39.76 kW (10.0%). For Izmir province, 2021 Turkey agricultural mechanization data and change rates in 17 years were found as 15.88 ha tractor^{-1} (-39.8%), 62.96 tractors 1000 ha^{-1} (66.2%), 1.39 kW ha^{-1} (49.1%), 45.28 kW (11.5%). When examined at the level of districts according to the average of Izmir, for the criterion of agricultural area per tractor (ha tractor^{-1}); It is seen that it is above average in Torbalı (9.94), Bayındır (12.40), Menemen (8.36), Kiraz (8.56), Kemalpaşa (12.65), Selçuk (10.67) and Dikili (14.88), and below average in Ödemiş (3.54), Bergama (7.12), Tire (7.52), Menderes (7.34) and Kınık (6.03) districts. In the criterion of the number of tractors per 1000 hectares of agricultural area, the opposite of the criterion of agricultural area per tractor is the case. For the tractor power criterion per unit area (kW ha^{-1}); Ödemiş (5.16), Tire (2.72), Menderes (2.69), Menemen (2.64), Kınık (3.06) and Bergama (2.58) districts are above the average of Izmir, while Torbalı (1.99), Bayındır (1.19), Kiraz (1.76), Kemalpaşa (1.81), Selçuk (2.04) and Dikili (1.36) districts are below the average of Izmir. For the average tractor power criterion, while Ödemiş (54.84), Kınık (54.21) and Kiraz (66.26) districts are above the provincial average, the other nine districts are below the provincial average.

Key Words: *Izmir, Tractor, Production area, Agricultural Mechanization Status*

İzmir İli ve İlçeleri Tarımsal Mekanizasyon Durumunun İncelenmesi

Özet

İzmir İli 30 ilçesi bulunan, Türkiye'nin nüfus bakımından üçüncü en kalabalık şehridir ve Ege Bölgesinde yer almaktadır. İzmir ili ve ilçelerinin 2004–2021 yılları arasındaki tarımsal mekanizasyon düzeyindeki değişim, bitkisel üretim alanları ve tarım traktörlerine ait istatistiksel verileri kullanılarak incelenmiştir. Tarımsal mekanizasyon düzeyinin belirlenmesi için traktör sayısı, traktör motor gücü dağılımı ve tarımsal üretim alanlarının değişimi dikkate alınmıştır. Tarımsal mekanizasyon düzeyinin belirlenmesi ve değerlendirilmesinde; bir traktöre düşen tarım alanı (ha traktör^{-1}), 1000 hektar tarım alanına düşen traktör sayısı (traktör 1000 ha^{-1}), birim alana düşen traktör gücü (kW ha^{-1}) ve ortalama traktör gücü (kW) verileri kullanılmıştır. İzmir ili ve ilçelerinin tarımsal mekanizasyon düzeyi ve tarım traktör sayılarının gelişim gösterdiği belirlenmiştir. İzmir ili içerisinde sırasıyla, Ödemiş, Bergama, Tire, Menderes, Torbalı, Bayındır, Menemen, Kiraz, Kemalpaşa, Kınık, Selçuk ve Dikili ilçelerinde tarım ürünlerinin üretimi yoğun olarak yapılmaktadır. İzmir ili geneli için 2021 yılı tarımsal mekanizasyon düzeyine ait veriler ve 17 yıldaki değişim oranları sırasıyla; bir traktöre düşen tarım alanı 8,16 ha traktör^{-1} (%-28,5), 1000 hektar tarım alanına düşen traktör sayısı 122.58 adet (%39,8), birim alana düşen traktör gücü 3,08 kW ha^{-1} (%27,0), ortalama traktör gücü 39,76 kW (%10,0) olarak hesaplanmıştır. İzmir ortalamasına göre ilçeler düzeyinde incelendiğinde bir traktöre düşen tarım alanı kriteri (ha traktör^{-1}) için; Torbalı (9,94), Bayındır (12,40), Menemen (8,36), Kiraz (8,56), Kemalpaşa (12,65), Selçuk (10,67) ve Dikili (14,88)'de ortalama üzeri, Ödemiş (3,54), Bergama (7,12), Tire (7,52), Menderes (7,34) ve Kınık (6,03) ilçelerinde ise ortalama altında olduğu görülmektedir. 1000 hektar tarım alanına düşen traktör sayısı kriterinde bir traktör başına düşen tarım alanı kriterinin tersi durum söz konusudur. Birim alana düşen traktör gücü kriteri (kW ha^{-1}) için; Ödemiş (5,16), Tire (2,72), Menderes (2,69), Menemen (2,64), Kınık (3,06) ve Bergama (2,58) ilçeleri İzmir ortalaması üzerinde, Torbalı (1,99), Bayındır (1,19), Kiraz (1,76), Kemalpaşa (1,81), Selçuk (2,14) ve Dikili (1,36) ilçeleri İzmir ortalaması altındadır. Ortalama traktör gücü kriteri (kW) için; Ödemiş (54,84), Kınık (54,21) ve Kiraz (66,26) ilçeleri il ortalaması üzerindeyken, diğer dokuz ilçe il ortalamasının altında kaldığı görülmektedir.

Anahtar Kelimeler: *İzmir, Traktör, Üretim alanları, Tarımsal mekanizasyon durumu*

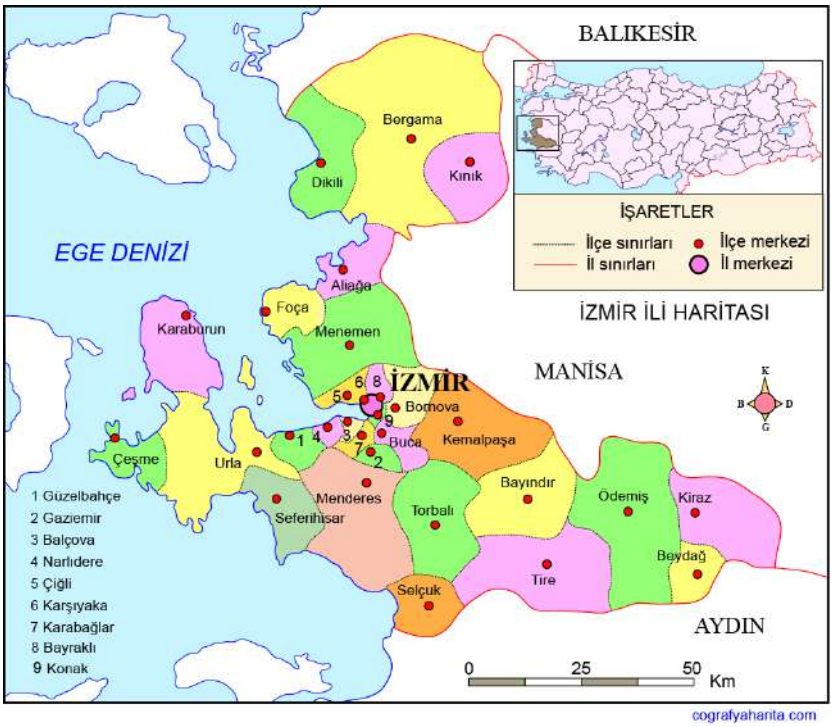
Giriş

Hızlı bir artış eğiliminde olan dünya nüfus artışı beraberinde beslenme ihtiyacında bir artış getirmektedir. Tarım alanlarındaki ve tarımsal üretimde çalışan işgücünde yaşanan azalmalar bu ihtiyacın karşılanmasında zorlukların doğmasına sebebiyet vermektedir. Yaşanan olumsuzlukların giderilebilmesi için tarımsal üretimden daha verimli ve daha fazla üretim yapılması gerekmektedir. Mevcut koşullar altında, yükselen talebin eldeki kısıtlı alanlarda yapılan üretimde, modern metotların ve makinaların kullanılması ile etkin ve ekonomik olarak yapılarak arz artışıyla karşılanması gereklidir (Comart ve Akıncı, 2017). Üretilen tarımsal ürünlerde verim ve kapasite artışı ise; etkin ve modern üretim metodunun seçimi, kaliteli tohumluk kullanımı, su ve toprak kaybını azaltan ve/veya korunmasını sağlayan metotların seçimi, girdi maliyetini azaltmak için değişken düzeyli uygulamaların temel amacı olan doğru zaman ve yerde doğru miktarın uygulanması ile akıllı tarım uygulamaları ile kontrolü sağlanabilen makinelerin kullanılması olarak sıralanabilir (Baran ve ark., 2014; Bilim ve ark., 2014; Özgünaltay Ertuğrul ve ark., 2019; Altuntaş, 2020; Güneş ve ark., 2020; Ertekin ve ark., 2021).

Tarımsal mekanizasyon durumun incelendiği, Türkiye geneli, farklı coğrafi bölgeler ve yöreler ile il ve ilçe bazında olmak üzere farklı araştırmalar yapılmıştır (Ünal, 2006; Altuntaş ve Aslan, 2009; Cankurt ve Miran, 2010; Altıkat ve Çelik, 2011; Gökdoğan ve Bayhan, 2011; Gökdoğan ve Demir, 2011; Eryılmaz ve ark., 2013; Gürsoy, 2013; Yeşilyurt ve ark., 2013; Eryılmaz ve ark., 2014; Gökdoğan, 2014; Korucu ve ark., 2015; Bayram ve Altuntaş, 2016; Bozkurt ve Aybek, 2016; Duran ve Ünal, 2016; Sağlam ve Kuş, 2016). Bu çalışmaların yanısıra farklı ülkelerin tarımsal mekanizasyon düzeylerinin Türkiye ile karşılaştırılması için çalışmalar da bulunmaktadır (Gökdoğan, 2012; Esenali Uluu and Öğüt, 2019; Güneş ve ark., 2020; Rahman ve ark., 2021). Teknolojide görülen gelişmeler ile uygulanan tekniklerdeki değişikliklerle birlikte, traktör ve makine kullanımının artmasının sonuçlarının incelenmesi ve verilerin güncelliğini koruması maksadıyla yeni çalışmaların devam ettiği görülmektedir (Akar ve Çelik, 2017; Comart ve Akıncı, 2017; Işık, 2017; Kayhan ve ark., 2017; Aslantürk ve Altuntaş, 2018; Kirpitçi ve ark., 2018; Yılmaz ve Sümer, 2018; Abdikoğlu, 2019; Bal ve Altuntaş, 2019; Mavioğlu ve Çobanoğlu, 2019; Altuntaş, 2020; Aygün ve Gürsoy, 2020; Malaslı ve ark., 2020; Sessiz, 2020; Ulusoy ve ark., 2020; Saygılı ve Çakmak, 2021a).

Tarım traktörleri, tarımsal üretimde kullanılan temel güç kaynağıdır (Altıkat ve Çelik, 2009; Evcim ve Özgünaltay Ertuğrul, 2017). Bu nedenle; tarımsal mekanizasyon düzeyinin hesaplanması için; birim alana başına traktör gücü (kW ha^{-1}), 1000 hektar başına traktör sayısı (adet $traktör^{-1}$), traktör başına tarım alanı sayısı (ha $traktör^{-1}$) ve ortalama traktör gücü (kW) olarak sıralanan kriterler en yaygın kullanılanlardandır.

İzmir ili, Ege Bölgesinde yer almakta olup Türkiye'nin nüfus bakımından üçüncü en kalabalık şehridir. 2021 yılı TÜİK verilerine göre şehrin nüfusu 4 425 789 kişi olup, 11 891 km^2'lik yüz ölçümüyle Türkiye'nin yirmi üçüncü büyük şehridir (İZKA, 2022b). Akdeniz ikliminin hâkim olduğu bölgede yıllık toplam yağış ortalaması 713,8 mm, yıllık yağışlı gün ortalaması ise 84,2 gündür (MGM, 2022). Bu çalışmada da İzmir ili ve ilçelerinde tarımsal üretim faaliyetlerinde kullanılan traktörler incelenmiş ve mekanizasyon durumu değerlendirilmiştir.



Şekil 1. İzmir ili ve ilçeleri (Anonim, 2022)

Materyal ve Yöntem

Çalışmanın materyalini, Türkiye İstatistik Kurumu'ndan alınan 2004-2021 yılları arasında İzmir ili ve ilçelerindeki bitkisel üretim alanları ile tarımsal üretim faaliyetlerinde kullanılan traktörlere ait istatistik verileri oluşturmaktadır.

Çalışmanın yöntemini, İzmir iline ait tarım alanları ve traktör sayılarının verilerin kullanılarak tarımsal mekanizasyon düzeyinin belirlenmesidir. Tarımsal mekanizasyon düzeyinin belirlenmesinde kullanılan ölçütler;

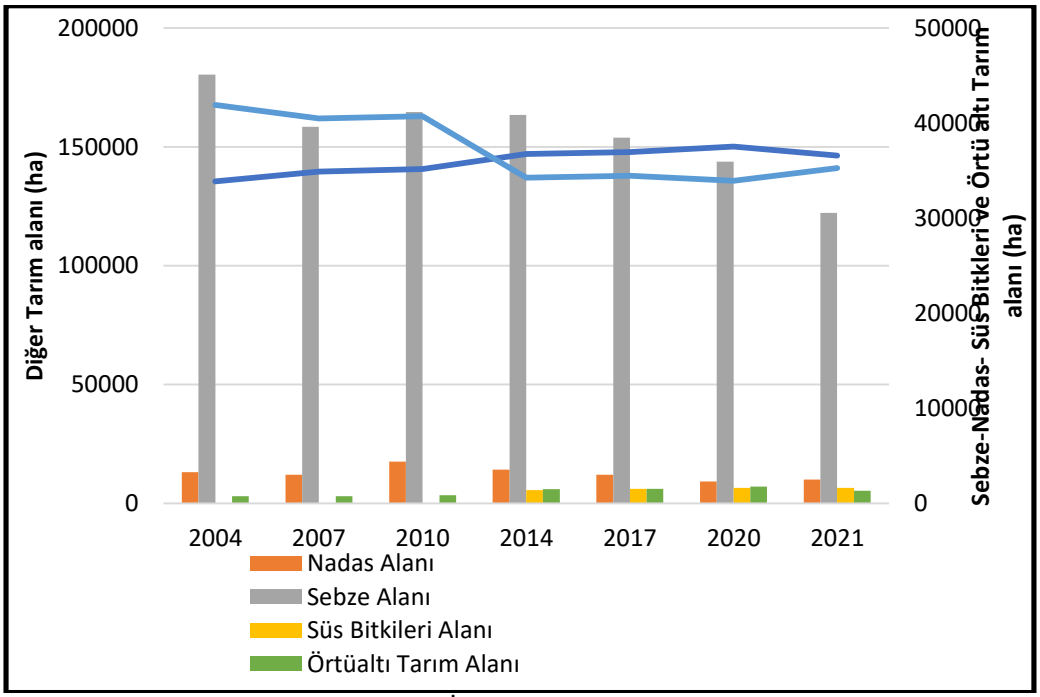
- Traktör başına düşen tarım alanı (ha traktör^{-1})
- 1000 hektar başına düşen traktör sayısı (traktör 1000 ha^{-1})
- Birim alana düşen traktör gücü (kW ha^{-1})
- Ortalama traktör gücü (kW)'dir (Koçtürk ve Onurbaş Avcıoğlu, 2007; Gökdoğan, 2012; Özgünaltay Ertuğrul ve ark., 2019).

Bulgular ve Tartışma

İzmir, 1 adet büyükşehir belediyesi ve 30 adet ilçe belediyesi bulunan ve tarımsal üretim yapan işletmelerin ortalama parsel büyüklüğü 3,7 ha olan, Türkiye'nin bitkisel üretiminin %3.1'nin yapıldığı bir ildir. Tarımsal üretim yapılan alanlar büyüklüklerine göre büyükten küçüğe doğru, Ödemiş, Bergama, Bayındır, Torbalı, Tire, Menderes, Kemalpaşa, Menemen, Kiraz, Selçuk, Dikili, Kınık, Seferihisar, Aliağa, Urla, Beydağ, Foça, Karaburun, Buca, Çeşme, Bornova, Güzelbahçe, Çiğli, Karabağlar, Karşıyaka, Gaziemir, Balçova, Narlıdere, Bayraklı ve Konak olarak sıralanmaktadır. Büyükşehir belediyesi sınırlarına ve şehir merkezlerine yaklaştıkça tarım alanlarında azalma görülmekte ve Konak ilçesinde tarım alanına ait bir veri bulunmamaktadır. Toplan tarım alanları incelendiğinde 2021 yılı içerisinde üretilen ürün gruplarına göre; meyveler, içecek ve baharat bitkiler birinci sırada yer alırken, tahıllar ve diğer bitkisel ürünler ikinci sırada, sebzeler üçüncü, nadas alanı dördüncü, süs bitkileri beşinci ve örtü altı üretim alanı ise altıncı sırada yer almaktadır. 2004-2021 yılları arasındaki veriler Tablo 1'de yer almaktadır. 2021 yılı İzmir il geneline ait Tarımsal ürün gruplarına göre dağılım Şekil 2'de verilmiştir.

Tablo 1. İzmir ili Tarım alanları gruplarına göre dağılımı

YIL	Meyveler, İçecek Ve Baharat Bitkileri Alanı	Nadas Alanı	Sebze Alanı	Süs Bitkileri Alanı	Tahıllar Ve Diğer Bitkisel Ürünlerin Alanı	Örtüaltı Tarım Alanı
2004	135451	3290	45092	0	167607	761.6
2007	139522.1	3008.5	39613.3	0	161897.1	754
2010	140622.7	4409.3	41148.6	0	162919	852.2
2014	146925.2	3564.5	40844.6	1389.88	137050.7	1499.38
2017	147803	3028	38449.3	1545.85	137847.4	1528.7
2020	150102.5	2317.7	35940.7	1636.47	135700.9	1760.4
2021	146312.6	2499.9	30564.3	1646.56	141083.4	1318.04



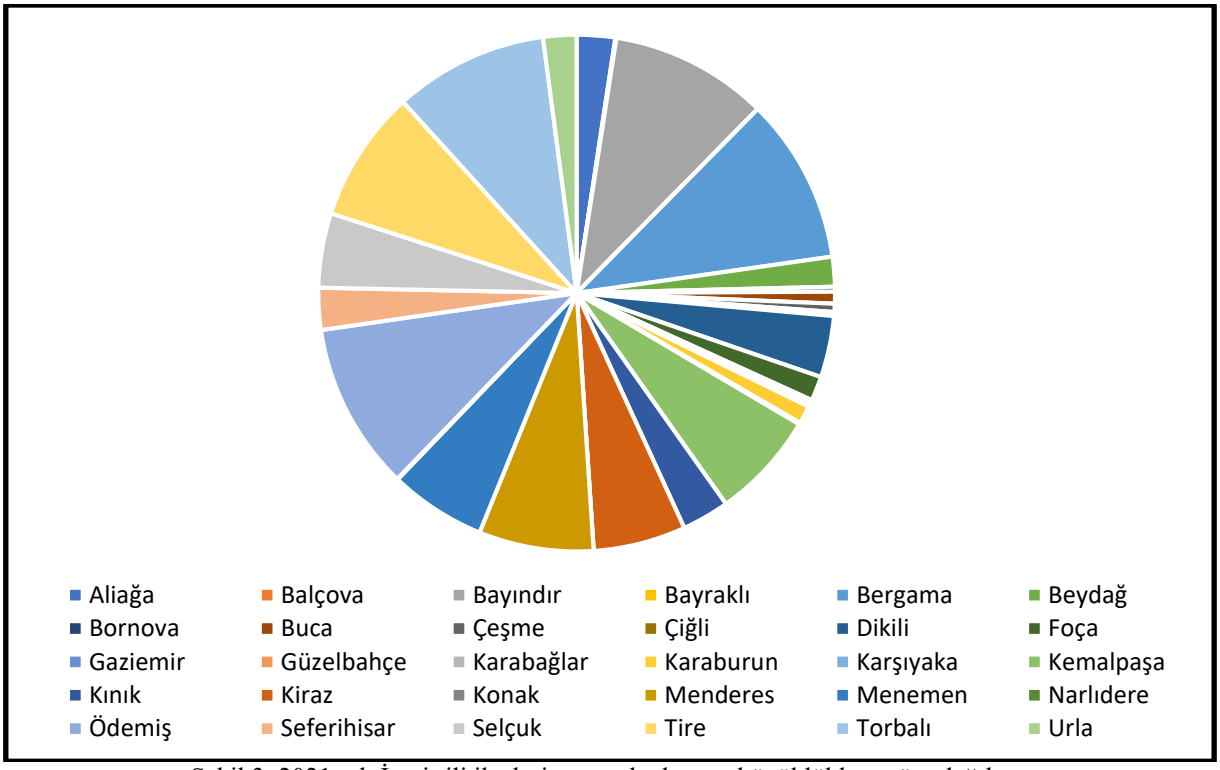
Şekil 2. 2021 yılı İzmir ili tarım alanları dağılımı

Tarımsal üretim yapılan alanların ilçeler düzeyinde incelenmesine ait veriler Tablo 2'de verilmiştir. 2021 yılında en çok tarımsal üretim yapılan ilçeler Ödemiş, Bergama, Bayındır, Torbalı, Tire, Menderes, Kemalpaşa, Menemen, Kiraz, Selçuk, Dikili ve Kınık ilçeleridir. Bu ilçeler İzmir ilinin tarımsal üretim alanlarının %85.89'luk kısmını oluşturmaktadır. 2021 yılına ait verilerden elde edilen tarımsal alan dağılımı Şekil 3'te verilmiştir.

Tablo 2. İzmir ili ilçelerinin toplam tarım alanlarına göre dağılımı

	Meyveler, içecek ve baharat bitkileri Alanı (ha)	Tahıllar Ve Diğer Bitkisel Ürünlerin Alanı (ha)	Nadas Alanı (ha)	Sebze Alanı (ha)	Süs Bitkileri Alanı (ha)
Aliağa	4978.7	2580	100	69	0
Balçova	126	15	1.2	34.3	28.48
Bayındır	18070.8	9800	0	3387.8	650
Bayraklı	9.2	0	0.5	1	0
Bergama	7287.2	24411.2	188.7	1512.8	0
Beydağ	3666.5	2144	17.2	178.6	0
Bornova	803.5	27.2	140	21.3	1.27
Buca	1341.2	587	243	219.6	0
Çeşme	669.3	197.6	15	775	0
Çiğli	16	738.4	30	20.3	0
Dikili	4967.1	6851.3	0	574.9	0
Foça	1825.4	2321.9	50	737.9	0
Gaziemir	109.4	138	26.5	7.8	0
Güzelbahçe	591.8	104.6	50	51.7	5.53
Karabağlar	345.4	0	22.8	0	0
Karaburun	3458.7	20.6	67.7	66.7	30.6
Karşıyaka	290	0	15.2	7.6	0
Kemalpaşa	19023.1	2029.2	356.1	201	14
Kınık	915.8	6627.9	30	1983.8	0
Kiraz	5736.5	10791.4	3	2097.5	12.6
Konak	0	0	0	0	0
Menderes	9008.2	11341.5	0	2634	161.5
Menemen	6609.5	11333.9	119	1416.5	0
Narlıdere	140.7	0	0	0	0.2
Ödemiş	10732.7	20172.8	0	2503	371.8
Seferihisar	7759.6	323.1	164.6	174.7	27.99
Selçuk	12570.6	1140	757	491	60
Tire	11816.6	12099	66.1	2570.3	89.5
Torbalı	8557	14568.3	26.3	7856.7	58.7
Urla	4886.1	719.5	10	969.5	134.4

İzmir ilinde tarımsal üretim faaliyetlerinde kullanılan tarım traktörlerinin sınıflandırmasına ait veriler Tablo 3'te verilmiştir. İl genelinde kullanılan traktörlerin toplam sayısının %99.236'sı çift akslı lastik tekerlekli, %0.761'i tek akslı lastik tekerlekli ve %0.003'ü ise paletli traktörlerden oluşmaktadır. Tek akslı traktörlerin kendi içerisinde incelendiğinde 0.5-3.68 kW arası %12.55'lik dilimi, 3.68 kW üzerindeki grup ise %87.45'lik dilimi oluşturmaktadır. Çift akslı traktörler güç gruplarına göre incelendiğinde, tabloda verilen sırasıyla, %0.51, %2.19, %8.20, %49.81, %34.50 ve %4.79'lik oranlara sahip olduğu hesaplanmaktadır. Traktör güç grubunda yoğunluğun 25.76 – 36.8 kW ile 37.54-51.52 kW'lik dilimde yer aldığı görülmektedir. Tarımsal üreticilerin parsel büyüklüklerinin Türkiye ortalamasının altında yer alması, kullanılan tarım makinalarının güç ihtiyaçlarının bu iki grupta yoğunlaşmasındaki en büyük etmendir.



Şekil 3. 2021 yılı İzmir ili ilçeleri tarım alanlarının büyüklüklere göre dağılımı

Tablo 3. İzmir ilinde kullanılan traktörlerin güç gruplarına göre dağılımı

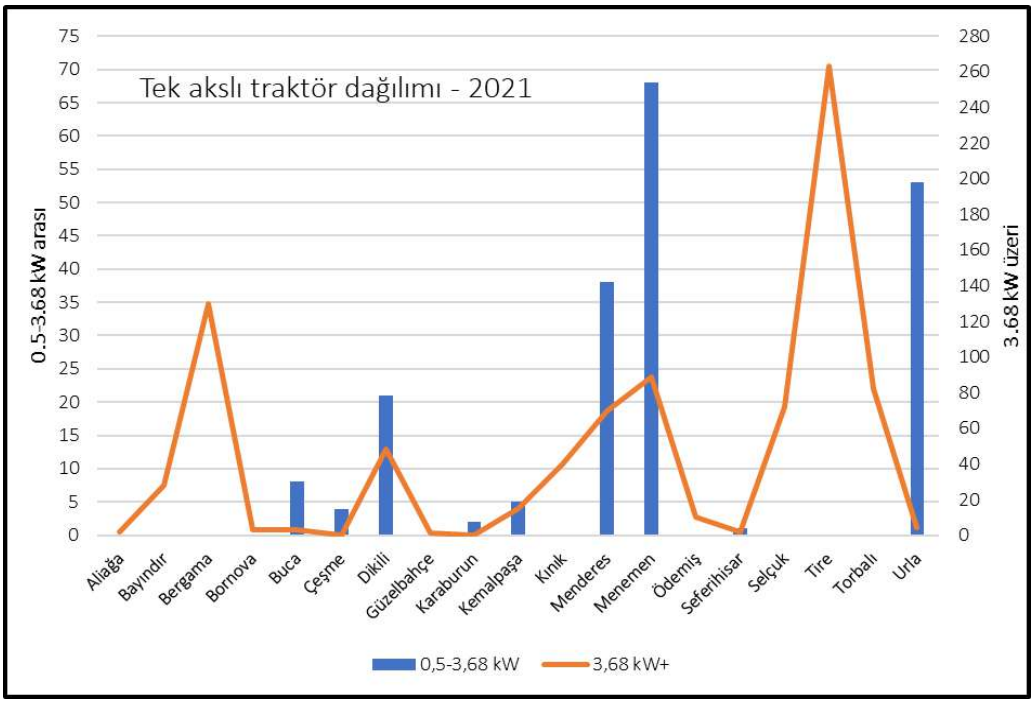
Yıl	Paletli (Tırtıllı)	Tek Akslı		İki Akslı						Toplam
		0,5-3,68 kW	3,68 kW+	0,5-7,36 kW	8,01-17,65 kW	18,4 kW-25,03 kW	25,76-36,8 kW	37,54-51,52 kW	51,52 kW+	
2004	6	18	40	500	1206	3214	16728	8622	554	30888
2007	4	20	72	193	823	3180	17646	9280	691	31909
2012	2	16	113	194	796	3074	17573	10150	1191	33109
2017	1	28	230	202	863	3241	17228	11473	1552	34818
2020	1	33	233	201	858	3223	17112	11619	1652	34932
2021	2	33	230	200	862	3225	19580	13562	1884	39313

İlçeler düzeyinde traktör grupları incelendiğinde tek asklı traktörlerin yer almadığı ilçeler Balçova, Bayraklı, Beydağ, Çiğli, Foça, Karabağlar, Karşıyaka, Kiraz, Konak ve Narlıdere ilçeleridir. Tek akslı traktörlere ait dağılımı ilçeler düzeyinde gösterimi Şekil 4'te verilmiştir.

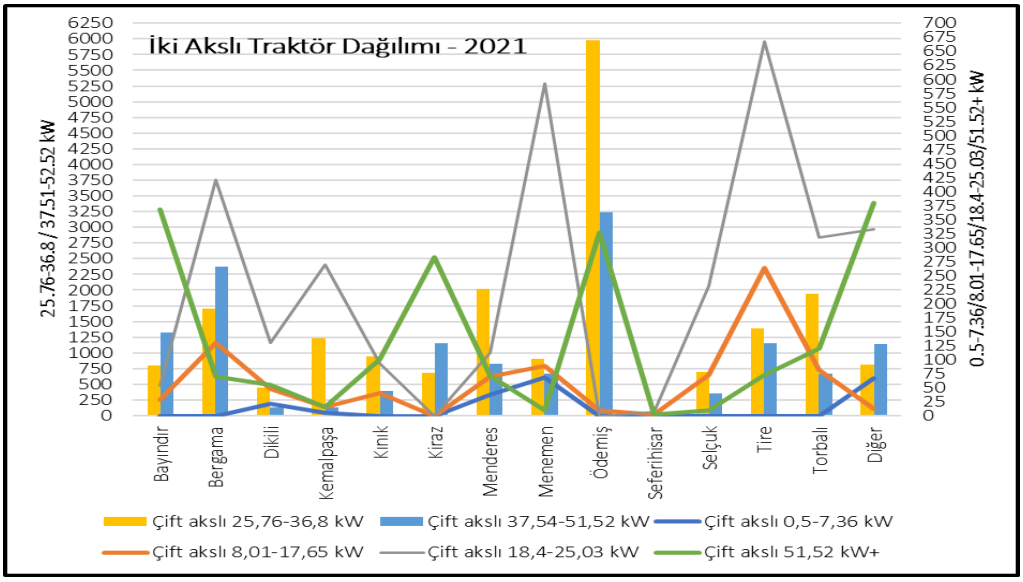
İki akslı traktörler incelendiğinde tarım traktörü bulunmayan tek ilçenin Konak olduğu görülmektedir. Ödemiş ilçesindeki traktör sayısı il geneline oranlandığında %24.14'lük bir paya sahiptir. Bu ilçenin ardından Bergama (%11.85), Tire (%8.95), Menderes (%7.92) ve Torbalı (%7.90) ilçeleri sıralanmaktadır. İki akslı traktörlerin dağılımları Şekil 5'te verilmiştir. Traktörlerin güç sınıflarına göre gruplandırmasında ise 25,76-36,8 kW ve 37,54-51,52 kW gruplarında olduğu görülmektedir. Özellikle Ödemiş, Bergama, Menderes, Torbalı, Tire ve Kemalpaşa ilçelerinde bu grupların yoğunlaştığı görülmektedir.

İzmir ili ilçelerinin tarımsal mekanizasyon düzeyine ait veriler Tablo 4'te verilmiştir. Tarımsal Mekanizasyon düzeyinin belirlenmesinde kullanılan kriterlere göre İzmir ili ortalama değerleri; traktör başına düşen tarım alanı 8,14 ha traktör^{-1}, 1000 hektar tarım alanına düşen traktör sayısı 122,87 traktör 1000 ha^{-1}, birim alana düşen traktör gücü 2,28 kW ha^{-1} ve ortalama traktör gücü 54,00 kW olarak hesaplanmıştır. Aynı kriterlere göre Türkiye ortalamaları 15,88 ha traktör^{-1}, 62.96 87 traktör 1000 ha^{-1}, 1.39 kW ha^{-1}, 45.28 kW olarak bulunmuştur. İlçeler düzeyinde incelendiğinde Konak ilçesinde tarım alanı ve tarım traktörü verisi bulunmadığı için değeri sıfır olarak hesaplanmaktadır. Karşıyaka, Karabağlar ve Narlıdere gibi büyükşehir belediyesi sınırları içerisinde kalan ilçelerde tarım traktörü sayılarının az olması sebebiyle bu kriterdeki değerleri İzmir il ortalamasının ve Türkiye

geneli ortalamasından yüksek hesaplanmaktadır. Karaburun ve Seferihisar ilçelerinde ise tarım alanlarının büyüklüğüne karşın tarım traktörü sayıları mekanizasyon düzeyini iyileştirebilecek seviyelerin altında yer almaktadır. Ödemiş ilçesi tarım alanlarının çok olmasına karşın il genelinde en çok traktör sayısına sahip olduğu için traktör başına düşen tarım alanı kriterinde birinci sırada yer almaktadır. Tarımsal üretim alanı bakımından ikinci sırada yer alan Bergama ilçesi mevcut veriler incelendiğinde İzmir ortalamasının altında kaldığı görülmektedir. Ödemiş, Kınık, Bergama, Menderes ve Tire ilçelerinde traktör sayılarının fazla olması bu kriter göz önüne alındığında İzmir il ortalaması ve Türkiye ortalamasının üzerinde olmasını sağlamaktadır. Birim alana düşen traktör gücü (kW ha^{-1}) Ödemiş, Kınık, Bergama, Kınık, Menderes, Menemen ve Tire gibi tarımsal üretimin yoğun yapıldığı ilçelerdeki traktör güçlerinin yüksek grupta yer aldığını gösteren bir kriterdir. Bayraklı ilçesindeki yüksek değerin sebebi ise tarım alanlarının 10.7 ha gibi bir değerde olması ve traktör güç grubunun yüksek olmasından kaynaklanmaktadır. Ortalama traktör gücü kriterinde ise Bayındır, Kiraz ilçeleri İzmir il ortalamasının üzerinde bir değerde yar almaktayken, Ödemiş, Kınık, Beydağ ve Bergama ilçeleri İl ortalamasında yakın bir değere sahiptir.



Şekil 4. 2021 yılı tek akslı traktörlerin ilçeler düzeyinde dağılımı



Şekil 5. 2021 yılı çift akslı traktörlerin ilçeler düzeyinde dağılımı

	Bir traktöre düşen tarım alanı (ha traktör^{-1})	1000 hektar tarım alanına düşen traktör sayısı (traktör 1000 ha^{-1})	Birim alana düşen traktör gücü (kW ha^{-1})	Ortalama Traktör Gücü (kW)
Aliağa	10.41	96.02	1.62	59.16
Balçova	20.50	48.79	0.82	59.50
Bayındır	12.40	80.67	1.19	67.60
Bayraklı	3.57	280.37	7.01	40.00
Bergama	7.12	140.45	2.58	54.46
Beydağ	12.26	81.58	1.48	54.95
Bornova	11.04	90.61	1.77	51.07
Buca	9.96	100.38	2.07	48.46
Çeşme	8.04	124.33	2.99	41.60
Çiğli	6.29	159.07	1.53	103.67
Dikili	14.88	67.21	1.36	49.41
Foça	9.56	104.56	1.23	85.23
Gaziemir	11.74	85.20	1.08	79.06
Güzelbahçe	20.61	48.53	0.77	63.00
Karabağlar	73.64	13.58	0.21	64.00
Karaburun	57.85	17.29	0.39	44.44
Karşıyaka	156.40	6.39	0.13	47.50
Kemalpaşa	12.65	79.08	1.81	43.66
Kınık	6.03	165.84	3.06	54.21
Kiraz	8.56	116.84	1.76	66.26
Konak	0.00	0.00	0.00	0.00
Menderes	7.34	136.27	2.69	50.58
Menemen	8.36	119.67	2.64	45.28
Narlıdere	35.23	28.39	1.03	27.50
Ödemiş	3.54	282.83	5.16	54.84
Seferihisar	111.18	8.99	0.18	49.23
Selçuk	10.67	93.75	2.04	45.86
Tire	7.52	132.99	2.72	48.82
Torbalı	9.94	100.59	1.99	50.61
Urla	26.45	37.80	0.81	46.67

İzmir ili ve ilçelerine ait 2004-2021 yılları arasını kapsayan 17 yıllık veriler ışığında tarımsal üretimde kullanılan traktör sayılarında artış olduğu ve tarımsal mekanizasyon düzeyinde gelişme olduğu saptanmıştır. Ödemiş, Bergama ve Bayındır ilçeleri en büyük tarım alanlarına sahip olmalarına karşın traktör sayıları arasındaki farktan dolayı Ödemiş ilçesindeki traktör başına düşen tarım alanı kriterinde diğer iki ilçeden daha az alanı işlemektedir. Aynı kriterde İzmir ili geneli Türkiye ortalamasının yarısı kadar bir değere sahiptir. Traktör başına düşen tarım alanı kriterinde Bergama, Tire, Menderes ve Kınık ilçeleri İzmir ili ortalamasının altında değerlere sahiptir. Aynı kriterde Menemen, Torbalı, Selçuk, Beydağ ve Kemalpaşa ilçeleri ise İzmir ili ortalamasının üzerinde değerlere sahiptir. Güneş ve ark. (2020), Türkiye'de bulunan traktörlerin güç büyüklüklerinin 44 ila 52 kW arasında olduğunu bildirmiştir. Çalışmada elde edilen verilerin bu çalışmayı desteklediği görülmektedir. Özgüven ve ark. (2010) ile Mavioğlu ve Çobanoğlu (2019) yaptıkları çalışmalarda İzmir bölgesinde kullanılan traktörlerin güç ortalamalarının Türkiye ortalama değerlerinin üzerinde olduğunu bildirmişlerdir. Birim alana düşen traktör gücü kriteri incelendiğinde Ödemiş, Kınık, Menderes, Menemen, Bergama ve Tire ilçeleri İzmir il ortalamasından yüksek değerdedir. Bu durum kullanılan traktör güç grubunun yüksek sınıfta yer aldığının bir göstergesidir. Bu durum İzmir ili ve ilçelerinde tarımsal üretimde makine kullanımının yoğun olarak gerçekleştiğini desteklemektedir.

Tarımsal üretim yapılan alanlardaki azalmalar, artan beslenme ihtiyacını karşılamak üzere tarımsal üretimde makine kullanımının artması ile teknolojik ve bilimsel gelişmelerin üretim tekniklerini iyileştirmede kullanılması kaçınılmazdır. Verim artışı için akıllı tarım uygulamalarının çoğaltılması ve ortak makine kullanımının yaygınlaşması, farklı güç ihtiyaçlarını karşılayacak büyüklükte ve tipte traktör-makine kullanımının desteklenmesi, üretici sayısını ve üretim miktarını arttıracak tedbir ve teşviklerin alınması önemlidir.

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Determination of Optimal Drying Characteristics for Color Quality Parameters of Carrot (Daucus Carota L.) at different drying temperatures

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Abstract

Carrot production has an important place in our country and the world. Carrot, which has a fibrous structure, is generally used in salads, appetizers, desserts, meals, and vegetable juice mixtures. Frequently consumed carrots cannot be stored fresh for a long time. Therefore, it is important to preserve it by drying it. In this study, our purpose to determine the most suitable drying method and temperature by drying the carrot in an oven, vacuum, and laboratory-type convective dryer at 40-50-60-70ºC drying air temperature and the shade in terms of color criteria and drying kinetics. According to the average drying times, it was determined that the longest drying time in the shade was 124 hours, and the shortest was 3 hours and 15 minutes at 40 ºC in the laboratory-type convective dryer. Midilli Kucuk, Page, and Wang Sing equations were used in the modeling. In the modeling, the highest R2 value was 0.9999 in the Midilli Kucuk equation, laboratory type convective dryer method, 40°C, 60°C, and 70°C drying temperatures, and Page equation, laboratory type convective dryer method, 40°C drying temperature. It was determined that the method that best preserves the color properties of the carrot is the laboratory-type convective dryer at 40°C drying air temperature.

Key Words: *Carrot, Drying, Color, Modeling*

Farklı kurutma sıcaklıklarında Havucun (*Daucus Carota* L.) Renk kalite Parametreleri İçin En Uygun Kuruma Karakteristiklerinin Belirlenmesi

Özet

Havuç üretimi ülkemizde ve dünyada önemli bir yere sahiptir. Lifli yapıya sahip olan havuç genellikle salatalarda, mezelerde, tatlılarda, yemeklerde ve sebze suyu karışımlarında kullanılmaktadır. Sıkça tüketilen havuç uzun süre taze halinde depolanamaz. Bundan dolayı kurutma işlemi yapılarak muhafaza edilmesi önemlidir. Bu çalışmada havucun etüvde, vakumda ve laboratuvar tipi konvektif kurutucuda 40-50-60-70ºC kurutma havası sıcaklığında ve gölgede kurutularak renk kriterleri ve kuruma kinetiği açısından incelenip en uygun kurutma yönteminin ve sıcaklığının belirlenmesi amaçlanmıştır. Ortalama kuruma sürelerine göre en uzun gölgede kurutma ile 124 saat, en kısa ise laboratuvar tipi konvektif kurutucu da 40 ºC sıcaklıkta 3 saat 15 dakika olduğu tespit edilmiştir. Modellemede Midilli Küçük, Page ve Wang Sing eşitlikleri kullanılmıştır. Modellemede en yüksek R^2 değeri 0.9999 olarak Midilli küçük eşitliğinde, laboratuvar tipi konvektif kurutucu yönteminde, 40°C, 60°C ve 70°C kurutma sıcaklıklarında ve Page eşitliğinde laboratuvar tipi konvektif kurutucu yönteminde, 40°C kurutma sıcaklığında görülmüştür. Havucun renk özelliklerini en iyi koruyan yöntemin ise laboratuvar tipi konvektif kurutucu 40°C kurutma havası sıcaklığında olduğu belirlenmiştir.

Anahtar Kelimeler: *Havuç, Kurutma, Renk, Modelleme*

1.Giriş

Havuç (*Daucus carota* L.), maydonozgiller familyasındandır. Anayurdu çoğu kaynağa göre değişiklik göstermektedir. Bazı kaynaklar havucun anayurdunun Avrupa olduğunu gösterirken bazı kaynaklarda da Kuzey Afrika ve eski Asya olarak bilinen Anadolu olarak belirtilmektedir.

İçerisinde bol oranda A vitamini bulunduran havuç B, C, D ve E vitaminleri yönünden de çok zengindir. Ayrıca içerisinde karoten, şeker ve fosfor barındırır. Güzel aroması, yüksek lif oranı, vitamin, antioksidan içeriği ve sağlık yönünden birçok faydalı etkisi ile insan beslenmesinde taze ve kurutulmuş olarak yaygın biçimde tüketilen sebzelerden biridir (Doymaz, İ., 2004; Gamboa-Santos ve ark., 2012).

En önemli kök sebzelerinden biri olan havuç, TÜİK (2022) verilerine göre 2015 yılında Türkiye'de 534.988 ton üretilmiş iken 2021 yılında yaklaşık %11 artış ile 590.483 ton üretime ulaşmıştır.

Bugün doğal bir gıda ve antioksidan kaynağı olan havucun tüketimi her geçen gün daha da çoğalmaktadır. Havuç ürünlerinin işlenmesi neticesinde elde edilen ürünler (kurutulmuş havuç, havuç suyu, havuç tozu ve havuç atıştırmalıkları) son zamanlarda araştırmacılar tarafından çokça araştırılmaktadır (Polat, 2019).

İnsanların yaşamlarını devam ettirebilmeleri için sürekli olarak enerji ihtiyaçlarını karşılamaları gerekmektedir. Bu nedenle enerji ihtiyaçlarını karşılayabilmek için bitkisel besinlerin kullanımına yönelmişlerdir. Hasat sonrasında taze mahsuller bulundurdukları yüksek nem miktarı sebebiyle bir müddet sonra çürüme eğilimine girerler ve gerek fiziksel gerekse de biyokimyasal özelliklerinde bazı kayıplar meydana gelir. Bu kayıpları önlemek için birçok muhafaza yöntemi geliştirilmiştir. Bu yöntemlerden en uygun olanlarından biri de kurutarak muhafaza yöntemidir.

Kurutma; meyve veya sebzelerin bünyesinde bulundurduğu nemin uzaklaştırılması işlemidir (Ratti, 2001). Fazla nem uzaklaştırılarak mikroorganizmaların gelişimi engellenen seviyelere düşürülecektir (Cemeroğlu, 2004). Böylece raf ömrü daha uzun olacaktır.

Kurutma işlemi, genellikle doğada kendi halinde meydana gelmektedir. Güneşte yapılan kurutma işlemlerinde ürünlerin nem içeriklerini azaltmada bilinen en eski yöntemdir. Ancak açık havada kurutulan materyallerin toz toprak, böcekler, yağmur vb. olumsuz durumdan çok kolay etkileneceği için ciddi kalite kayıpları yaşanmaktadır. Yaşanan bu kalite kayıpları global piyasada bazı ekonomik problemler oluşturmaktadır (Yaldız ve ark. 2001; Lahsasni ve ark. 2004; Sacilik ve Elicin 2006). Bu sebeple ülkemiz dünya piyasasındaki payını koruması ve arttırabilmesi adına kalite kayıplarının az yaşanacağı temiz şartlarda ürün kurutması gerekmektedir. Dünyada ticareti yapılan kurutulmuş ürünlerin %98'i kontrollü koşullar altında sıcak hava ile kurutulmaktadır. Sıcak havada kurutulan ürünler kaliteli ve doğrudan yenilebilir (Işık ve Alibaş, 2000). Bu çalışmada havuç; etüv, vakum ve laboratuvar tipi konvektif kurutucuda 40, 50, 60, 70 ºC kurutma havası sıcaklıklarında ve gölge ortamında kurutularak en uygun kurutma yöntemi ve sıcaklığının belirlenip renk kriteri üzerine etkisinin araştırılması amaçlanmıştır.

2. Materyal Ve Yöntem

2.1. Kurutulacak Ürün

Çalışma materyali Tokat' ta bulunan yerel bir marketten temin edilmiştir. Tokat Gaziosmanpaşa Üniversitesi Biyosistem Mühendisliği kurutma laboratuvarına getirilmiş ve kurutma işlemleri bitene kadar ürünler +4 ± 0.5 ºC sıcaklığındaki buzdolabında muhafaza edilmiştir.



Şekil 1. Kurutma materyali taze havuç

2.2 Nem Tayini

Kurutma işlemine başlamadan önce havucun ilk nem seviyesini belirlemek için 100 gr örnek kullanılmıştır. Nem tayini 70 ºC sıcaklıkta ürün ağırlığı sabitlenene kadar bekletilmiştir.

2.3. Kurutma Yöntemi

Çalışma kapsamında havuç; etüv, vakum, laboratuvar tipi konvektif kurutucu ve gölge ortamında olmak üzere dört farklı kurutma yöntemi kullanılmıştır. Etüv, vakum ve laboratuvar tipi konvektif kurutucularda 40, 50, 60 ve 70 °C kurutma havası sıcaklıkları kullanılarak kurutma işlemi yapılmıştır. Kurutma işlemi için üçer tekerrür ve her tekerrürde ortalama 125 g ürün kullanılmıştır. Kurutma esnasında ağırlık değişimlerini belirlenmesi için başlangıçta 30 dk daha sonra 60, 120, 180 ve 240 dk aralıklarla ölçüm alınmıştır. Ürünler 0.01 g hassasiyete sahip terazide tartılmıştır. Tartılan ürünler yaş baza göre %10-13 nem değerine düşene kadar kurutma işlemine devam edilmiştir (Polatcı ve Taşova 2017).

2.4. Etüv Kurutucu

Çalışmada kurutma denemesi için Şimşek Laborteknik marka / ST-120 model sıcak havalı kabin tip kurutucu etüv kullanılmıştır.



Şekil 2. Etüv kurutucu

2.5. Vakum Kurutucu

Kurutma denemeleri için CLS Scientific marka / CLVO-64T model vakumlu kurutucu kullanılmıştır.



Şekil 3. Vakum Kurutucu

2.6. Laboratuvar Tipi Konvektif Kurutucu

Denemede, Tokat Gaziosmanpaşa Üniversitesi Biyosistem Mühendisliği Bölümü Kurutma laboratuvarı bünyesinde bulunan kurutma denemeleri önce tasarlanıp Tokat sanayisinde imal edilen laboratuvar tipi konvektif kurutucu kullanılmıştır. Kurutma odası, üç adet kurutma kanalı ve kontrol panosu olmak üzere üç ana bölümden oluşmaktadır.



Şekil 4. Laboratuvar tipi konvektif kurutucu

2.7.Renk ölçümü

Taze ve kurutulmuş havuçların Minolta CR300 marka renk ölçer ile Hunter Lab Chromameter renk değerleri (L, a, b) ölçülmüştür. "L" parlaklığı ifade ederken "a" pozitifken kırmızıyı negatifken yeşili, "b" ise pozitifken sarıyı negatifken mavi renkleri ifade etmektedir (McGuire, 1992). Ölçümler sonucunda ortalama Hunter Lab Chromameter değerlerine DUNCAN testi yapılmıştır. Bu değerler tek başına piyasada direkt anlaşılan renk değerleri olmadığından insanların renk olgularına uyması için kroma, hue açısı, toplam renk değişimi ve kahverengileşme indeks değerleri ile hesaplanarak daha anlamlı hale getirilmiştir. Eşitlikler Çizelge 1'de verilmiştir.

Çizelge 1. Hesaplanan renk kriterlerine ait eşitlikler

Renk Değeri	Eşitlik	Kaynak
Croma, C	$C = (a^2 + b^2)^{1/2}$	Kavdır ve ark. (2007)
Hue, °	$h° = \tan^{-1}(\frac{b}{a})$	McGuire (1992)
Renk değişimi, ΔE	$\Delta E = \sqrt{(L_t - L_k)^2 + (a_t - a_k)^2 + (b_t - b_k)^2}$	Çakır (2015)
Kahverengileşme İndeksi	$BI = \frac{[100(x=0,31)]}{0,17}$, $x = \frac{a+(1.75xL)}{[(5.645xL)+(a=(3.012xb))]}$	Plou ve ark. (1999)

Kuruma modeli

Kurutulan havucun zamana bağlı ayrılan nem oranı değerlerini belirlemek için 1 no'lu eşitlik kullanılmıştır.

$$ANO = \frac{M - M_e}{M_0 - M_e} \quad (1)$$

ANO: Ayrılabilir nem oranı
M: Ürünün anlık nem içeriği (kg su/kg kuru madde)
M_e: Ürüne ait verilen durumdaki nem değeri (kg su/kg kuru madde)
M_0: Ürünün başlangıç nem içeriği

Havucun en uygun ince tabakalı kuruma eğrilerini belirlemek için Midilli Küçük, Page ve Wang-Sing eşitlikleri kullanılmıştır. SigmaPlot 10.0 programı kullanılarak oluşturulan modellere ait eşitlikler Çizelge 2'de verilmiştir.

Çizelge 2. İnce Tabakalı Matematiksel Kuruma Modelleri

Model ismi	Eşitlik	Kaynak
Midilli Küçük	$MR = h.\exp(-j.(t^k)) + (l \,.\, t)$	Midilli ve ark. (2002)
Page	$MR = \exp(-kt^n)$	Murthy ve Manohar (2014)
Wang Sing	$MR = 1+k.t+h.t^2$	Wang ve Sing (1978)

İstatistiksel Analiz

Kurutma sıcaklıklarının havucun renklerine olan etkilerini belirlemek için SPSS paket programında $p<0.05$ önem seviyesine göre, çoklu karşılaştırma analizi (DUNCAN) yapılmıştır.

3. Bulgular Ve Tartışma

3.1. Kuruma Verileri

Kurutulan havuç dilimlerinin yaş baza (y.b.) göre ortalama nem içeriği %87,91 olarak belirlenmiş ve son nem değeri %10-13 aralığına gelene kadar kurutma işlemine devam edilmiştir. Uygulanan kurutma yöntemlerindeki sıcaklık değerleri ürünün kuruma sürelerini etkilediği görülmüştür (Çizelge 3).

Çizelge 3. Havucun ortalama son nem değerleri (% yb) ile kuruma süreleri

Kurutma yöntemleri	*Kurutma sıcaklıkları*	*Ortalama son nem değerleri %yb*	*Kurutma süreleri (dakika)*
Etüv	40°C	10,82	3030
	50°C	10,46	1350
	60°C	10,32	570
	70°C	10,88	510
Vakum	40°C	9,98	5070
	50°C	11,33	2070
	60°C	12,07	810
	70°C	12,99	630
Laboratuvar Tipi Konvektif Kurutucu	40°C	10,80	335
	50°C	10,05	450
	60°C	11,54	315
	70°C	10,56	195
Gölge	-	12,89	7440

Çizelge 3'e göre, kurutma yöntemlerinin ürünün kuruma karakteristiklerini etkilediği görülmektedir. Materyalin bünyesindeki mevcut nemin istenilen aralığa gölge ortamında 124 saatte ulaştığı ve aynı zamanda kurutma yöntemleri arasında en uzun işlem olarak da belirlenmiştir. En kısa süren kurutma işlemi ise laboratuvar tipi konvektif kurutucuda 70 °C sıcaklıkta olduğu ve yaklaşık 3 saatte istenilen nem aralığına ulaştığı tespit edilmiştir.

3.2. Kuruma Modellerine Ait Katsayılar, "R^2" ve "P" Değerleri

Kuruma modellerinde güvenilirlik değeri $p<0.001$ olarak bulunmuştur. Tüm kurutma yöntemleri ve sıcaklıklarında hesaplanan en yüksek R^2 değeri en yüksek 0.9999 ile laboratuvar tipi konvektif kurutucu da 40, 60 ve 70 °C kurutma sıcaklığında Midilli Küçük modelinde belirlenmiştir. Yine laboratuvar tipi konvektif kurutucu da 40°C kurutma sıcaklığında Page modeli de en yüksek R^2 değerini (0.9999) vermiştir (Çizelge 4).

3.3. Renk Değerleri

Taze ve kurutulmuş havuç dilimlerine ait ölçülen ve hesaplanan renk değerleri ver Çizelge 5 ve Çizelge 6'da verilmiştir.

Çizelge 4. İnce tabakalı kurutma modellerine ait hesaplanan değerler

Model eşitlikleri	Kurutma yöntemi	Kurutma sıcaklıkları	R^2	p	k	h
Midilli Küçük	Etüv	40°C	0,9995	<0,0001	1,3480	0,9837
		50°C	0,9987	<0,0001	1,3344	0,9772
		60°C	0,9991	<0,0001	1,1562	0,9918
		70°C	0,9997	<0,0001	1,2428	0,9974
	Vakum	40°C	0,9997	<0,0001	0,9715	1,0020
		50°C	0,9995	<0,0001	1,1420	0,9888
		60°C	0,9995	<0,0001	1,0980	1,0039
		70°C	0,9962	<0,0001	1,2426	0,9749
	Laboratuvar Tipi Konvektif Kurutucu	40°C	0,9999	<0,0001	1,1838	1,0013
		50°C	0,9997	<0,0001	0,9520	0,9970
		60°C	0,9999	<0,0001	1,0053	0,9990
		70°C	0,9999	<0,0001	1,0875	0,9998
	Gölge	-	0,9997	<0,0001	1,3752	0,9883
Page	Etüv	40°C	0,9971	<0,0001	0,0123	1,4077
		50°C	0,9961	<0,0001	0,0475	1,3660
		60°C	0,9948	<0,0001	0,1595	1,3068
		70°C	0,9969	<0,0001	0,1558	1,3694
	Vakum	40°C	0,9985	<0,0001	0,0303	1,0538
		50°C	0,9988	<0,0001	0,0543	1,1611
		60°C	0,9967	<0,0001	0,1092	1,2465
		70°C	0,9954	<0,0001	0,2552	1,1999
	Laboratuvar Tipi Konvektif Kurutucu	40°C	0,9999	<0,0001	0,5140	1,1849
		50°C	0,9995	<0,0001	0,5606	0,9679
		60°C	0,9992	<0,0001	0,5932	1,0708
		70°C	0,9991	<0,0001	0,8973	1,1748
	Gölge	-	0,9994	<0,0001	0,0055	1,3458
Wang Sing	Etüv	40°C	0,9981	<0,0001	-0,0321	0,0002
		50°C	0,9985	<0,0001	-0,0797	0,0016
		60°C	0,9997	<0,0001	-0,1825	0,0082
		70°C	0,9985	<0,0001	-0,1885	0,0084
	Vakum	40°C	0,9924	<0,0001	-0,0271	0,0002
		50°C	0,9983	<0,0001	-0,0620	0,0010
		60°C	0,9991	<0,0001	-0,1270	0,0040
		70°C	0,9948	<0,0001	-0,2421	0,0148
	Laboratuvar Tipi Konvektif Kurutucu	40°C	0,9947	<0,0001	-0,4202	0,0445
		50°C	0,9641	<0,0001	-0,3681	0,0326
		60°C	0,9898	<0,0001	-0,4487	0,0510
		70°C	0,9969	<0,0001	1,0787	0,7923
	Gölge	-	0,9968	<0,0001	-0,0159	6,4342

Çizelge 5. Ölçülen ortalama renk değerlerinin istatiksel farklılıkları

Kurutma yöntemleri	***Kurutma sıcaklıkları***	***L***	***a***	***b***
Taze	-	$57,83^{cde}$	$21,04^{g}$	$37,28^{a}$
Etüv	40°C	$54,60^{f}$	$22,91^{efg}$	$28,84^{f}$
	50°C	$60,11^{bc}$	$24,99^{bcd}$	$26,50^{f}$
	60°C	$59,15^{cd}$	$22,45^{efg}$	$27,31^{def}$
	70°C	$57,86^{cde}$	$25,35^{bcd}$	$29,28^{cd}$
Vakum	40°C	$57,27^{cdef}$	$23,41^{def}$	$25,04^{f}$
	50°C	$59,70^{bcd}$	$23,81^{cde}$	$29,10^{cde}$
	60°C	$59,39^{bcd}$	$26,84^{ab}$	$30,96^{c}$
	70°C	$62,90^{a}$	$25,61^{abc}$	$31,57^{bc}$
Laboratuvar Tipi Konvektif Kurutucu	40°C	$63,06^{a}$	$27,63^{a}$	$33,78^{b}$
	50°C	$56,81^{def}$	$27,63^{a}$	$30,08^{c}$
	60°C	$62,07^{ab}$	$27,04^{ab}$	$31,05^{c}$
	70°C	$42,79^{g}$	$17,95^{h}$	$17,63^{g}$
Gölge	-	$56,25^{ef}$	$21,59^{fg}$	$26,66^{ef}$

Çizelge 5 incelendiğinde L, a ve b değerleri %5 önem seviyesinde tazeye göre istatistiki açıdan ($P<0.05$) farklı bulunmuştur. Fakat L değerine bakıldığında taze ile etüv 70 °C istatistiki açıdan benzer bulunmuştur. Çalışmada

a değerine bakıldığında; etüv 40°C ile 60°C, etüv 50 °C ile 70°C, vakum 60°C ile laboratuvar tipi konvektif kurutucuda 60°C ve laboratuvar tipi konvektif kurutucuda 40°C ile 50°C aralarında istatistiki açıdan bir farkın olmadığı tespit edilmiştir. b değeri incelendiğinde ise; etüv 40°C-50°C ile vakum 40°C, vakum 60°C ile laboratuvar tipi konvektif kurutucu 50°C-60°C aralarında istatistiki açıdan farklılık olmadığı tespit edilmiştir.

Çizelge 6. Hesaplanan renk değerleri

Kurutma Yöntemi	*Kurutma Sıcaklıkları*	*C*	*H,Derece*	*ΔE*	*BI*
Taze	-	42,81	90,98	-	-
Etüv Kurutucu	40°C	33,79	68,27	86,96	140,65
	50°C	36,42	73,37	93,48	151,19
	60°C	35,35	72,39	92,11	149,03
	70°C	38,73	78,83	100,36	162,35
Vakum Kurutucu	40°C	34,28	69,14	88,08	142,47
	50°C	37,60	77,04	98,03	158,60
	60°C	40,97	83,39	106,16	171,74
	70°C	40,65	83,37	106,08	171,62
Laboratuvar Tipi Konvektif Kurutucu	40°C	43,64	89,42	113,79	184,10
	50°C	40,84	82,55	105,15	170,07
	60°C	41,17	83,74	106,61	172,46
	70°C	25,16	50,21	64,02	103,52
Gölge	-	34,30	70,37	89,53	144,85

Çizelge 6 incelendiğinde kurutulan havucun taze havuca göre farklı oldukları belirlenmiştir. Renk doygunluğunu gösteren kroma değeri 42,81 olarak bulunmuştur. Demiray (2015) tarafından yapılan çalışmada kroma değeri ortalama 33,79 bulunmuştur ve bu çalışmada bulunan değere yakın değerler elde edilmiştir. En düşük kroma değeri 25,16 ile laboratuvar tipi konvektif kurutucuda 70°C kurutma havası sıcaklığında gözlemlenmiştir. En yüksek kroma değeri ise 43,64 ile laboratuvar tipi konvektif kurutucuda 40°C kurutma havası sıcaklığında bulunmuştur ve tazeye en yakın değer olduğu görülmektedir. Bulgulara göre havuç kurutma işleminde laboratuvar tipi konvektif kurutucuda 70 °C kurutma havası sıcaklığının seçilmesinin renk değeri açısından daha uygun olacağı ve kuruma süresinin de kısa olacağı belirlenmiştir.

Taze havucun hue açısı 90,98 olarak bulunmuştur. Çalışmada en düşük hue açısı laboratuvar tipi konvektif kurutucuda 70°C kurutma havası sıcaklığında 50,21 bulunmuştur. En yüksek hue açısı ise laboratuvar tipi konvektif kurutucuda 40°C kurutma havası sıcaklığında 89,42 olarak tespit edilmiştir.

Toplam renk değişimi en yüksek laboratuvar tipi konvektif kurutucuda 40 °C' de 113,79 olarak ölçülürken en düşük laboratuvar tipi konvektif kurutucuda 70°C' de 64,02 olarak ölçülmüştür.

Kahverengileşme indeksinin (BI) en düşük değeri laboratuvar tipi konvektif kurutucuda 40 °C' de 103,52, en yüksek değeri ise laboratuvar tipi konvektif kurutucuda 70°C' de 184,10 olarak bulunmuştur.

4. Sonuç

Yapılan bu çalışmada havuç gölge ortamında, etüvde, vakumda ve laboratuvar tipi konvektif kurutucuda 40, 50, 60 ve 70°C kurutma havası sıcaklıkları kullanarak kurutulmuş en iyi renk değerleri ile kuruma kinetiği belirlenmiştir. Havucun kuruma parametreleri göz önünde bulundurulduğunda en kısa kuruma süresi laboratuvar tipi konvektif kurutucuda 70°C kurutma havası sıcaklığında 3 saat 15 dakika olarak tespit edilmiştir. Modelleme sonuçlarına bakıldığında en yüksek R^2 değeri Midilli küçük eşitliğinde, laboratuvar tipi konvektif kurutucu yönteminde, 40°C, 60°C ve 70°C kurutma sıcaklıklarında ve Page eşitliğinde laboratuvar tipi konvektif kurutucu yönteminde, 40°C kurutma sıcaklığında görülmüştür. Renk kriteri açısından taze havucun özelliklerini en iyi koruyan, en yakın değerin laboratuvar tipi konvektif kurutucuda 40°C kurutma havası sıcaklığında olduğu bulunmuştur. Bu nedenle havuç için renk açısından en iyi düşük sıcaklıklarda kurutma olduğu belirlenmiştir.

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The Globalization of the Food Sector and the Importance of the Logistic

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Abstract
Food systems imply a sequence of processes to fulfill the demand for food, which ranges from farming, processing, distributing to final use. With increasing globalization of the food supply chain, supply chain service providers must consider the full potential for lapses in safety controls. The setting of global freight distribution systems has enabled a wider scale and scope for the commercialization of agricultural goods. A food system can be articulated as a supply chain that reveals much about the global structure of production and consumption. We studied in the presentation about the countries satisfy domestic food consumption by importing from foreign supplies, therefore, highlighting the function of food exports in maintaining and diversifying the global food supply in the age of globalisation,
Keywords: Globalization, Food Sector, Logistic

Investigation of Agricultural Machinery Usage and Agricultural Production in İzmir

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Abstract
Izmir Province is in the Aegean Region and is the third most populous city in Turkey in terms of population. In this study, statistical data between 2004 and 2021 of plant products produced in Izmir and agricultural machinery used in production stages were used. In the examination of agricultural areas, fruits, beverage and spice crops area, fallow area, vegetable area, ornamental plants area, cereals and other vegetable products area and greenhouse agricultural area criteria were taken into consideration. When the year 2004 is taken as a reference, it is seen that the total production areas have decreased over the years. A loss of 8.17% was calculated in 2021. While there was an increase in the criteria of fruits, beverage and spice plants area (8.02%), ornamental plants area (18.47%) and greenhouse agricultural area (73.06%), fallow area (24.02%), vegetable area (32.22%) and cereals and other vegetable products area (15.82%) decreased. With the decrease in fallow areas, there is an increase in the areas where production is made. It also shows that changes in product patterns lead manufacturers to the production of products with high added value. In 2021, 45.24% of the agricultural production areas are fruits, beverages and spice plants, 43.62% are cereals and other vegetable products, 9.45% are vegetable areas, 0.77% are fallow areas, 0.51% are ornamental plants areas and 0.41% are covered agricultural areas. When tractors (28.13%), harvesters (150.00%) and agricultural machinery (21.81%) used in agricultural production were examined, it was seen that their numbers increased over the years. In the total number of agricultural machinery, tillage group has 29.22%, maintenance, fertilization and spraying group has 25.32%, irrigation group has 22.35%, other machines have 13.58%, sowing and planting group has 5.40% and harvesting and threshing machinery group has 4.11%. The number of agricultural machines per tractor was calculated as 9.33.
Key Words: *Izmir, Vegetative Production, Agricultural Machinery.*

İzmir İlinde Üretilen Tarımsal Ürünler ve Kullanılan Tarım Makinelerinin İncelenmesi

Özet
İzmir İli, Ege Bölgesinde yer almaktadır ve Türkiye'nin nüfus bakımından üçüncü en kalabalık şehridir. Bu çalışmada, İzmir İlinde üretilen bitkisel ürünler ve üretim aşamalarında kullanılan tarım makinalarına ait 2004–2021 yılları arasındaki istatistiksel verileri kullanılmıştır. Tarım alanlarının incelenmesinde; meyveler, içecek ve baharat bitkileri alanı, nadas alanı, sebze alanı, süs bitkileri alanı, tahıllar ve diğer bitkisel ürünlerin alanı ile örtüaltı tarım alanı kriterleri dikkate alınmıştır. 2004 yılı referans alındığında, toplam üretim alanlarının yıllar içerisinde azaldığı görülmektedir. 2021 yılında %8,17'lik bir kayıp hesaplanmıştır. Meyveler, içecek ve baharat bitkileri alanı (%8,02), süs bitkileri alanı (%18,47) ile örtüaltı tarım alanı(%73,06) kriterlerinde artış görülürken, nadas alanı (%24,02), sebze alanı (%32,22) ile tahıllar ve diğer bitkisel ürünlerin alanı (%15,82) kriterlerinde azalış görülmüştür. Nadas alanlarındaki azalma ile üretim yapılan alanlarda artış görülmektedir. Ayrıca ürün desenlerindeki değişikliklerin üreticilerin katma değeri yüksek ürünlerin üretimine yöneldiği sonucunu göstermektedir. 2021 yılında tarımsal üretim alanlarının %45,24'ünü meyveler, içecek ve baharat bitkileri alanı, %43,62'sini tahıllar ve diğer bitkisel ürünlerin alanı, %9,45'ini sebze alanı, %0,77'sini nadas alanı, %0,51'ini süs bitkileri alanı ve %0,41'ini de örtüaltı tarım alanı oluşturmaktadır. Tarımsal üretimde kullanılan traktörler (%28,13), biçerdöverler (%150,00) ve tarım makineleri (%21,81) incelendiğinde yıllar içerisinde sayılarında artış olduğu görülmüştür. Toplam tarım makinaları sayısı içerisinde toprak işleme grubu %29,22, bakım, gübreleme ve ilaçlama grubu %25,32, sulama grubu %22,35, diğer makineler %13,58, ekim ve dikim grubu %5,40 ve hasat ve harman makinaları grubu ise %4,11'lik orana sahiptir. Traktör başına düşen tarım makinası sayısı ise 9,33 adet olarak hesaplanmıştır.
Anahtar Kelimeler: *İzmir, Bitkisel üretim, Tarım makineleri*

Giriş

Her geçen gün artmakta olan dünya nüfusunu beraberinde beslenme ihtiyacının karşılanmasında artış getirmektedir. Tarım üretim alanlarındaki ve bu sektörde çalışan işgücünde görülen azalmalar bu ihtiyacın karşılanmasında yeni önlemler alınmasına sebebiyet vermektedir. Bu durumun önlenebilmesi için tarımsal üretim yapılan alanlardan daha verimli ve daha yüksek miktarda üretimin gerçekleştirilmesi gerekmektedir. Mevcut koşullar altında, yükselen talebin eldeki kısıtlı alanlarda yapılan üretimde, modern metotların ve makinaların kullanılması ile etkin ve ekonomik olarak yapılarak arz artışıyla karşılanması gereklidir (Comart ve Akıncı, 2017). Üretilen tarımsal ürünlerde verim ve kapasite artışı ise; etkin ve modern üretim metodunun seçimi, kaliteli tohumluk kullanımı, su ve toprak kaybını azaltan ve/veya korunmasını sağlayan metotların seçimi, girdi maliyetini azaltmak için değişken düzeyli uygulamaların temel amacı olan doğru zaman ve yerde doğru miktarın uygulanması

ile akıllı tarım uygulamaları ile kontrolü sağlanabilen makinelerin kullanılması olarak sıralanabilir (Baran ve ark., 2014; Bilim ve ark., 2014; Özgünaltay Ertuğrul ve ark., 2019; Altuntaş, 2020; Güneş ve ark., 2020; Ertekin ve ark., 2021).

İzmir ili, Ege Bölgesinde yer almakta olup Türkiye'nin nüfus bakımından üçüncü en kalabalık şehridir. 2021 yılı TÜİK verilerine göre şehrin nüfusu 4 425 789 kişi olup, 11 891 km^2'lik yüz ölçümüyle Türkiye'nin yirmi üçüncü büyük şehridir (İZKA, 2022b). Akdeniz ikliminin hâkim olduğu bölgede yıllık toplam yağış ortalaması 713,8 mm, yıllık yağışlı gün ortalaması ise 84,2 gündür (MGM, 2022). Bu çalışmada da İzmir ili ve ilçelerinde tarımsal üretim faaliyetleri ve bu faaliyetler için kullanılan makineler değerlendirilmiştir.



Şekil 1. İzmir ili ve ilçeleri (Anonim, 2022)

Materyal ve Yöntem

Çalışmanın materyalini, Türkiye İstatistik Kurumu'ndan alınan 2004-2021 yılları arasında İzmir ili ve ilçelerindeki bitkisel üretim alanları ile tarımsal üretim faaliyetlerinde kullanılan traktörlere ait istatistik verileri oluşturmaktadır.

Çalışmanın yöntemini, İzmir iline ait tarım alanları, tarım traktörleri ve tarım makinaları sayılarının verilerin kullanılarak tarımsal mekanizasyon düzeyinin belirlenmesidir. Tarımsal mekanizasyon düzeyinin belirlenmesinde kullanılan ölçüt, Traktör başına düşen tarım makinası (makina traktör^{-1})'dür.

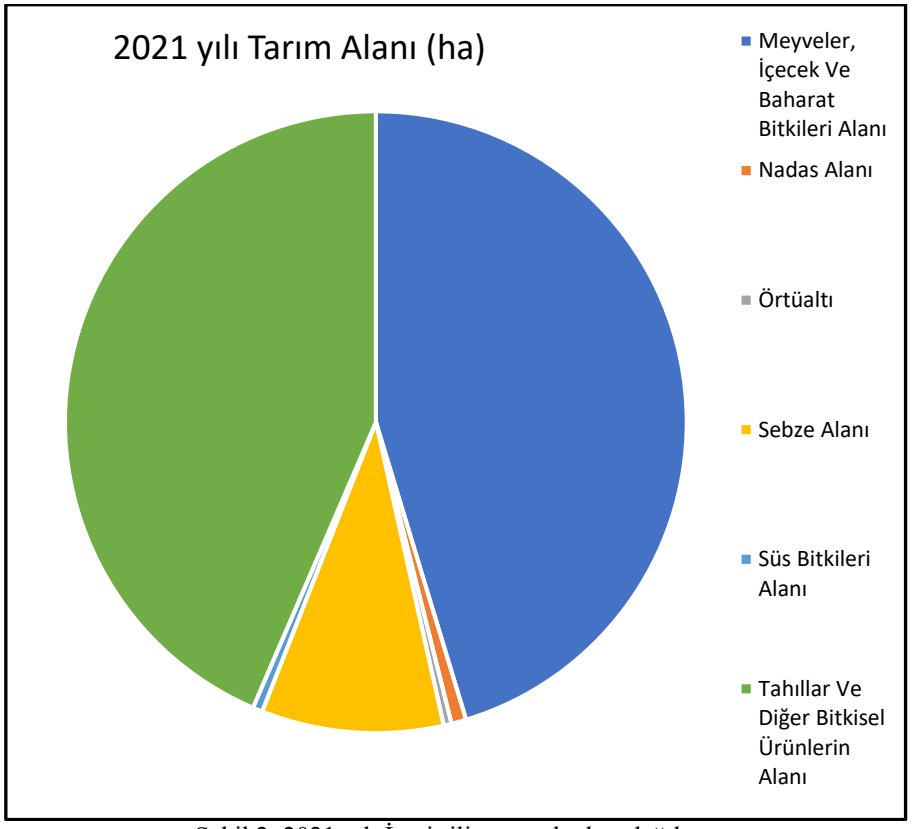
Bulgular ve Tartışma

İzmir, 1 adet büyükşehir belediyesi ve 30 adet ilçe belediyesi bulunan ve tarımsal üretim yapan işletmelerin ortalama parsel büyüklüğü 3,7 ha olan, Türkiye'nin bitkisel üretiminin %3.1'nin yapıldığı bir ildir. Tarımsal üretim yapılan alanlar büyüklüklerine göre büyükten küçüğe doğru, Ödemiş, Bergama, Bayındır, Torbalı, Tire, Menderes, Kemalpaşa, Menemen, Kiraz, Selçuk, Dikili, Kınık, Seferihisar, Aliağa, Urla, Beydağ, Foça, Karaburun, Buca, Çeşme, Bornova, Güzelbahçe, Çiğli, Karabağlar, Karşıyaka, Gaziemir, Balçova, Narlıdere, Bayraklı ve Konak olarak sıralanmaktadır. Büyükşehir belediyesi sınırlarına ve şehir merkezlerine yaklaştıkça tarım alanlarında azalma görülmekte ve Konak ilçesinde tarım alanına ait bir veri bulunmamaktadır. Toplan tarım alanları incelendiğinde 2021 yılı içerisinde üretilen ürün gruplarına göre; meyveler, içecek ve baharat bitkiler birinci sırada yer alırken, tahıllar ve diğer bitkisel ürünler ikinci sırada, sebzeler üçüncü, nadas alanı dördüncü, süs bitkileri

beşinci ve örtü altı üretim alanı ise altıncı sırada yer almaktadır. 2004-2021 yılları arasındaki veriler Tablo 1'de yer almaktadır. 2021 yılı İzmir il geneline ait Tarımsal ürün gruplarına göre dağılım Şekil 2'de verilmiştir. İzmir ili toplam tarım alanları incelendiğinde, meyveler, içecek ve baharat bitkileri alanı %45,31, tahıllar ve diğer bitkisel ürünlerin alanı %43,53, sebze alanı %9.47, süs bitkileri alanı %0,51, nadas alanı %0,77, örtüaltı %0.41'lik oranlara sahip olduğu görülmektedir.

Tablo 1. İzmir ili Tarım alanları gruplarına göre dağılımı

YIL	Meyveler, İçecek Ve Baharat Bitkileri Alanı	Nadas Alanı	Sebze Alanı	Süs Bitkileri Alanı	Tahıllar Ve Diğer Bitkisel Ürünlerin Alanı	Örtüaltı Tarım Alanı
2004	135 451	3 290	45 092	0	167 607	761,6
2007	139 522,1	3 008,5	39 613,3	0	161 897,1	754
2010	140 622,7	4 409,3	41 148,6	0	162 919	852,2
2014	146 925,2	3 564,5	40 844,6	1 389,88	137 050,7	1 499,38
2017	147 803	3 028	38 449,3	1 545,85	137 847,4	1 528,7
2020	150 102,5	2 317,7	35 940,7	1 636,47	135 700,9	1 760,4
2021	146 312,6	2 499,9	30 564,3	1 646,56	141 083,4	1 318,04



Şekil 2. 2021 yılı İzmir ili tarım alanları dağılımı

Tahıllar ve diğer bitkisel ürünler, buğday, mısır, arpa, çavdar, yulaf, triticale, pamuk, susam, ay çekirdeği, tütün, fiğ, burçak, yonca, patates, italyan çimi 'dir. Meyveler, içecek ve baharat bitkileri, üzüm, avokado, muz, incir, greyfurt (altıntop), limon, portakal, mandalina, elma, armut, ayva, kayısı, zerdali, kiraz, vişne, şeftali, nektarin, erik, kivi, ahududu, çilek, böğürtlen, dut, badem, kestane, antep fıstığı, ceviz, muşmula, nar, trabzon hurması, zeytin, anason, kekik 'dir. Sebze, fasulye, barbunya, bezelye, börülce, bakla, lahana, karnabahar, brokoli, marul, ıspanak, enginar, maydanoz, roka, tere, nane, dereotu, karpuz, kavun, biber, domates, kabak, bamya, hıyar, patlıcan, havuç, sarımsak, soğan, pırasa, mantar 'dır. Süs bitkileri olarak kesme çiçekler, iç mekân ve dış mekân çiçek fideleri yetiştirilmektedir.

2021 yılında en çok tarımsal üretim yapılan ilçeler Ödemiş, Bergama, Bayındır, Torbalı, Tire, Menderes, Kemalpaşa, Menemen, Kiraz, Selçuk, Dikili ve Kınık ilçeleridir. Bu ilçeler İzmir ilinin tarımsal üretim alanlarının %85.89'luk kısmını oluşturmaktadır. 2021 yılına ait verilerden elde edilen İzmir ilinde kullanılan tarım makinalarının grupları ve mevcut verileri Tablo 2'de verilmiştir. İzmir ilinde tarımsal üretimde kullanılan traktör sayısı toplamı 39 578 adettir. Bu traktörler incelendiğinde farklı tiplerde olduğu ve güç grupları içerisinde yer aldıkları görülmektedir. Traktör başına düşen makine sayısı grup bazında incelendiğinde; toprak işleme grubu 2,72 adet, ekim ve dikim grubu 0,50 adet, bakım, gübreleme ve ilaçlama grubu 2,36 adet, hasat ve harman grubu 0,38 adet, sulama makine ve sistemleri grubu 1,27 adet ve diğer makineler ise 1,27 adettir.

Tablo 2. 2021 yılında İzmir ilinde kullanılan Tarım Makinaları Dağılımı (adet)

Toprak işleme grubu	Ekim ve dikim grubu	Bakım, Gübreleme ve İlaçlama Grubu	Hasat ve Harman Grubu	Sulama Grubu	Diğer	Toplam
107 787	19 913	93 539	15 149	82 450	50 105	368 943
%29,22	%5,40	%25,37	%4,10	%22,34	%13,57	%100,00

Tarım makinaları içerisinde toprak işleme makinları grubu en çok adede sahip olan makine grubu olarak öne çıkmaktadır. Tarım makinaları sayısında en büyük oran sahip olan toprak işleme makinaları verileri içerisinde, kulaklı traktör pulluğu (31599 adet), dişli tırmık (18713 adet), diskli tırmık (diskaro) (16086 adet), kültivatör (12516 adet), ark açma pulluğu (9288 adet), Toprak frezesi (rotovatör) (3852 adet), diskli traktör pulluğu (2751 adet), kepçe (2186 adet), set yapma makinesi (1857 adet), merdane (1817 adet), kombikürüm (1633 adet), dip kazan (subsoiler) (1371 adet), toprak tesviye makinesi (1319 adet), rototiller (1187 adet), toprak burgusu (564 adet), diskli anız pulluğu (vanvey) (524 adet) ve kulaklı anız pulluğu (524 adet) bulunmaktadır. Toprak işleme makinalarının %29.32'lik kısmını oluşturan kulaklı traktör pulluğunu, %17.36'lık kısmını oluşturan dişli tırmık, %14.92'lik kısmını oluşturan diskli tırmık(diskaro) ve %11.61'lik kısmını oluşturan kültivatörler izlemektedir. Toprak işleme grubu özelinde traktör başına düşen makine sayısı; kulaklı traktör pulluğu için 0,80 makine traktör^{-1}, dişli tırmık için 0,47 makine traktör^{-1}, diskli tırmık (diskaro) için 0.41 makine traktör^{-1}, kültivatör için 0.32 makine traktör^{-1}, ark açma pulluğu için 0,23 makine traktör^{-1} ve toprak frezesi için 0.10 makine traktör^{-1} değerlerine sahiptir.

Ekim ve dikim makinalarına ait veriler, traktörle çekilen hububat ekim makinesi, kombine hububat ekim makinası, pnömatik ekim makinesi, üniversal ekim makinesi, anıza ekim makinesi ile patates dikim ve fide dikim makinelerini kapsamaktadır. Bu gruptaki makinaların %82.89'lık kısmını ekim makinaları %17.11'lik kısmını ise dikim makinaları oluşturmaktadır. Ekim ve dikim makinaları içerisinde üniversal ekim makinaları (13589 adet) en büyük dilimi oluşturmaktadır. Bu makineyi sırasıyla, patates dikim (2886 adet), pnömatik ekim (1579 adet), traktörle çekilen hububat ekim (712 adet), kombine hububat ekim (539 adet), fide dikim (522 adet) ve anıza ekim (86 adet) makinesi takip etmektedir. Traktör başına düşen makine kriterinde ise; üniversal ekim makinesi için 0,34 makine traktör^{-1}, patates dikim makinesi için 0,07 makine traktör^{-1}, pnömatik ekim makinesi için 0.04 makine traktör^{-1}, traktörle çekilen hububat ekim makinesi için 0,02 makine traktör^{-1} ve diğer makineler için 0.01 makine traktör^{-1} değerleri hesaplanmaktadır. Bu durum tarımsal üretim yapan işletmelerin ekim ve dikim makineleri kullanımı için ortaklaşa makine kullanımı gerçekleştirdiğini göstermektedir.

Bakım, gübreleme ve ilaçlama makinaları grubunda üç ayrı işlemi gerçekleştiren makine grubu yer almaktadır. Bu grupların toplam sayı içerisindeki oranları tipleri, gübreleme (%17,75), ilaçlama (%67,92) ve bakım (%14,34) olarak sayılabilir. Gübreleme makinelerini çiftlik gübresi dağıtma ve kimyevi gübre dağıtma makinaları oluşturmaktadır. Traktör başına düşen makine sayısı kriterinde; çiftlik gübresi dağıtma makinesi için 0,01 makine traktör^{-1} ve kimyevi gübre dağıtma makinesi için 0,41 makine traktör^{-1} sayısı hesaplanmaktadır. İlaçlama makinelerini, sırt pulverizatörü (37 752 adet), kuyruk milinden hareketli pulverizatör (10 586 adet), atomizör (9 338 adet), motorlu pulverizatörler (4819 adet), kombine atomizör (550 adet) ve tozlayıcı (483 adet) oluşturmaktadır. Traktör başına düşen ilaçlama makinesi değeri ise kuyruk milinden hareketli pulverizatörler için geçerli olup 0,27 makine traktör^{-1} değerine sahiptir. Bakım işlemlerinin gerçekleştiren ara çapa makinesi ise 0.34 makine traktör^{-1} değerindedir. İlaçlama işlemlerinde sırt pulverizatörü kullanımının, gübreleme işlemlerinde mineral gübre kullanımının yaygın olduğu eldeki verilerle desteklenmektedir.

Hasat ve harman makineleri grubunda farklı işlemleri gerçekleştiren makinelerin olduğu görülmektedir. Bu işlemler; tahıl hasadı için orak makinesi, biçer bağlar makinesi, mısır silaj makinesi, mısır hasat makinesi, harmanlama için tınaz makinesi, sap döver ve harman makinesi (batöz), mısır daneleme makinesi, motorlu tırpan, balya makinesi, saman yapma makinesi, meyve hasat makinesi, patates sökme makinesi, pancar sökme makinesi, ot silaj makinesi, pamuk toplama makinesi ve motorlu tırpan olarak sıralanabilmektedir. Traktör başına makine sayısı kriteri; mısır silaj makinesi için 0,11 makine traktör^{-1}, patates sökme makinesi için 0,07 makine traktör^{-1}, traktörle çekilen çayır biçme makinesi için 0,03 makine traktör^{-1} ve ot silaj makinesi için 0,03 makine traktör^{-1}'tür. Sulama makineleri incelenediğinde sulama makinelerini, santrifüj pompa, elektropomp, motopomp ve derin kuyu pompa olarak sıralamak mümkündür. Sulama tesisleri incelendiğinde ise yağmurlama ve salma sulama tesisleri görülmektedir. Sulama makineleri ve tesislerine ait toplam sayı incelendiğinde makineler %71.20'lik paya sahipken, tesisler %28.20'lik kısmını oluşturmaktadır. Sulama makinaları sayısı toplamında ise derin kuyu pompalar 28 321 adet ile %48,24 oranını, elektropomplar 19 839 adet ile %33,80 oranı, motopomplar 6059 adetle %10,32 oranını ve santrifüj pompalar 4484 adetle %7.64'lük oranı oluşturmaktadır. Tesislerin içerisinde ise damla sulama tesisi %86.88'lik kısmı 20 631 adetle oluştururken %13,12'lik oranı yağmurlama sulama tesisleri 3116 adetle oluşturmaktadır. Bu durum tarımsal üretim yapan çiftçilerin bilinç düzeyinin yüksek olduğunu ve su kullanımını azaltmayı hedeflediğini göstermektedir.

Diğer makineler olarak adlandırılan grupta ise, römork, su tankeri, yem hazırlama makinesi, sap parçalama makinesi ve yem dağıtıcı römorklar yer almaktadır. Traktör başına düşen römork sayısı 0,84 makine traktör^{-1} ve su tankeri sayısı ise 0,28 makine traktör^{-1} değerine sahiptir. Yem hazırlama makinesi 2258 adet ve yem dağıtıcı

römork ise 1661 adet olarak görülmektedir. Bu makineler haricinde sap parçalama makinesi sayısı 1594 adet olarak bulunmuştur.

Tarımsal üretimde kullanılan traktörler (%28.13), biçerdöverler (%150.00) ve tarım makineleri (%21.81) incelendiğinde yıllar içerisinde sayılarında artış olduğu görülmüştür. Toplam tarım makinaları sayısı içerisinde toprak işleme grubu %29.22, bakım, gübreleme ve ilaçlama grubu %25.32, sulama grubu %22.35, diğer makineler %13.58, ekim ve dikim grubu %5.40 ve hasat ve harman makinaları grubu ise %4.11'lik orana sahiptir. Traktör başına düşen toplam tarım makinası sayısı ise 9.33 adet olarak hesaplanmıştır. Gökdoğan (2012), yaptığı çalışmada Türkiye'de traktör başına düşen makine sayısının 5,20 makine olduğunu bildirmiştir. Bu durum İzmir ili ve ilçelerinde tarımsal üretimde makine kullanımının yoğun olarak gerçekleştiğini desteklemektedir.

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ID: 747

The Role of E-commerce in the Daily Food Sector

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Abstract

New commerce ecosystems such as social media platforms and all-in-one apps are also becoming incredibly powerful ways to connect to and engage with consumers. E-commerce sales have been rising yearly and during Covid-19 more consumers began shopping online in greater numbers and frequency. Food Industry professionals also believe that this is a permanent change. In this presentation, we focus on the use of electronic commerce for quality control and cost cutting efficiencies by the food and agricultural industries such as daily food products in the world.

Keywords: E-commerce, Food, Daily Food.

ID: 748

Impact of Microplastic Pollution on Biota in the coastline of Turkey

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Abstract
Plastics are high demand raw material with applications in many industries due to their low costs and easily processable structures. Increasing plastic production in line with the high demand and inadequate waste management of plastic waste gives rise to accumulation of these wastes in terrestrial and aquatic ecosystems. It has been reported that microscopic size plastics (microplastics) (<5 mm) which were eighter produced intentionally in response to sectoral needs or formed by the degradation of large plastic wastes as a consequence of physical, chemical and biological environmental factors cause significant problems in aquatic ecosystems.
The aim of present study is to reveal the impact of microplastic pollution on biota in the Turkish coastline by evaluation of a data set, created by expanding the scope our biyota exposure data with the available information gathered from scientific database platforms (Web of Science, Scopus, and TR index). With the final dataset, we were able to evaluate the impact of the pollution on 13422 individuals belonging to 54 species at a regional sea system level. Results of the study highlights impact of microplastic pollution on biota through the Turkish coastline and the reveals the data gaps and hot pollution spots in regional level. This information has the ability to guide researchers in the process of determining areal coverage of their future studies.
Key Words: *Teleost, Invertebrates, Zooplankton, Pollution Assessment*

Türkiye Sahil Şeridinde Mikroplastik Kirliliğinin Biyota Üzerine Etkisi

Özet
Plastikler ucuz maliyetleri ve kolaylıkla işlenebilir yapıları sebebiyle, günümüzde birçok sektörel uygulamada tercih edilen bir hammaddedir. Talep doğrultusunda her geçen gün artan plastik üretimi ve kullanım ömrünü tamamlaması ardından atık niteliği kazanan plastik malzemelerin yönetiminin gereği gibi yapılmaması sebebiyle doğal ortama ulaşan bu atıklar karasal ve sucul ekosistemlerde birikim göstermektedir. Gerek sektörel gereksinimi cevaben kasıtlı üretilen, gerekse de fiziksel, kimyasal ve biyolojik faktörler etkisinde büyük plastik atıkların bozunumuyla oluşan mikroskobik boyuttaki (<5 mm) plastiklerin (mikroplastikler) yapılan bilimsel değerlendirmeler neticesinde sucul ekosistemlerde önemli sorunlara neden olduğu raporlanmıştır.
Sunulan bu çalışmada, kendi çalışmalarımızdan oluşturduğumuz veri bankasındaki bilgilere ek olarak bilimsel veri tabanı platformlarında (Web of Science, Scopus ve TR dizin) yapılan literatür taramaları neticesinde ülkemiz denizlerinde günümüze kadar yapılmış olan ve denizel biyotanın mikroplastik kirliliğinden etkilenme durumunu araştıran çalışmaların incelenmesiyle oluşturulan veri setinin analizi gerçekleştirilmiştir. Bu kapsamda 54 türe ait 13422 birey mikroplastik kirliliğinden etkilenme durumu göz önüne alınarak ülkemiz denizlerinde var olan mikroplastik kirliliğinin biyota üzerine etkisi bölgesel ve deniz bazında ortaya konulmuştur. Yapılan değerlendirmeyle veri eksiklikleri gösterilmiş ve gelecekte dizayn edilecek çalışmalara dair öneriler sunulmuştur.
Anahtar Kelimeler: *Kemikli Balıklar, Omurgasızlar, Zooplankton, Kirlilik Değerlendirmesi,*

ID: 749

Effects of Tetracycline Exposure on Neocaridina Davidi Behavior, Reproduction, and Morphology

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Abstract

Neocaridina davidi, with its non-aggressive behavior and red color, is a freshwater shrimp type and its gender can be easily determined by physical appearance. *N. davidi* are used as model organisms because of various reasons; these freshwater shrimps are easy to look after and breed. Also, their behavioral patterns, morphology, and reproductive habits can be observed, however, there are not enough studies regarding these.

Tetracycline is an antibiotic that is widely used in agriculture and its waste is released into nature. Tetracycline is toxic and as an ecotoxic agent, its behavioral and morphological effects on organisms are unknown. That's why in this study, the behavioral, morphological, and reproductive effects of tetracycline on *N. davidi* have been observed and statistical analyses were made for all four groups; the control group and three different exposure rates 25µg/L, 50µg/L, 100µg/L. All exposure groups had 10 *N. Davidi*, 6 female 4 male, and 100µg/L was determined as the lethal dosage.

It has been shown that the survival rate of N. davidi got affected by exposure to tetracycline. Especially when the exposure rate was 50µg/L and 100µg/L. After tetracycline exposure, a total of 10 deaths have been recorded in these two groups.

Reproduction frequency and amount of hatchlings also dropped. Aggressive behavior like attacking pregnant females and eating hatchlings was seen on 25µg/L and 50µg/L groups after 2 weeks and these behavior patterns continued for about 3 weeks.

To sum up, after exposure to different dosages of tetracycline; behavioral, reproductive, and morphological traits of *N. Davidi* got affected.

Key Words: *Neocaridina davidi, tetracycline, behavior, reproduction, morphology, fresh water.*

Tetrasiklin Maruziyetinin *Neocaridina davidi* Davranışı, Üremesi ve Morfolojisi Üzerindeki Etkileri

Özet

Tatlı su karideslerinden biri olarak tanınan *Neocaridina davidi* 2-2.5 cm boylarında ve doğada kırmızı renkleri ile ünlüdür. Agresif olmayan N. davidi'lerin cinsiyet ayrımı gözle ayırt edilebilirdir. Model organizma olarak N. davidi seçiminde rol alan birçok sebep bulunmaktadır. Öncelikle tatlı sularda yaşayan N. davidi, yetiştirmesi kolay olup davranış, üreme ve morfolojileri gözlemlenebilecek ancak bu konular üzerinde çok fazla çalışma yapılmamış canlılardır. Tetrasiklin antibiyotiği hem tarımsal olarak kullanılmakta hem doğaya atık olarak salınan bir antibiyotiktir. Toksik etkileri olduğu bilinen ve ekotoksik bir ajan olarak sayılan bu antibiyotiğin canlılar üzerindeki hem morfolojik hem de davranışsal etkileri birçok araştırmada incelenmektedir. Bu projede de bu antibiyotiğinin bir model organizma olan *Neocaridina davidi* üzerindeki davranışsal ve morfolojik etkileri gözlemlenmiştir ve 25µg/L, 50µg/L, 100µg/L ile kontrol grubu için istatistiksel analizler gerçekleştirilmiştir. Tüm maruz bırakılan gruplarda 6 dişi, 4 erkek olacak şekilde toplamda 10 *N. Davidi* bulundurulmuştur ve bunun sonucunda 100µg/L, lethal doz olarak belirlenmiştir.

Tetrasiklin maruziyeti sonucunda *N. Davidi* hayatta kalma oranının etkilendiği görülmüştür. Özellikle de 50µg/L ve 100µg/L tetrasikline maruz bırakılan gruplar en çok etkilenmiştir. Tetrasiklin maruziyeti sonrasında her iki grubun toplamında 10 ölüm kaydedilmiştir.

Üreme sıklığı ve yavru sayısı da tetrasiklin maruziyeti sonucunda düşüşe uğramıştır. Aynı zamanda hamile dişilere saldırma ve yavruları yeme gibi agresif davranışlar, 2 hagtanın sonunda hem 25µg/L, hem 50µg/L maruz bırakılan grupta görülmüştür ve bu davranış özellikleri yaklaşık 3 hafta boyunca devam etmiştir.

Sonuç olarak bakıldığında, farklı tetrasiklin dozlarına maruz kalan *N. Davidi* 'lerde; davranış, üreme ve morfolojik özelliklerinde değişiklikler olduğu görülmüştür.

Anahtar Kelimeler: *Neocaridina davidi, Tetrasiklin, davranış, üreme, morfoloji, tatlı su*

ID: 752

Production And Characterization of Carboxymethyl Cellulose (CMC)/ Gelatine (GLT)/ Tara Gum (TG) Biomedical Films Enriched with Smoke Tree Leaf Extract

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Abstract

In this study, the synthesis biomedical films containing different natural polymers, which have the potential to be used as a wound dressing, was studied. The films were produced by the solvent casting method. In the formulation optimization studies, carboxymethyl cellulose (CMC), gelatin (GLT), tara gum (TG) polymers and glycerol (GLY), as a plasticizer, were used. Smoke tree (*Cotinus coggygria*) leaf extract, which has wound healing properties, and $AgNO_3$, were added to the polymer mixtures, resulting in simultaneous green synthesis of silver nanoparticles (AgNP). The obtained biomedical films were characterized by measuring their thickness, opacity, percent elongation and tensile strength, water vapor permeability (WVP), solubility, and moisture holding capacity. Furthermore, they were analyzed by thermogravimetric analysis (TGA), Fourier Transform Infrared (FTIR) spectroscopy, and determination of total phenolic content, antioxidant and antimicrobial activity analyses. The thickness of the synthesized gelatin-based films varied between 0.05 and 0.12 mm, WVP between 0.788 and 1.481 g.mm/kPa.s.m^2, solubility between 19.6% and 64%, tensile strength between 9.6 and 18.6 MPa, elongation values between 8.7% and 15.2%. It was observed that the antioxidant and antibacterial activity of the films against E. coli, S. aureus and B. pumilus increased with the addition of smoke tree leaf extract and the presence of AgNP. As a conclusion, these mechanically strong, antioxidant and antimicrobial films, synthesized from natural polymers, have been shown to have the potential to be used as wound dressings.

Key Words: *Biomedical film, Wound dressing, Smoke tree, Silver nanoparticles, Green synthesis.*

Duman Ağacı Yaprağı Ekstresiyle Zenginleştirilmiş Karboksimetil Selüloz (CMC)/ Jelatin (GLT)/ Tara Gam (TG) Biyomedikal Filmlerin Üretimi ve Karakterizasyonu

Özet

Bu çalışmada, yara örtüsü olarak kullanım potansiyeli taşıyan, farklı doğal polimerler içeren biyomedikal filmlerin sentezi çalışılmıştır. Filmler çözücü döküm yöntemi ile üretilmiştir. Biyomedikal filmlerin formülasyon optimizasyonu çalışmalarında karboksimetil selüloz (CMC), jelatin (GLT), tara gam (TG) polimerleri ve plastikleştirici olarak gliserol (GLY) kullanılmıştır. Polimer karışımlarına, yara iyileştirici özelliği bulunan, duman ağacı (*Cotinus coggygria*) yaprağı ekstresi ve $AgNO_3$ ilave edilerek eşzamanlı gümüş nanopartikül (AgNP) yeşil sentezi sağlanmıştır. Hazırlanan biyomedikal filmlerin kalınlık, opaklık, uzama yüzdesi ve gerilme mukavemetli, su buhar geçirgenliği (SBG), çözünürlük, nem tutma kapasitesi ölçümleriyle karakterize edilmiştir. Ayrıca termogravimetrik analiz (TGA), Fourier Transform Infrared (FTIR) spektroskopisi ve toplam fenolik içeriğin belirlenmesi, antioksidan ve antimikrobiyal aktivite analizleri de yapılmıştır.

Sentezlenen jelatin bazlı filmlerin kalınlığı 0,05 ile 0,12 mm, SBG 0,788 ile 1,481 g.mm/kPa.s.m^2, çözünürlüğü %19,6 ile %64, çekme dayanımı 9,6 ile 18,8 MPa, uzama değerleri %8,7 ile %15,2 arasında ölçülmüştür. Duman ağacı yaprağı ekstresinin eklenmesi ve AgNP varlığı ile filmlerin *E. coli, S. aureus ve B. pumilus*'a karşı antibakteriyel ve antioksidan aktivitesinin arttığı gözlemlenmiştir.

Sonuç olarak, doğal polimerlerden sentezlenen mekanik olarak güçlü, antioksidan ve antimikrobiyal özellik taşıyan bu filmler yara örtüsü olarak kullanım potansiyellerinin olduğu gösterilmiştir.

Anahtar Kelimeler: *Biyomedikal film, Yara örtüsü, Duman ağacı, Gümüş nanopartiküller, Yeşil sentez*

ID: 753

Selection Of Winter-Resistant Genotypes And Determination Of Some Agricultural Characteristics In Hybrid Feed Pea Lines (F2)

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Abstract
This study was carried out to select winter-hardy pea genotypes and to determine some agricultural characteristics. In the study, lines in the F2 generation obtained by crossing the wild pea genotypes collected from nature with the bred varieties and lines were used (242 lines). Planting of the lines was done in rows with a length of 2m in 50cm row spacing, 20cm in row spacing, and 5cm planting depth. The experiment was carried out in the experimental field of Selçuk University Faculty of Agriculture in the growing season of 2020/2021. Maintenance procedures such as irrigation, fertilization and weed control, which are necessary for the healthy growth of plants, have been carried out. In this study; Winter damage, disease damage, number of flowering days, number of main branches, plant height, number of pods (fruit) per plant, number of seeds per pod, number of plants reaching harvest maturity and seed yield were emphasized. Winter damage was not seen in 174 lines; disease damage was not seen in 164 lines; the number of flowering days varied between 146-176 days; the number of major branches varied between 2-12; plant height varied between 35-150cm; the number of pods per plant varied between 4-81; the number of seeds per pod varied between 2-9.3; The number of plants reaching the harvest maturity ranged from 1-10 and the seed yield per plant was between 0.49-90.90 grams.
Key Words: *Fodder Pea, Seed Yield, Number Of Seeds, Number Of Main Branches*

Melez Yem Bezelyesi Hatlarında (F2) Kışa Dayanıklı Genotiplerin Seçilmesi Ve Bazı Tarımsal Özelliklerin Belirlenmesi

Özet
Bu çalışma kışa dayanıklı bezelye genotiplerinin seçilmesi ve bazı tarımsal özelliklerin belirlenmesi amacı ile yapılmıştır. Araştırmada doğadan toplanan yabani bezelye genotipleri ile ıslah edilmiş çeşit ve hatların melezlenmesinden elde edilmiş F2 generasyonundaki hatlar kullanılmıştır (242 hat). Hatların ekim işlemi 2m boyundaki sıralara 50cm sıra aralığında, 20cm sıra üzeri sıklığında, 5cm ekim derinliğinde yapılmıştır. Deneme, Selçuk Üniversitesi Ziraat Fakültesi deneme tarlasında 2020/2021 yetiştirme mevsiminde yürütülmüştür. Bitkilerin sağlık bir şekilde yetişmesi için gerekli olan sulama, gübreleme, yabancı ot mücadelesi gibi bakım işlemleri yapılmıştır. Bu çalışmada; kış zararı, hastalık zararı, çiçeklenme gün sayısı, ana dal sayısı, bitki boyu, bitki başına bakla (meyve) sayısı, bakla başına tohum sayısı, hasat olgunluğuna gelen bitki sayısı ve tohum verimi üzerinde durulmuştur. Kış zararı 174 hatta görülmemiş; hastalık zararı 164 hatta görülmemiş; çiçeklenme gün sayısı 146-176 gün arasında değişmiş; ana dal sayısı 2-12 arasında değişmiş; bitki boyu 35-150cm arasında değişmiş; bitki başına bakla sayısı 4-81 adet arasında değişmiş; bakla başına tohum sayısı 2-9.3 arasında değişmiş; hasat olgunluğuna gelen bitki sayısı 1-10 arasında değişmiş ve bitki başına tohum verimi 0.49-90.90 gram arasında olmuştur.
Anahtar Kelimeler: *Yem Bezelyesi, Tohum Verimi, Tohum Sayısı, Ana Dal Sayısı*

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Cauliflower Powder as an Alternative Source for Gluten-Free Products

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Abstract
Gluten-free products prepared from commercial starches and gluten-free cereals are known to have low amounts of dietary fiber. For this reason, celiac patients' gluten-free diet, food choices and eating habits in this direction lead to long-term concerns. Recent studies on this eating style; It has been revealed that it creates insufficient protein, carbohydrate, fat intake. Gluten, which is a limiting nutrient in the diet of celiac patients, is also a component rich in dietary fibers. For this, it is aimed to produce foodstuffs to increase dietary fiber intake with various studies. Fruits and vegetables are a good source of dietary fiber to compensate for nutritional deficiencies in gluten-free products. Vegetables have a higher percentage of soluble dietary fiber than fruits and have superior gel-forming, water retention, fat retention and swelling properties. Therefore, it is recommended to increase the intake of dietary fiber in celiac disease with vegetable supplements. Cauliflower, which contains higher dietary fiber than pumpkin, cabbage, broccoli, sugar beet and carrot, can be used as an alternative source in the enrichment of gluten-free products and in eliminating nutritional deficiencies. Cauliflower, which is one of the brassica vegetables, can be added to the bread structure, which is the basic nutrition product, due to its high secondary metabolite and dietary fiber feature. Bread making causes some reduction of secondary metabolites. Research reveals a promising, innovative and healthy product to increase the consumption of bioactives high in fiber by adding fresh cauliflower and its leaves to bread. This review will focus on the chemical composition of cauliflower, its health benefits, and its use as a potential ingredient in functional food development.
Key Words: *gluten, cauliflower, bread, celiac*

Glutensiz Ürünlerde Alternatif Hammadde Kaynağı: Karnabahar Tozu

Özet
Ticari nişastalardan ve glutensiz tahıllardan hazırlanan glutensiz ürünlerinin düşük miktarda diyet lifine sahip olduğu bilinmektedir. Bu nedenle çölyak hastalarının glutensiz diyet yapmaları, bu yöndeki gıda seçimleri ve beslenme alışkanlıkları uzun vadeli endişelere yol açmaktadır. Bu beslenme tarzı üzerine son zamanlarda yapılan çalışmalar; yetersiz protein, karbonhidrat, yağ alımı oluşturduğunu ortaya koymuştur. Çölyak hastalarının beslenmesinde sınırlayıcı besin olan gluten, diyet lifleri bakımından da zengin bir bileşendir. Bunun için çeşitli çalışmalar ile diyet lifi alımını arttırmaya yönelik gıda maddeleri üretilmesi hedeflenmektedir. Meyve ve sebzeler glutensiz ürünlerdeki beslenme ögesi eksikliklerini telafi etmek için iyi bir diyet lifi kaynağıdır. Sebzeler meyvelere göre daha yüksek oranda çözünür diyet lifine sahip olup üstün jel oluşturma, su tutma, yağ tutma ve şişme özelliklerine sahiptir. Bundan dolayı çölyak hastalığında diyet lifi alımının sebze takviyesi ile arttırılması önerilmektedir. Bal kabağı, lahana, brokoli, şeker pancarı, havuca nazaran daha yüksek diyet lifi içeren karnabahar glutensiz ürünlerin zenginleştirilmesinde ve beslenme eksikliğinin giderilmesinde alternatif bir kaynak olarak kullanılabilmektedir. Brassica sebzelerinden olan karnabahar yüksek sekonder metabolit ve diyet lifi özelliğinden dolayı temel beslenme ürünü olan ekmek yapısına ilave edilebilmektedir. Ekmek yapımı sekonder metabolitlerin bir miktar azalmasına neden olmaktadır. Araştırmalar taze karnabahar ve yapraklarının ekmeğe ilave ederek lif oranı yüksek, biyoaktif tüketimini artırmak için umut verici, yenilikçi ve sağlıklı bir ürün ortaya koymaktadır. Bu derleme, karnabaharın kimyasal bileşimi, sağlık yararları ve fonksiyonel gıda gelişiminde potansiyel bir bileşen olarak kullanımı üzerine odaklanacaktır.
Anahtar Kelimeler: *gluten, karnabahar, ekmek, çölyak*

Giriş

Ticari nişastalardan ve glutensiz tahıllardan hazırlanan glutensiz ürünlerinin düşük miktarda diyet lifine sahip olduğu düşünülmektedir. Bu nedenle çölyak hastalarının glutensiz diyet yapmaları, bu yöndeki gıda seçimleri ve beslenme alışkanlıkları uzun vadeli endişelere yol açmıştır. Bu beslenme tarzı üzerine son zamanlarda yapılan çalışmalar, yetersiz protein, karbonhidrat, yağ alımı ile dengesiz protein alımını oluştuğunu göstermiştir. Çölyak hastalığı için yapılan beslenme diyetinde sınırlayıcı besin olan glutensiz diyet lifleri birçok temel besin maddesini taşıyan maddelerdir. Bunun için çeşitli çalışmalar ile diyet lifi alımını arttırmaya yönelik gıda maddeleri üretilmesi hedeflenmektedir. Yapacağımız çalışmanın temeli de buna dayanmaktadır. Meyve ve sebzeler glutensiz ürünlerdeki beslenme eksikliklerini telafi etmek için iyi bir diyet lifi kaynağıdır. Diyet lifleri, meyve ve sebzelerin hücre duvarından ve parankimatoz dokularından beslenir. Meyvelere nispeten daha yüksek oranda çözünür diyet lifine sahip sebzeler bazı yararlı durumlar sergilerler. Jel oluşumu, su tutma kapasitesi, şişme kapasitesi ve yağ

tutma özellikleri gibi özellikleri daha üstündür (Arslan ve ark., 2018). Bu yüzden sebzelerden elde edilen diyet lifleri daha fazla besin değerine sahiptir. Çölyak hastalığında diyet lifi alımının sebze ve meyve alımını arttırılması ile desteklenmesi önerilmektedir. Yapacağımız çalışma glutensiz tahıl ürünlerinde sebzelerdeki yüksek diyet lifinden faydalanarak bu beslenme türünü iyileştirmek, gıdaları zenginleştirmektir. Bu nedenlerden dolayı, sebze olarak karnabahar çiçeği ve yaprakları esas ürün alınarak glutensiz ekmek yapılması hedeflenmiştir. Böylelikle hem atık ürün olarak çok kıymetli olan karnabahar yaprakları kullanılacak hem de diyet lifi yüksek sebze ile beslenmedeki eksikliğin giderilmesi düşünülmektedir.

Latince Caulis (lahana) ve flower isimlerinin birleşmesiyle oluşan karnabahar (Brassica oleracea var. botrytis) Brassicaceae familyasının önemli türlerinden biridir. Karnabahar, çiçek ve çiçek tablası yenilen sebzeler grubundadır. Çiçek tablaları sarımtırak beyaz, beyaz ve nadiren mor renkli olmaktadır. İki yıllık bir kültür bitkisi olan karnabaharın ilk yıl yenilen çiçek tablası ve yaprakları, ikinci yıl ise tohumları oluşmaktadır. Ana vatanı Akdeniz Bölgesi kabul edilen karnabahar buradan Atlantik kıyıları boyunca yayılmıştır ve M.Ö. 600 yıllarından itibaren insanlar tarafından tüketildiği tahmin edilmektedir. (Kıl, 2014; Üslü, 2020). Lahana grubu sebzeler arasında yer alan karnabahar, A, B1, B2, C, K ve E vitaminlerinin yanı sıra, fitokimyasal bileşiklerce de zengin içeriği sayesinde son dönemlerde dikkatleri üzerine çekmektedir (Kıl, 2014). Lahana grubu sebzeler ayrıca vitamin C, karoten, folik asit, kalsiyum ve demir kaynağıdırlar. Fenolik bileşikler ve karotenoidler gibi çok çeşitli antioksidan maddeler, hücreleri oksidatif stresten koruyarak kronik hastalık riskini azaltır. Lahana grubu sebzeler, vitamin içerikleri ve kükürtlü bileşikler sayesinde çeşitli hastalıklara karşı koruyucu özellik göstermektedir. Antioksidan aktivitesini belirlemeye yönelik yapılan çalışmalarda; karnabaharın vitamin içeriğinin azımsanmayacak düzeyde olduğu bildirilmiştir. Serbest radikallerin yarattığı oksidatif stresin önlenmesi ve etkisinin en aza indirilmesi için yeterli miktarda antioksidan tüketilmelidir (Kıyak ve ark, 2014).

Tablo 1. *Karnabaharın Bileşen Kompozisyonu (100 g) (Anonim, 2019)*

Karnabaharın Besin İçeriği (100 g/ çiğ örnek)					
Bileşimi	**Miktar**	**Mineral Maddeler**	**Miktar**	**Vitaminler**	**Miktar**
Su	%92,07	Kalsiyum	22 mg	Askorbik asit	48,2 g
Enerji	25 kcal	Demir	0,42 mg	Thiamin	0,050 mg
Protein	1,92 g	Magnezyum	15 mg	Riboflavin	0,060 mg
Toplam yağ	0,28 g	Fosfor	44 mg	Niasin	0,507 mg
Karbonhidrat	4,97 g	Potasyum	299 mg	B6	0,184 mg
Toplam lif	2g	Sodyum	30 mg	Folik asit	57 µg
Toplam şeker	1,91 g	Çinko	0,27 mg	E vitamini	0,08 µg
				K vitamini	15,5 µg

Brassica sebzelerinin tüketimi, yüksek konsantrasyonlar içerdiğinden sağlık yararları ile bağlantılıdır. Bu durum sekonder bitki metabolitleri olan; glukozinolat yıkım ürünleri, karotenoidler, klorofiller ve fenolik bileşikleri ile alakalıdır. Özellikle Brassica sebzeleri mikro yeşillik (gelişmiş kotiledonlar) olarak tüketilmektedir. Brassica sebzelerinde sekonder bitki metabolitleri (SPM) konsantrasyonlarda farklılık gösterir. SPM etkisi ek olarak mikro yeşilliklerde (7 gün) ve yapraklarda (14 gün) sürer. Brassica aşlesine ait bir sebze ile SPM'lerden faydalanılarak yapılan karışık buğday ekmeği değerlendirildi. Karnabaharın yapraklarındaki karotenoidler, klorofiller ve fenolik bileşikler mikro yeşilliklerle karşılaştırıldığında daha yüksek bulunmuştur. Ekmek yapımı SPM'lerin azalmasına neden olmuştur. Klorofil bozunması gözlenmiş, feofitin ve pirofeofitin oluşumuna yol açmıştır. Bu nedenle, karnabaharın yaprakları doğal içerik maddeleri olarak uygundur (Klopsch ve ark.,2019). Ekmeğe eklenen malzemelerle ilgili önceki çalışmalar bitki tozlarının eklenmesini içermiştir. Ama Klopsch ve ark., yaptığı çalışma taze veya nazikçe işlenmiş mikro yeşillikler (gelişmiş kotiledonlar) ve Brassica sebzelerinin yaprakları ile ekmeğe biyoaktif tüketimini artırmak için umut verici, yenilikçi, sağlığı geliştirici bir strateji olmuştur (Lin ve Zhou 2018; Świeca, Sęczyk, Gawlik-Dziki, Dzik, 2014). Karnabaharda bulunan SPM'lerin bileşimi ve konsantrasyonunda hasat öncesi faktörlerin (örn. gelişim aşaması) yanı sıra hasat sonrası faktörlerinde etkisi vardır. Örneğin, ekmek yapma işlemi sırasında bitki dokusu bileşimi ve konsantrasyonu etkileyebilecek hem mekanik etkilere hem de ısıl işlemeye maruz kalan metabolitlerin etkisi farklıdır (Klopsch, Baldermann, Voss, Rohn, Schreiner ve Neugart 2018). SPM'lerde gıda işleme bu nedenle spesifik işleme türüne bağlıdır (örn. kesme, pişirme, buharda pişirme, kızartma, fırınlama) ve ayrıca bitki genotipi, ontogenetik aşama, genel bitki gibi çeşitli diğer parametreler, SPM'nin kimyasal yapısı da önemlidir (Gerardin, Paris ve ark. 2017; Klopsch, Baldermann, Voss, Rohn, Schreiner ve Neugart 2018). Tahıl ürünlerinde sebze unları ile zenginleştirme yapılarak glutensiz formülasyona sahip birçok

gıda çalışması yapılmıştır. Örneğin, enginar, karnabahar ilavesiyle glutensiz ekmeği hazırlanmıştır. Yapılan ekmeğin lif bakımından zengin olduğu gözlemlenmiştir (Capriles ve Arêas, 2014; Rocha Parra ve ark., 2015). Ekmek içerisine brokoli, rezene ve kabak ilave edilerek duyusal kaliteyi, antioksidan içeriğini ve glisemik kaliteyi artırmak amacıyla bir çalışma yapılmıştır (Saccotelli, Spinelli, Conte ve Del Nobile, 2018). Aynı şekilde, glutensiz spagetti çalışmaları farklı sebzeler ile desteklenmiştir. Yapılan çalışmalarda enginar, kuşkonmaz, balkabağı, havuç ve biber gibi 159 sebze unlu spagetti hazırlanmıştır (Padalino ve Del Nobile, 2013). Karnabahar yapraklarında bulunan peptitlerin yani proteinleri oluşturan parçaların sağlık faydaları bulunmaktadır. Özellikle endotel fonksiyon (kalp-damar sağlığı) ve kanseri iyileştirdiğine dair bilimsel çalışmalar vardır. Karnabahar yaprakları kurutulduktan önce antioksidan sonrasında da protein ekstraksiyonu yapılabilir. Böylelikle atık olarak görülen bir üründen yüksek katma değerli iki ürün çıkartılmış olmaktadır. Antioksidanlar toplum sağlığını güçlendirmede, protein ve peptitler ise özellikle endotel sağlığını güçlendirmede kullanılmış olacaktır. Endotel sağlığı demek, fiziksel ve mental sağlık demektir. Türkiye de yılda yaklaşık 200,000 ton karnabahar üretiliyor ve neredeyse %50 sine yakını yapraktan oluşuyor. 100,000 ton yaş yapraktan 10,000 ton kuru yaprak elde edilmektedir. Bu yapraklardan elde edilecek antioksidan verimi %25, protein verimi de %10 civarlarındadır. 2,500 ton antioksidan yani 1,000 ton protein elde edilmiş olunmaktadır. Bu oranlar atık bir üründen elde edildiği için çok yüksektir. Ülkemiz yılda 4,000 ton protein ithal ediyor. Ancak anlatılan yöntem ile sadece karnabahar yaprağından protein ihtiyacının ¼ ini karşılamış olacaktır. Ayrıca içerdiği yüksek diyet lifi ve SPM'lerden dolayı yapılan çalışmalarından de görüldüğü gibi değerli bir hammaddedir. Karnahabarın en yüksek antioksidan etki göstermesi için buharda pişirme yöntemi kullanılmalıdır. Yapılan birçok çalışmada karnabaharın glukosinolat içeriğinin brokoli ile aynı, lahanadan daha yüksek ve Brüksel lahanasından ise daha düşük olduğu belirtilmiştir (Kushad et al., 1999; Tian et al., 2005; Cieslik et al., 2007). Yapılan araştırmalarda karnabahar sebzesinin başta kanser olmak üzere çeşitli hastalıklara karşı koruyucu özelliği, içeriğinde bulunan kükürtlü bileşikler olan glukozinolat isimli sekonder metabolitlere dayandırılmaktadır (Sarıkamış, 2016). Karnabaharın kanser riskini %67 oranında azalttığı belirtilmektedir (Güven ve Gülmez, 2006). 5 farklı karnabahar çeşidinin (2 tane beyaz, 2 tane yeşil, 1 tane mor) glukosinolat içeriğinin incelendiği çalışmada beyaz karnabaharın, alifatik glukosinolatlardan sinigrin içeriği en yüksek bulunmuştur. Yeşil karnabaharda ise alifatik glukosinolatlardan glucoraphanin içeriği daha fazla saptanmıştır. Toplam indol içeriği ise alifatiklere oranla daha düşük bulunmuştur. İndollerden glucobrassicin toplam glukosinolat içeriğinin % 29-35'ini oluştururken, bazı karnabahar çeşitlerinde % 45-59'u gibi değerlere ulaşmıştır. Bu yüksek oranla glucobrassicin toplam indolleri temsil etmektedir. Glucobrassicinin glukosinolatlar içinde turpgillere özgü aromayı ve hafif acı tadı baskın bir şekilde sağladığı belirtilmiştir (Volden et al., 2009b). Kushad et al. (1999), karnabaharda sinigrin, glucobrassicin değerlerini yüksek bulmuşlardır. Aynı şekilde Tian et al. 8 (2005), karnabaharda sinigrin ve glucoiberinin en fazla bulunan alifatikler olduğunu belirtmişlerdir.

Yapılan bu çalışmada en düşük glukosinolat konsantrasyonu beyaz ve yeşil karnabaharda bulunmuştur. Alifatik glukosinolatların, toplam glukosinolat içeriğinin beyaz karnabaharda % 45.4'ünü, indollerin ise % 54.6'sını oluşturduğu saptanmıştır. Brassicaceae sebzelerinin metabolizma üzerinde detoks etkisi yarattığı, zayıflama amaçlı diyetlerde kullanıldıkları görülmektedir. Bu nedenle son zamanlarda bu sebzelerin zayıflama amacıyla haşlama sularının içildiği, kürlerinin hazırlandığı, salata, çorba olarak yaygın olarak tüketildiğine rastlanmaktadır. Bu sebzeler antioksidan ve antikanserojen özelliklere sahiptir ve bunlar vitamin, karotenoid, polifenoller gibi fotokimyasallar için iyi bir kaynaktır. Karnabahar, fosfor ve vitamin bakımından çok zengindir. Karnabahar sebzesinin bileşenleri, lipit peroksidayonuyla ilişkilendirirlir. Metabolizma hızını artırdığı ileri sürülmektedir. Lipit otooksidasyonu antioksidanlar tarafından yavaşlatılır. Antioksidanca zengin sebzelerle beslenme seçimi sağlıklı beslenme konusunda anahtar rol oynamaktadır (Karabaş, 2016). Karnabahar hem gıda lifi içeriği açısından hem de flavanoller bakımından kolon kanserine karşı koruyucudurlar. Diyet posasının kolon kanserine karşı koruyucu etkisi bilinmesine rağmen, son araştırmalar folik asidinde kanser riskini azalttığını ortaya koymuştur (Sezgin, 2014). Bıraktığı bol posa ile kabızlık yapmaz ve bağırsakların çalışmasını düzenlemektedir (Kıl, 2014). Karnabahar sebzesini kurutmak için bazı ön işlemler uygulanmalıdır. Yapılan çalışmalara göre öce sitrik aside yatırılıp, daha sonra ön haşlama yapılarak kurutulan karnabahar örneklerinin nem içerikleri daha düşük olmaktadır (Şahin, 2014). Son on yılda, glutensiz ekmeğinin besin değerini ve kalitesini çeşitli hammaddeler kullanarak veya katkı maddelerinin eklenmesiyle iyileştirmek için çeşitli formülasyonlar, teknolojik parametreler kapsamlı bir şekilde incelenmiştir. Glutensiz ekmeğin üstün gelişimi için emülgatörler, proteinler veya farklı hidrokolloidler araştırılmıştır (Schoenlechner ve ark., 2010). Daha iyi kullanım özellikleri ve su emilimi için hamurda, farklı süt ürünleri bileşenleri de kullanılmıştır. Bununla birlikte çölyak hastaları için glutensiz ekmeklerinde laktoz bakımından zengin tozun takviyesi de uygun değildir (Pruska-Kędzior ve ark., 2008). Fırıncılık endüstrisinde gamlar ve hidrokolloidler doku, görünüm kazandırmak ve diyet lifi alımını arttırmak için yaygın olarak kullanılmaktadır (Anon, 2002; Cunin, 1999). Glutensiz ürün hazırlamak için hazırlanan ürün gamlar, hidrokolloid, buğday nişastaları ve buğday dışı nişastalarla birlikte kullanılır. Buğday nişastası, çölyak hastaları tarafından daha az toleransı nedeniyle daha az arzu edilir (Lohiniemi ve ark., 2000; Skerritt ve Tepe, 1992).

Hidrokolloidler doğada bitki özleri, deniz yosunları, tohumlar, sebzeler, mikroorganizmalar gibi çeşitli kaynaklardan elde edilir (Norton ve Foster, 2002). Çölyak glutensiz diyetinde diyet lifleri psödotahıllar, meyve,

sebze, baklagil ve bakliyattan karşılanır. Glutensiz beslenme diyetindeki bu önemli besini tamamlamak için hidrokolloidler ve sebzeler uygun bir seçenek olabilir.

Tablo 2. *Karnabahar İle Yapılan Çalışmalar ve Sonuçları*

Çalışmalar	**Elde Edilen Sonuçlar**	**Değerlendirme**
Klopsch ve ark (2019)'ın karnabahar ilavesi ile buğday ekmeği yapımı çalışması	Ekmek yapımı sekonder metabolitlerin azalmasına neden olmuştur. Klorofil bozunması gözlenmiş bu durumda karnabaharın yaprakları doğal içerik maddeleri olarak uygun bulunmuştur.	Tahıl ürünlerince zengin temel beslenme ürünü olan ekmek zenginleştirme ürünü karnabahar ile kullanılınca lif oranı yüksek gelecekte umut vaat eden bir çalışma olarak görülmektedir.
Wani ve ark (2011)'ın karnabahar yaprağı tozu ilavesi ile erişte yapımı çalışması	Protein miktarı karnabahar yaprağı tozu ilavesiyle, artış göstermiştir. Ham lif oranı da karnabahar yaprağı ilavesi ile %1,5 oranda artış göstermiştir.	Tahıl ürünleriyle elde edilen erişte de karnabahar ilavesi ile Klospch ve ark.'nın sonuçlarını destekler yönde verilere ulaşmıştır.
Alam ve ark. (2016)'ın yaptığı düşük maliyetli, besleyici karnabahar ilaveli ürün çalışması	Ürünlerin besleyiciliği artmış, protein ve lif oranlarında artış gözlenmiştir.	Besleyici ürün çalışmasında karnabahar yine özelliğini ön plana çıkartarak lif oranının yüksek oluşunu son ürüne yansıtmıştır.

Tahıl Ürünlerinde Zenginleştirme Çalışmaları;

- Tahıl ürünlerinde sebze unları ile zenginleştirme yapılarak glutensiz formülasyona sahip birçok gıda çalışması yapılmıştır.
- Örneğin, enginar, karnabahar ilavesiyle glutensiz ekmek hazırlanmıştır (Francisco ve ark., 2010).
- Yapılan çalışmada karnabahar ekmeğinin lif bakımından zengin olduğu gözlemlenmiştir.
- Başka bir çalışmada (Reis ve ark., 2015) ekmek içerisine brokoli, rezene ve kabak ilave edilerek duyusal kaliteyi, antioksidan içeriğini ve glisemik kaliteyi artırmak amaçlanmıştır.
- Aynı şekilde, glutensiz spagetti çalışmaları farklı sebzeler ile desteklenmiştir.
- Yapılan çalışmalarda enginar, kuşkonmaz, balkabağı, havuç ve biber gibi 159 sebze unlu spagetti hazırlanmıştır.

Glutensiz Ürünlerin Yapılarının İyileştirilmesi;
Son on yılda, glutensiz ekmeğin besin değerini ve kalitesini çeşitli hammaddeler kullanarak veya katkı maddelerinin eklenmesiyle iyileştirmek için çeşitli formülasyonlar, teknolojik parametreler kapsamlı bir şekilde incelenmiştir.
Glutensiz ekmeğin üstün gelişimi için emülgatörler, proteinler veya farklı hidrokolloidler araştırılmıştır.
Fırıncılık endüstrisinde gamlar ve hidrokolloidler doku, görünüm kazandırmak ve diyet lifi alımını arttırmak için yaygın olarak kullanılmaktadır (Barışık, 2016; Hager ve Arendt, 2013; Lazaridou ve diğ, 2007; Skendi ve diğ, 2021).
Çölyak hastalarının glutensiz diyetinde diyet lifleri psödotahıllar, meyve, sebze, baklagil ve bakliyattan karşılanır. Glutensiz beslenmede bu önemli besin öğesini tamamlamak için hidrokolloidler ve sebzeler uygun bir seçenek olabilir. Sebzeler içerisinden sunum içeriğinde de belirttiğimiz gibi zengin vitamin içeriği, kansere ve çeşitli hastalıklara karşı koruyucu etkisi ve diyet lifi oranın yüksek olması gibi nedenlerle glutensiz ürünlerde karnabahar tozu kullanımı tercih edilebilir.

Sonuç ve Öneriler
Sonuç olarak glutensiz ürünlerin düşük diyet lifi, protein, mineral ve vitamin içeriği karnabahar ve karnabahar yaprağı tozu kullanılarak arttırılabilir. Yapılan çalışmalar karnabaharın yüksek diyet lifi içeriğini ve sağlığa karşı koruyucu etkilerini ortaya koymuştur. Karnabahar yaprakları çoğunlukla atık olarak bertaraf edilirken lif oranı yüksek bu kısmı glutensiz ürünlere dahil ederek değerlendirmek ileriki çalışmalar için umut vericidir.
Karnabahar ve karnabahar yaprağının gerek gluten içeren gerekse gluten içermeyen formülasyonlarda değerlendirilmesi için daha fazla çalışmaya ihtiyaç vardır.

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Evaluation of Noise in Children's Playgrounds: The Case of Dokuma Park

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Abstract

The increase in the world population and rapid urbanization cause different types of pollution such as air, water, soil and noise. Today, this situation significantly affects the quality of life in densely populated settlements both in the world and in Turkey. Noise pollution, which is one of the important types of pollution, especially in urban areas, is increasing day by day due to anthropogenic effects. Studies conducted by the European Noise Directive (END) show that noise pollution is one of the important factors that cause health problems.

Parks are places that allow children trapped in the structural environment in urban life to get to know nature and play games in open spaces. In particular, the children's playgrounds in the parks allow children to play and socialize in the open area and also allow parents to rest. However, park users may be exposed to noise pollution due to high-level noises originating from vehicle traffic, user density, and children's playgrounds in these places. This situation adversely affects the physical and mental health of the park users.

The aim of the research is to determine the noise pollution caused by the children's playgrounds in the parks and to develop suggestions for reducing this pollution. As a result of the preliminary studies carried out in this context, Antalya/Kepez Dokuma Park was determined as a research area. Zones were created at certain intervals around the children's playground in the research area. And noise levels were measured on weekdays and weekends from the noise measurement points determined in these zones. The results obtained show that the noise pollution originating from the children's playgrounds in the parks is high. In this context, landscape design and planning proposals have been developed to reduce noise pollution originating from children's playgrounds.

Key Words: *Urban, Park, Playground, Noise, Antalya*

Çocuk Oyun Alanlarındaki Gürültünün Değerlendirilmesi: Dokuma Park Örneği

Özet

Dünya nüfusunda yaşanan artış ve hızlı kentleşme hava, su, toprak ve gürültü gibi farklı kirlilik türlerine neden olmaktadır. Günümüzde bu durum hem dünyanın hem de Türkiye'nin yoğun nüfuslu yerleşim yerlerindeki yaşam kalitesini önemli ölçüde etkilemektedir. Özellikle de kentsel alanlardaki önemli kirlilik türlerinden birisi olan gürültü kirliliği, gün geçtikçe antropojenik etkilere bağlı olarak artmaktadır. Avrupa Gürültü Direktifi (END) tarafından yapılan araştırmalarda gürültü kirliliğinin sağlık sorununa neden olan önemli etkenlerden birisi olduğu görülmektedir.

Kentsel yaşam içerisinde yapısal çevreye hapsolan çocukların doğayı tanıma ve açık alanda oyunlar oynayabilmelerine imkân veren mekanlar parklardır. Özellikle parkların içerisindeki çocuk oyun alanları, çocukların açık alanda oyun oynamasına ve sosyalleşmesine imkân vermekte ve aynı zamanda ebeveynlerin dinlenmesine de olanak sağlamaktadır. Fakat kullanıcılar araç trafiğinden, kullanıcı yoğunluğundan, çocuk oyun alanlarından kaynaklanan yüksek düzeydeki seslerden dolayı bu alanlarda gürültü kirliliğine maruz kalabilmektedir. Bu durum ise kullanıcıların bedensel ve ruhsal sağlığını olumsuz etkilemektedir.

Araştırmanın amacı, parklardaki çocuk oyun alanlarından kaynaklanan gürültü kirliliğini tespit etmek ve bu kirliliğin azaltılmasına yönelik öneriler geliştirmektir. Bu kapsamda yapılan ön çalışmalar sonucunda, Antalya/Kepez Dokuma Park araştırma alanı olarak belirlenmiştir. Araştırma alanında bulunan çocuk oyun alanının çevresinde belli aralıklar ile zonlar oluşturulmuş ve bu zonlar üzerinde belirlenen gürültü ölçüm noktalarından hafta içi ve hafta sonu gürültü seviyeleri ölçülmüştür. Elde edilen sonuçlar, parklarda çocuk oyun alanlarından kaynaklı gürültü kirliliğinin yüksek düzeyde olduğunu göstermektedir. Bu bağlamda çocuk oyun alanlarından kaynaklı gürültü kirliliğinin azaltılmasına yönelik peyzaj tasarım ve planlama önerileri geliştirilmiştir.

Anahtar Kelimeler: *Kent, Park, Çocuk Oyun Alanı, Gürültü, Antalya*

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Guar Gum and Sumac Based Active Food Packaging: Effect of Sumac Form and Solvent Type

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Abstract

The development of edible films from natural, nontoxic, biodegradable polymers has been great interest due to environmental plastic waste problems. Antioxidant food packaging is one type of active packaging based on incorporating antioxidant compounds into packaging materials to eliminate undesirable deterioration of foods. Sumac (*Rhus coriaria*) is a natural antioxidant source due to having significant amount of phenolic compounds, especially tannins, anthocyanins, and flavones. The amount of extracted phenolic compounds changes with the types and forms of sumac and extraction procedure. The main aim of this study is to produce active packaging materials from sumac extract and guar gum. Different forms of sumac (powder and granule) and extraction procedures (water and ethanol/water as extraction solvent, hot and cold extraction) were applied to get the highest extraction yield and extracted sumac phenolics incorporated guar gum films. The total phenolic content, antioxidant activity, density, moisture content, opacity, and color parameters were investigated. When the effect of solvent type was examined, it was obvious that ethanol/water extracted powder sumac incorporated films showed higher total phenolic content and antioxidant activity than water extracted sumac films. Granule sumac particles were extracted at 50°C and room temperature, and hot extracted sumac-added guar gum films showed higher antioxidant activity than the cold ones. While density and moisture content values were found similar, powder sumac extracted films showed higher opacity, a* and b* values than the granule ones. To be used as active packaging material, ethanol/water (4/1) extracted powder sumac incorporated guar gum films can be suggested.

Key Words: *guar gum, edible film, sumac, extraction, antioxidant*

Guar Gum ve Sumak Bazlı Aktif Gıda Ambalajları: Sumak Formunun ve Çözücü Tipinin Etkisi

Özet

Doğal, toksik olmayan, biyolojik olarak parçalanabilen polimerlerden yenilebilir filmlerin geliştirilmesi, çevresel plastik atık sorunları nedeniyle büyük ilgi görmüştür. Antioksidan gıda ambalajı, gıdalardaki istenmeyen bozulmaları ortadan kaldırmak için ambalaj malzemelerine antioksidan bileşiklerin dahil edilmesine dayanan bir tür aktif ambalajdır. Sumak (*Rhus coriaria*), başta tanenler, antosiyaninler ve flavonlar olmak üzere önemli miktarda fenolik bileşiğe sahip olması nedeniyle doğal bir antioksidan kaynağıdır. Ekstrakte edilen fenolik bileşiklerin miktarı, sumak çeşidine, formuna ve ekstraksiyon prosedürüne göre değişir. Bu çalışmanın temel amacı sumak özü ve guar zamkından aktif ambalaj malzemesi üretmektir. En yüksek ekstraksiyon verimini elde etmek için farklı sumak formları (toz ve granül) ve ekstraksiyon prosedürleri (ekstraksiyon çözücüsü olarak su ve etanol/su, sıcak ve soğuk ekstraksiyon) uygulanmış ve guar zamkı filmlerine ekstrakte edilmiş sumak fenolikleri eklenmiştir. Toplam fenolik içerik, antioksidan aktivite, yoğunluk, nem içeriği, opaklık ve renk parametreleri incelenmiştir. Çözücü tipinin etkisi incelendiğinde, etanol/su ile ekstre edilmiş toz sumak katkılı filmlerin, su ile ekstre edilmiş sumak filmlerinden daha yüksek toplam fenolik içerik ve antioksidan aktivite gösterdiği görülmüştür. Granül sumak partikülleri 50°C'de ve oda sıcaklığında ekstrakte edilmiş ve sıcak ekstrakte edilmiş sumak ilaveli guar zamkı filmleri soğuk olanlardan daha yüksek antioksidan aktivite göstermiştir. Yoğunluk ve nem içeriği benzer bulunurken, toz sumak ekstrakte edilmiş filmler granül olanlara göre daha yüksek opaklık, a* ve b* değerleri göstermiştir. Aktif ambalaj malzemesi olarak kullanılmak üzere etanol/su (80/20 v/v) ekstrakte edilmiş toz sumak içeren guar zamk filmleri önerilebilir.

Anahtar Kelimeler: *guar zamkı,yenilebilir film,sumak, ekstraksiyon,antioksidan*

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Physical and Chemical Pretreatments Applied to Lignocellulosic Biomass

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Abstract
The economic, environmental, and social concerns about sustainable energy have increased in the world. These concerns have caused researchers to find sources for biofuel production such as biogas, biodiesel, and bioethanol that are environmentally friendly, sustainable, and renewable. Agricultural residues or wastes, forest residues (branches, leaves), and energy crops have been preferred in biofuel production. In this context, residues or wastes generated as a result of agricultural activities have been widely used to reduce environmental adverse effects resulting from population increase. Agricultural residues or wastes mostly have a lignocellulosic structure, and producing biofuels from biomass offers a significantly sustainable potential compared to fossil fuels. The lignocellulosic biomass composition inhibits hydrolysis to other organic compounds that can convert the cellulose in its structure into sugars and then into biofuels. Physical, chemical, physicochemical, and biological pretreatment methods can change the chemical and physical structure of lignocellulosic biomass; therefore, biomass becomes accessible by improving the hydrolysis ratios. Pretreatments not only disrupt the biomass structure but also offer less energy consumption and lower process costs. This review aims to outline the effects and advantages of physical (mechanical grinding, microwave, ultrasonic) and chemical (acid, alkaline, organo-solvent, ozonolysis) pretreatment methods, which are among the pretreatment methods commonly used in producing biofuel from the lignocellulosic biomass.
Key Words: *Lignocellulosic biomass, Physical pretreatment, Chemical pretreatment*

Lignoselülozik Biyokütleye Uygulanan Fiziksel ve Kimyasal Ön İşlemler

Özet
Dünyada, sürdürülebilir enerji ile ilgili ekonomik, çevresel ve sosyal kaygılar artmıştır. Bu endişeler araştırmacıların biyogaz, biyodizel ve biyoetanol gibi biyoyakıt üretimi için çevre dostu, sürdürülebilir ve yenilenebilir kaynaklar bulmasına neden olmuştur. Biyoyakıt üretiminde tarımsal kalıntı veya atıklar, orman artıkları (dallar, yapraklar) ve enerji bitkileri tercih edilmiştir. Bu kapsamda, nüfus artışına bağlı olarak çevresel olumsuz etkileri azaltmak için tarımsal faaliyetler sonucu oluşan kalıntı yada atıklar yaygın kullanılmıştır. Tarımsal kalıntı veya atıklar çoğunlukla lignoselülozik yapıda olup, biyokütlenin biyoyakıtlara dönüştürülmesi, fosil yakıtlara göre sürdürülebilir önemli bir potansiyeldir. Lignoselülozik biyokütle bileşimi, yapısında bulunan selülozu şekerlere, daha sonrasında ise biyoyakıtlara dönüştürebilen diğer organik bileşiklere hidrolizi engellemektedir. Lignoselülozik biyokütlenin kimyasal ve fiziksel yapısını; fiziksel, kimyasal, fizikokimyasal ve biyolojik ön işlem yöntemleri değiştirebilir; dolayısıyla hidroliz oranları iyileştirilerek biyokütle erişilebilir hale getirilmektedir. Ön işlem uygulamaları, sadece biyokütle yapısını bozmakla kalmayıp aynı zamanda daha az enerji ihtiyacı ve ekonomik işlem maliyetine sahiptir. Bu derlemede, lignoselülozik biyokütlenin biyoyakıtlara dönüştürülmesinde yaygın kullanımı olan ön işlem yöntemlerinden fiziksel (mekanik öğütme, mikrodalga, ultrasonik) ve kimyasal (asit, alkali, organo çözücü, ozonoliz) ön işlem yöntemlerinin etkileri ve avantajlarının ana hatlarıyla belirtilmesi amaçlanmıştır.
Anahtar Kelimeler: *Lignoselülozik biyokütle, Fiziksel ön işlem, Kimyasal ön işlem*

1. Giriş
Dünyadaki ekonomik gelişmeler, fosil yakıtların zararlı etkileri nedeniyle alternatif kaynaklara olan ihtiyacı gündeme getirmiştir. Fosil yakıtlar, atmosferde yüksek sera gazı emisyon seviyelerine ve küresel ısınmaya neden olmaktadır. Bu yakıtların hızla tükenmesi ve kirletici etkileri devam ederken, biyoyakıtlar (biyohidrojen, biyometan, biyoetanol, biyometanol, biyodizel) yenilenebilir, alternatif, sürdürülebilir ve ucuz enerji kaynakları düşüncesini güçlendirmiştir (Kumari ve Singh, 2018). Bir başka sorun da, ekosistemlerin sürdürülebilirliği için çeşitli tipte oluşan atıkların çevreye zarar vermeden yönetilmesi gerektiğidir. Atık yönetimi; çevresel olumsuz etkileri azaltmak, dolayısıyla ekosistemlerin sürdürülebilirliği için oldukça önemlidir. Tarımsal faaliyetler ile, milyonlarca ton atık oluşmaktadır. Bu atıkların, tarımsal faaliyetlere bağlı olarak artması ve uygun olmayan şekillerde bertaraf edilmesi çevre sağlığı için endişe verici duruma gelmiştir. Tarımsal atıkları katma değerli ürünlere dönüştürme stratejisi sürdürülebilir, çevre dostu ve atık yönetimi için düşük maliyetlidir. Tarımsal üretim fazlalığı olarak oluşan ve çoğunlukla lignoselülozik yapıda olan biyokütle, yasaklara rağmen genellikle yakma yöntemi kullanıldığı için geçmiş yıllarda etkin şekilde değerlendirilmemiştir. Son yıllarda lignoselülozik

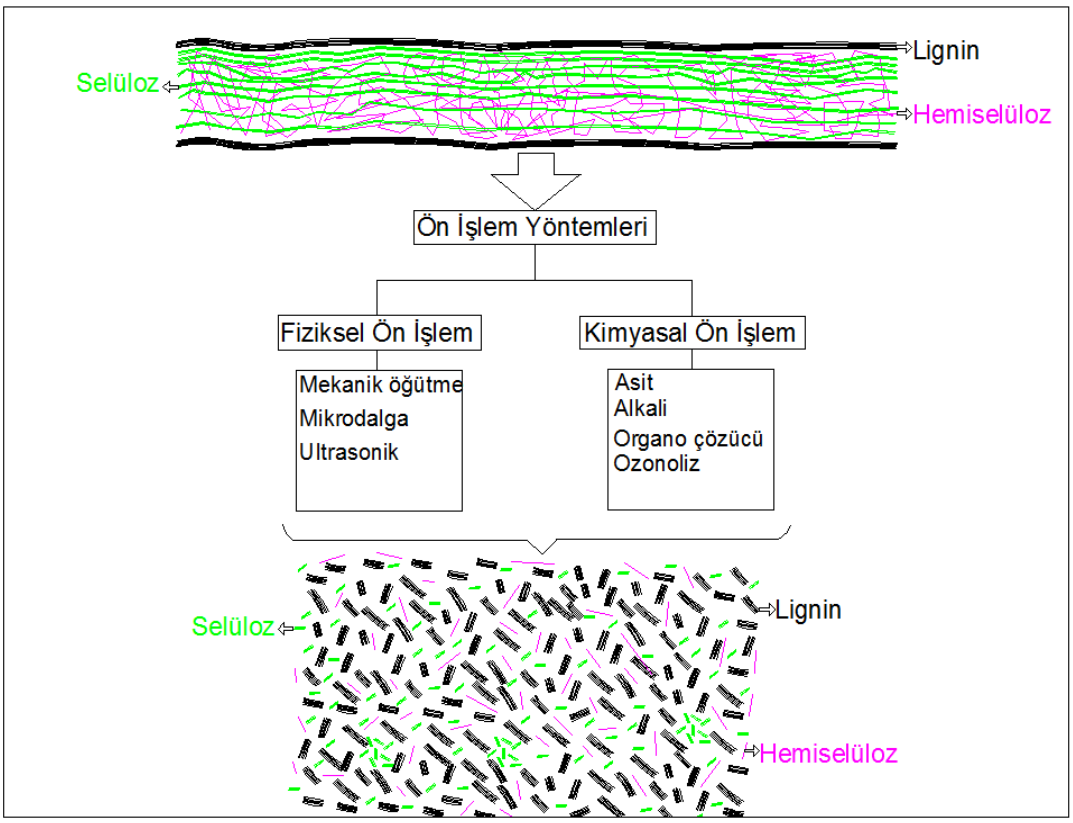
biyokütle, geleneksel atık bertaraf yöntemlerinin aksine, ön işlem uygulamalarından geçirilerek biyoyakıt üretimine katkı sağlamaya başlamıştır.

Lignoselülozik biyokütle, kaynaklarına göre; (i) tarımsal atıklar (şeker pancarı küspesi, buğday samanı, pirinç samanı, arpa samanı, mısır koçanı), (ii) enerji bitkileri (dallı darı), (iii) çeşitli selülozik atık türleri (kereste fabrikası atıkları, kağıt hamuru fabrikası atıkları, kentsel katı atıklar) olarak sınıflandırılabilir (Kim vd., 2016). Ön işlem uygulamalarından herhangi biri, lignoselülozik biyokütleye uygulanmadan biyoyakıt üretimi için kullanılabilir. Ancak, biyokütlenin hidroliz aşamasında selülozun makrofibrillerdeki hemiselüloz ve lignin kökeni tarafından büyük ölçüde korunduğu, bu nedenle selülozun şekere dönüşümünün çok yavaş olduğu bildirilmiştir (Kamarludin vd., 2014). Bu nedenle, biyokütleye ön işlem yöntemleri uygulanmıştır. Lignoselülozik biyokütleye yapılan ön işlemde makro ve mikro boyutu, mikroskobik yapısı, kimyasal bileşimde değişiklik oluşturması amaçlanmaktadır. Bu sayede, biyokütle artan şeker verimi ile hızlı hidrolize hazır hale gelmektedir (Mosier vd., 2005). Ön işlem uygulamasından sonra katı ve sıvı fraksiyon üretilmektedir. Katı fraksiyon çoğunlukla hidrolize edilmemiş lignin ve selülozdan oluşmaktadır. Sıvı fraksiyon esas olarak ksiloz ve diğer bazı indirgeyici şekerleri içermektedir. Lignoselülozik biyokütle tiplerinde, selüloz ve hemiselüloz ana bileşenleri fermente edici mikroorganizmalar tarafından substratlara dönüştürülmektedir. Şeker üretiminde kullanılan teknikler alkali, seyreltik asit, ozonoliz gibi ön işlem yöntemlerini kapsamaktadır (Triana vd., 2011).

Ön işlem yöntemleri fiziksel, kimyasal, fizikokimyasal, biyolojik ve bunların çeşitli kombinasyonları olarak farklı kategorilere ayrılmaktadır. Lignoselülozik biyokütleye ön işlem uygulama adımı, biyoyakıt üretim proseslerinin verimliliği üzerindeki etkisinden dolayı tüm proses adımlarındaki en hayati parçalardan biri olarak kabul edilebilir. Bu derlemenin amacı, biyoyakıt üretiminde yaygın kullanımı olan lignoselülozik biyokütlenin parçalanabilirliğinde iyileştirilebilir olan ön işlemlerden fiziksel (mekanik öğütme, mikrodalga, ultrasonik) ve kimyasal (asit, alkali, organo çözücü, ozonoliz) ön işlem yöntemlerinin etkileri ve avantajlarını ana hatlarıyla sunmaktır.

2. Ön İşlem Yöntemleri

Biyoyakıt üretimi için işleme zorluğu olan lignoselülozik biyokütlenin verimli kullanımını, biyokütleye uygulanan ön işlemler etkilemektedir. Lignoselülozik biyokütle; lignin, hemiselüloz ve selüloz ana bileşenlerinden oluşmaktadır. Ön işlem yöntemleri ile, lignoselülozik biyokütlenin bu bileşenlerinden bir veya daha fazlası çözündürülmekte ve ayrılmaktadır. Kalan katı biyokütle, ileri biyolojik ve kimyasal işlem için daha kullanılabilir hale gelmektedir (Demirbaş, 2005). Lignoselülozik biyokütle kompleksi, Şekil 1'de sunulduğu üzere hemiselüloz zincirleriyle bağlanmış lignin ve selüloz matrisinden oluşmaktadır.



Şekil 1. Lignoselülozik biyokütle için fiziksel ve kimyasal ön işlem yöntemleri

2.1. Fiziksel Ön İşlem

Yaygın kullanımı olan fiziksel ön işlem uygulamaları mekanik öğütme, mikrodalga ve ultrasonik olarak aşağıda sunulmuştur.

2.1.1. Mekanik öğütme

Mekanik boyut küçültme işlemlerinde sıkıştırmalı öğütme, ıslak öğütme, kuru öğütme ve titreşimli bilyalı öğütme işlemlerinin kullanımı yaygındır. Lignoselülozik biyokütlenin öğütülmesindeki enerji tüketimi; malzeme özellikleri, ilk parçacık boyutu, nem içeriği, makine değişkenleri ve besleme malzemesi hızına bağlıdır. Öğütücülerin ana sınıflandırması öğütme mekanizmasına göre olup, boyut küçültme, parçacık geometrisinin darbe veya sıkıştırma nedeniyle hasar gördüğü keskin bıçaklarla bölünerek veya kesilerek gerçekleştirilebilir (Kamarludin vd., 2014).

Mekanik ön işlem uygulaması, biyogaz üretim verimliliğini artırma başta olmak üzere hammadde tedarik zincirini ve depolama koşullarını kolaylaştırma, toplam erişilebilir yüzey alanını arttırma, karmaşık yapıyı kırma, bileşenlerin biyo-erişilebilirliğini ve hidroliz sırasında sakkaritlerin dönüşümünü iyileştirmesi dolayısıyla biyokütlenin morfolojisini değiştirme avantajı bulunmaktadır (Lindmark vd., 2012; Vidal Jr vd., 2011; Miao vd., 2011; Yu vd., 2019). Mekanik öğütme genel olarak, bir sonraki ön işleme geçmeden önce lignoselülozik biyokütlenin biyoyakıta dönüştürülmesinde en önemli ve umut verici ön işlem uygulaması olarak görülmüştür (Kamarludin vd., 2014).

2.1.2. Mikrodalga

Mikrodalga ön işlem uygulaması, çeşitli biyokütle tiplerinin parçalanabilirliğini arttırmak için uygun bir yöntem olarak dikkat çekmiştir. Mikrodalga kullanımının hücre duvarı ve lignini etkili bir şekilde bozduğu ve böylece hidrolizi kolaylaştırdığı rapor edilmiştir (Salema vd., 2017). Bu yöntemin, 300 MHz ve 300 GHz arasında bir frekans ve 0.1 ila 100 cm arasında eşdeğer bir dalga boyundan geçen elektromanyetik radyasyonlardan oluştuğu bildirilmiştir (Bastiaens vd., 2017; Saini vd., 2015; Li vd., 2012).

Mikrodalga ısıtma, mekanizması nedeniyle konvansiyonel ısıtmaya göre daha tercih edilen bir yöntemdir. Konvansiyonel ısıtma, transfer ortamı gerektirmekte, temas yüzeyinde başlamakta ve difüzyonla içeriye doğru iletilmektedir. Dış tarafta aşırı ısınma, biyokütlede yaygın bir sorundur. Ancak mikrodalga ısıtma, biyokütle ile doğrudan temas olmaksızın aynı anda tüm hacmi ısıtmakta ve böylece homojen, hızlı ve hacimsel ısıtma sağlamaktadır. Buna ilaveten, mikrodalga ısıtma anlık olarak düzenlenebilmektedir. (Saini vd., 2015).

2.1.3. Ultrasonik

Yeşil teknoloji olarak uygulanan ultrasonun, zor ayrışabilen lignoselülozik biyokütlenin etkin ayrışmasıyla katma değerli kimyasalların veya biyoyakıtların verimli üretiminde olumlu rol oynadığı rapor edilmiştir. Ultrasonik ön işlemin başlıca avantajları; kısa işlem süresi ve düşük işlem sıcaklığıdır. Ayrıca, bu ön işlem uygulamasının diğer teknolojilerle birleştirilme potansiyeli bulunduğu bildirilmiştir (Chatel, 2018).

2.2. Kimyasal Ön İşlem

Biyoyakıt üretiminde önemli etkileri olan kimyasal ön işlem uygulamalarından, en yaygın kullanılan asit ve alkali ön işlemi aşağıda sunulmuştur. Buna ilaveten, organo çözücü ve ozonoliz ön işlem uygulamalarından da bahsedilmiştir.

2.2.1. Asit

Asit ön işlem yöntemi uygulanan lignoselülozik biyokütlenin ana fraksiyonu hemiselüloz olup, bu prosesle aynı zamanda lignin ve selülozun bir kısmı çözündürülerek karbonhidratlar serbest bırakılmaktadır (Jönsson ve Martín, 2016). Asit ön işlem uygulama prosesinde; asit konsantrasyonu, katı madde yüklemesi, sıcaklık ve bekleme süresi ana proses değişkenleridir. Dolayısıyla şeker verimi, katı madde geri kazanımı, hemiselüloz dönüşümü, glikoz, furfural ve ksiloz konsantrasyonu çeşitli biyokütle tipleri için yapılmış çalışmalarda incelenmiştir (López-Linares vd., 2013; Triana vd., 2011; Yoon vd., 2015; Cara vd., 2008).

Lignoselülozik biyokütleyi işlemede H_2SO_4, HCl gibi konsantre asitler kullanılmıştır. Konsantre asit ön işlem uygulaması ile, selülozun hidrolizi aşamasında düşük sıcaklıklarda yüksek şeker verimine ulaşılabilir. Biyokütle kaynağından bağımsız olarak konsantre asit ön işlemi çok verimli olmasına rağmen toksik, aşındırıcı, korozyona dayanıklı reaktör tasarımları gerektirmektedir. Bu da, ön işlem uygulamalarını maliyetli duruma getirmektedir. Buna ek olarak, ön işlemin ekonomik olması hidroliz aşamasından sonra konsantre asitin geri kazanımı ile gerçekleştirilebilir. Araştırmalar, ucuz ve etkili olduğu için %4'ün altı H_2SO_4 konsantrasyonlarında yapılmış çalışmalara ilgiyi artırmıştır. Bu kapsamda, seyreltik H_2SO_4, biyoyakıt üretiminden ziyade özellikle ticari amaçlı olarak selülozik malzemelerden furfural üretmek için kullanılmıştır. Seyreltik H_2SO_4, lignoselülozik biyokütle yapısında bulunan hemiselülozu, ksiloz ve diğer şekerlere hidrolize etmek için biyokütleye uygulanmaktadır. Seyreltilmiş H_2SO_4 ön işlemi, selüloz hidrolizini önemli ölçüde iyileştirebilir. Bu ön işlem uygulaması ile, hemiselülozun çoğu çözünmüş şekerler olarak etkin bir şekilde uzaklaştırılmakta ve geri kazanılmaktadır. Selülozdan tam glikoz verimine ise, tam hemiselüloz hidrolizi ile hemiselülozun uzaklaştırılmasıyla ulaşılmaktadır. Dolayısıyla, asit eklenmesi ile hemiselüloz çıkarılarak, kalıntı katılar selülozun bozunabilirliğini artırmaktadır. Seyreltik asit ön işleminde, yüksek sıcaklıklar selüloz hidrolizi için uygundur (Kumar vd., 2009).

Asit ön işlem uygulaması, katı madde yüklemesine göre kuru ve ıslak ön işlem uygulaması olarak sınıflandırılabilir. Islak asit ön işlem uygulaması, % 15 (w/w)'in altındaki katı madde yüklemelerinin kullanılması ile karakterize edilmektedir. Lignoselülozik biyokütleye asit ön işlem uygulamasının yolu katalizör olarak hem CH_2O_2, $C_2H_4O_2$, $C_3H_6O_2$, $C_4H_4O_4$ gibi organik asitleri hem de H_2SO_4, HCl, H_3PO_4 gibi mineral asitleri kapsamaktadır (Jung ve Kim, 2015; Behera vd., 2014). Islak asit ön işlem uygulaması, lignoselülozik biyokütlenin hemiselüloz parçalanmasını gerçekleştirmek için kullanılmaktadır. Bu ön işlem uygulaması, asit çözeltisindeki asit konsantrasyonuna bağlı olarak, konsantre veya seyreltilmiş asit prosesi olarak sınıflandırılabilir. Konsantre asit ön işlem uygulamasının avantajı, düşük işletme maliyetlerinde (düşük sıcaklık ve uzun süreli çalışma) gerçekleşir. Dezavantajı ise, korozyona dayanıklı proses ekipmanları gerektiği için pahalıdır. Seyreltik asit ön işlem uygulamasında proses ekipmanları daha az maliyetli olup, yüksek sıcaklıklarda çalışılmaktadır. Buna ilaveten bu uygulamada, fermente edici mikroorganizmaların büyümesinin potansiyel inhibitörleri olan furfural, 5-hidroksimetilfurfural (HMF), formik asit gibi şeker bozunma bileşikleri üretilmektedir (Janga vd., 2012). Kuru seyreltik asit ön işlem uygulanması, genel olarak sıvı fraksiyondan iki kat daha büyük bir katı fraksiyonda çalışmaktadır. Kuru seyreltik asit ön işlemi, lignoselülozik matris ve asit katalizörü arasındaki kütle transferini iyileştirmeye yardımcı olan seyreltik asit çözeltisi ile bir ön ıslatma adımından sonra gerçekleştirilebilir. Ön ıslatma aşamasında bekleme süresi, oda sıcaklığında yaklaşık 12 saat olarak bildirilmiştir. Bu ön ıslatma adımı, ihtiyaç duyulan uzun bekleme süreleri nedeniyle endüstriyel faaliyet yapılan alanlar için uygun değildir (Zhang vd., 2011).

2.2.2. Alkali

Lignoselülozik biyokütleye uygulanan alkali ön işlemde oluşan etki, biyokütlenin lignin içeriğine bağlıdır. Bu ön işlem uygulaması, diğer ön işlem uygulamalarından daha düşük sıcaklık ve basınçta yarar sağlamaktadır (Kumar vd., 2009; Kim vd., 2016). Ancak, ön işlem uygulama süresi saniye veya dakika yerine saat veya gün şeklinde daha uzun sürelidir. Asit ön işlem uygulamaları ile kıyaslandığında, alkali ön işlem uygulamalarında daha az şeker bozulması gerçekleşir ve kostik tuzların çoğu geri kazanılabilir ve/veya yeniden üretilebilir (Kumar vd., 2009). Bu yöntemde, korozyon etkisi düşük olduğundan, pahalı malzemelere ve özel tasarımlara olan ihtiyaç ortadan kaldırabilir (Kim vd., 2016).

Alkali ön işlem uygulaması ile, lignoselülozik biyokütlenin enzim bozunabilirliğini arttırmak için çeşitli reaktifler kullanılmıştır. Bu reaktiflerin sodyum hidroksit, kalsiyum hidroksit, potasyum hidroksit ve amonyum hidroksit olduğu ve alkali ön işlem reaktiflerinin sülfit ve sülfürik asit gibi asidik reaktiflerden daha az yakıcı olduğu bildirilmiştir. Bunlardan yaygın olarak sodyum hidroksit kullanılmıştır (Li ve Kim, 2011; Kim ve Holtzapple, 2006; Novakovic vd., 2021; Kumar vd., 2009; Kim vd., 2016). Kalsiyum hidroksitin (sönmüş kireç) ise, etkili bir ön işlem malzemesi olduğu ve kg hidroksit başına en uygun maliyetli olduğu bildirilmiştir. Kireç ön işleminde kireç su ile bulamaç haline getirilerek, biyokütle üzerine püskürtülmekte ve biyokütlenin saatlerce veya haftalarca yığın halinde depolanmasını kapsamaktadır. Biyokütle parçacık boyutunun genel olarak 10 mm veya daha küçük boyutlarda olduğu, yüksek sıcaklık değerlerinin temas süresini azalttığı bildirilmiştir (Kumar vd., 2009).

Alkali ön işlem ile diğer ön işlem uygulamalarının kombinasyonunun hidrolizi önemli ölçüde iyileştirebildiği rapor edilmiştir. Seyreltik asit, mikrodalga, ıslak öğütme ve alkali işlemli ultrasonikasyonun bir kombinasyonu, tek başına alkali ön işlemi yapılmasına göre yüksek enzimatik hidroliz şeker verimi ile sonuçlanmıştır (Keshwani ve Cheng, 2010; Cheng vd., 2011; He vd., 2010; Moodley ve Gueguim Kana, 2017; Rodrigues vd., 2011).

2.2.3. Organo çözücü

Organosolvasyon yöntemi, lignoselülozik biyokütleye uygulanmış umut verici ön işlem stratejilerinden biridir. Bu ön işlem yönteminde, iç lignin ve hemiselüloz bağlarının kırılmasında, inorganik asit (H_2SO_4 veya HCl) katalizörleri ile organik veya sulu bir organik solvent karışımı kullanılmaktadır. Organosolvasyon ön işlem uygulamalarında yaygın olarak etanol, metanol, trietilen glikol, etilen glikol ve aseton çözücüleri kullanılmaktadır. Oksalik, salisilik ve asetilsalisilik gibi organik asitlerin organosolvasyon işleminde katalizör olarak kullanıldığı bildirilmiştir. Bu işlem temelde, organik çözücüler ve genel olarak seyreltik sulu asit çözeltileri tarafından desteklenen lignoselülozik biyokütlenin eşzamanlı ön hidrolizini ve ligninin uzaklaştırılmasını (delignifikasyon) kapsamaktadır (Kumar vd., 2009; Zhao vd., 2009; Papatheofanous vd., 1995).

2.2.4. Ozonoliz

Ozon ön işlemi, lignoselülozik biyokütlenin lignin içeriğinin azaltılmasında kullanılarak, ön işlem uygulanmış biyokütlenin parçalanabilirliğini artırmaktadır. Ayrıca, diğer kimyasal ön işlem uygulamalarından farklı olarak toksik kalıntı üretilmemektedir. Buğday samanı, pamuk samanı, çam, fıstık, şeker kamışı küspesi gibi lignoselülozik biyokütlelerde hemiselüloz ve lignini parçalamak için kullanılabilir. Bozunma lignin ile sınırlı olup, hemiselüloz çok az etkilenmekte, selüloz ise etkilenmemektedir (Kumar vd., 2009).

Ozonoliz ön işlem uygulamasının avantajı, sıvı fazın olmaması, ürün seyreltme ile ilgili sorunlardan kaçınma, reaksiyonların oda sıcaklığı ve basınçta gerçekleştirilmesidir. Ayrıca, ozonun sıcaklığın artırılmasıyla veya katalitik bir yatak kullanılarak kolayca parçalanabilmesi, proseslerin çevre kirliliğini minimum seviyelere indirebilecek şekilde tasarlanmasını desteklemektedir. Ozonoliz uygulamasının dezavantajı, prosesin soğutma sistemi gerektirmesi, prosesi maliyetli duruma getirebilecek çok miktarda ozon gerektirmesi, ozonun yüksek derecede reaktif, aşındırıcı, yanıcı ve toksik özellikler göstermesidir (Travaini vd., 2016; Kumar vd., 2009).

3. Sonuçlar ve Öneriler

Lignoselülozik biyokütle kullanımı, hem tarımsal kökenli atık veya kalıntıların azaltılması hem de biyoyakıt üretimi için faydalıdır. Yöntemden yönteme değişen ve biyokütle türlerine bağlı olarak ön işlem verimliliği farklı kriterlerle belirlenebilir. Ön işlem yöntemi, biyokütlenin biyolojik parçalanabilirliğini kolaylaştırmak ve genel işleme süresini azaltmak için hayati öneme sahip olmakla birlikte, kullanılabilecek tek ön işlem uygulaması genel verimliliği düşürebilir. Bu nedenle, mekanik öğütme işlemi, diğer ön işlemlerden biri ile birleştirilebilir. Lignoselülozik biyokütleye uygulanan fiziksel ve kimyasal ön işlemin; hidroliz hızını arttırma, nihai karbonhidrat çıktısı, erişilebilirlik ve biyoyararlanım için önemli olduğu sonucuna varılmıştır. Biyokütlenin biyoyakıt kaynağı olarak kullanılabilirliği ile ilgili araştırmaların geliştirilmesi ve bu biyokütle tiplerinin bileşenlerinin verimli ayırma ile yüksek değerli kimyasallara dönüştürülmesinin araştırılması önerilmektedir.

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Importance of Feed Quality in the Production of Foods Obtained from Ruminants and Human Welfare

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Abstract
Foods of animal origin contribute significantly to human nutrition. In particular, the necessity of producing these traded products to meet the needs of society makes it difficult and obligatory to ensure that they comply with adequate quality standards. Nowadays, the concepts of food/feed safety and food/feed quality have gained importance, and the need to evaluate both feeds and foods not only in terms of their nutritional properties but also in terms of their ability to protect health has emerged. Because the physical and chemical structures of feeds used in animal nutrition directly affect product safety as well as productivity in animal production. Therefore, feed quality is vital in producing animal foods consumed for long-term human welfare. In this study, the roles of feed production processes and feed quality in ensuring the health, safety, and quality of foods of animal origin are emphasized.
Keywords: *animal products, contamination, feed, food, residues*

Ruminantlardan Elde Edilen Gıdaların Üretiminde ve İnsan Refahında Yem Kalitesinin Önemi

Özet
Hayvansal kökenli gıdalar, insanların beslenmesine önemli ölçüde katkıda bulunmaktadır. Özellikle ticareti yapılan bu ürünlerin toplumun ihtiyaçlarını karşılayacak ölçüde üretilme gerekliliği, yeterli kalite standartlarına uygun olmasının sağlanmasını hem zorlaştırmakta hem de zorunlu kılmaktadır. Günümüzde gıda/yem güvenliği ve gıda/yem kalitesi kavramları önem kazanmış hem yemlerin hem de gıdaların sadece besinsel özellikleri açısından değil aynı zamanda sağlığı koruma yetenekleri açısından da değerlendirilmesi ihtiyacı ortaya çıkmıştır. Çünkü hayvan beslemede kullanılan yemlerin fiziksel ve kimyasal yapıları hayvansal üretimde verimliliğin yanı sıra ürün güvenliğini doğrudan etkiler. Dolayısıyla uzun vadeli insan refahı için tüketilen hayvansal gıdaların üretilmesinde yem kalitesi önemli role sahiptir. Bu çalışmada hayvansal kaynaklı gıdaların kalitesinin, güvenliğinin ve sağlıklı olmasının sağlanmasında yem üretim süreçlerinin ve yem kalitesinin rolleri üzerinde durulmuştur.
Anahtar Kelimeler: *gıda, hayvansal ürünler, kalıntılar, kontaminasyon, yem*

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Understanding Aerobic Deterioration and Ensuring Stability in Ensiled Feeds

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Abstract

Aerobic stability is a crucial indicator that shows the length of time that the silage opened to be fed to the animals can be used without deterioration. In other words, it refers to the shelf-life of silage. Exposure to oxygen leads to activating microorganisms such as yeast and mold, which cause aerobic deterioration in silage. Aerobic microorganisms grow by consuming components such as water-soluble carbohydrates, organic acids, and nitrogenous compounds in the silage. Hence, there is an increase in silage temperature, an enhancement in pH value, and losses in dry matter content. Therefore, silage spoiled by oxygen is an economic problem. Various additives and methods are used to improve the stability of silages by preventing or minimizing their aerobic deterioration. This study aims to review and update the understanding both in the aerobic deterioration process of silage and in the applications that improve stability.

Keywords: *aerobic stability, silage, silage management, additives*

Silo Yemlerinde Aerobik Bozulmanın Anlaşılması ve Stabilitenin Sağlanması

Özet

Aerobik stabilite, hayvanlara yedirilmek üzere açılan silajın bozulmaksızın kullanılabileceği süreyi belirten çok önemli bir göstergedir. Başka bir deyişle, silajın ömrünü ifade eder. Oksijene maruz kalma, silajda aerobik bozulmaya neden olan maya ve küf gibi mikroorganizmaların aktif hâle gelmesine yol açmaktadır. Aerobik mikroorganizmalar silaj bünyesindeki suda çözünebilir karbonhidratlar, organik asitler ve nitrojenli bileşikler gibi komponentleri tüketerek gelişirler. Bunun sonucunda ise silaj sıcaklığında artış, pH değerinde yükselme ve kuru madde içeriğinde kayıplar olur. Bu nedenle hava alarak bozulmuş silajlar ekonomik bir sorundur. Silajların aerobik bozulmalarını önleyerek veya minimize ederek stabilitelerini geliştiren çeşitli katkı maddelerine ve yöntemlere başvurulmaktadır. Bu çalışmada hem silajın aerobik bozulma sürecindeki hem de stabiliteyi artıran uygulamalardaki anlayışın gözden geçirilmesi ve güncellenmesi amaçlanmıştır.

Anahtar Kelimeler: *aerobik stabilite, silaj, silaj yönetimi, katkı maddeleri*

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Analysis of organic compounds in industrial effluents and surface water.

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Abstract
Organic compounds are classes of chemical compounds which evaporate easily from water into the air and they contain carbon. This research examined the analysis of organic compounds in industrial and effluent water of Asa River, Ilorin, Nigeria and the purpose is to ascertain that raw materials used in production have a link to the pollution of surface water, and it was carried out using Fourier Transform Infra red Spectroscopy from eight sampling locations. Findings showed that detergent company effluent and its surface water (EW-GS-1 & GS/SW1) presents peaks 3447.7-3454.2 cm^{-1} which can be ascribed to primary amines of –N-H- distends; Pharmaceutical companies A&B (EW-TP-1&KC-GS-TP/SW1 with EW-KC-3&KC/SW1 respectively) shows the band at 750.07cm^{-1} for effluent waters and 754.97cm^{-1} for surface water were assigned to –C-C stretching of mononuclear aromatic hydrocarbons which is benzene while, battery company (EW-FB-4&FB/SW1) reveals energetic alp at 1271cm^{-1} assigned to –C-O-C distends indicative of alkyl aryl ether because of strong dipole moment. This research reveals that surface water is most times polluted with organics and it has to be controlled to ensure safe water for drinking.
Key words: *Organic compounds, Peaks, Surface water, Industrial effluent, Dipole moment*

1. Introduction
Organic compounds (OCs) are classes of chemical compounds evaporate easily from water into the air and they contain carbon which components that have high vapour pressure and low water solubility (Kwon and Finneran, 2008). Many organic compounds are human-made chemicals that are used and produced in the manufacture of paints, pharmaceuticals and refrigerants. They are typically industrial solvents such as trichloroethylene; fuel oxygenated such as methyl tetra-butyl ether (MTBE) or by-products produced by chlorination in water treatment, such as chloroform (Kumar and Pransannamedha, 2021). They are often components of petroleum fuels, hydraulics fluids, and paint thinner and dry cleaning agent. They are associated with product such as gasoline, plastics, adhesives, dry-cleaning fluids and biological source, which include trees, cows, termite (methanol) and cultivation (Ninemets *et al*., 2004; Reikichi andToshihiko, 2005).
Organic compounds can enter groundwater from a variety of sources. Benzene for instance, may enter groundwater from gasoline or oil spills on the ground surface or from leaking underground fuel tanks spilled or improperly disposed of OCs may be released into the environment. Any portion that does not evaporate may soak into the soil and can be carried into groundwater by rain, water and Snow Belt (Mariana and Pietro, 2019; Miroslaw et al., 2015; Makshakova et al., 2014). Factor that influence the likelihood of contamination include among others, proximity of the water to the source of contamination, the amount of OCs that are spilled or discarded, depth of the well (shallow wells are affected by surface spills more quickly and severely than deep wells); local geology (groundwater that is protected by thick, dense soil is less vulnerable to contamination); and time (groundwater moves slowly, so it can take months or years after a spill before contamination releases well). (Benotti and Snyder, 2009; Tripathi et al., 2020; Schymanski et al., 2014). The harmful effects of OCs vary considerably. At high levels, some OCs may damage the central nervous systems, the kidney or the liver. They may cause irritation to mucous membranes if inhaled.
In this research, our focus is on Asa River, which was pointed out that the river is subject to high level of eutrophication due to organic matter and industrial discharge into it (Eletta and Adekola, 2005; Reikichi, 2019). The aim of this work is to use Fourier Transform Infra Red Spectroscopy to determine functional groups of organic compounds present in industrial effluent which also traceable to access Asa River in Ilorin, Kwara State used for all activities in that locality. This study was carried out on effluent and surface water samples of Ilorin environs based on eight sampling sites which are EW-GS-1, EW-TP-2, EW-KC-3, EW-FB-4, GS/SW1, KC-GS-TP/SW1, KC/SW1 and FB/SW1 respectively. These sites are highly industrialised and commercialised; also discharge of effluents from various companies into water bodies occurs majorly in these areas.

2. Materials and Methods
2.1 Study sites, sample collection and pretreatment
Eight water samples were collected along the course of Asa River (Figure 1, Table 1) seasonally for two years (February 2013-April 2015). OCs samples were collected in pre-sterilised glass bottles and aluminum foil was used to air tight the bottles to avoid temperature changes and preserved with 2 mL conc. tetraoxosulphate (VI) acid per litre at 4°C to prevent the loss of volatile compounds until chemical analysis.

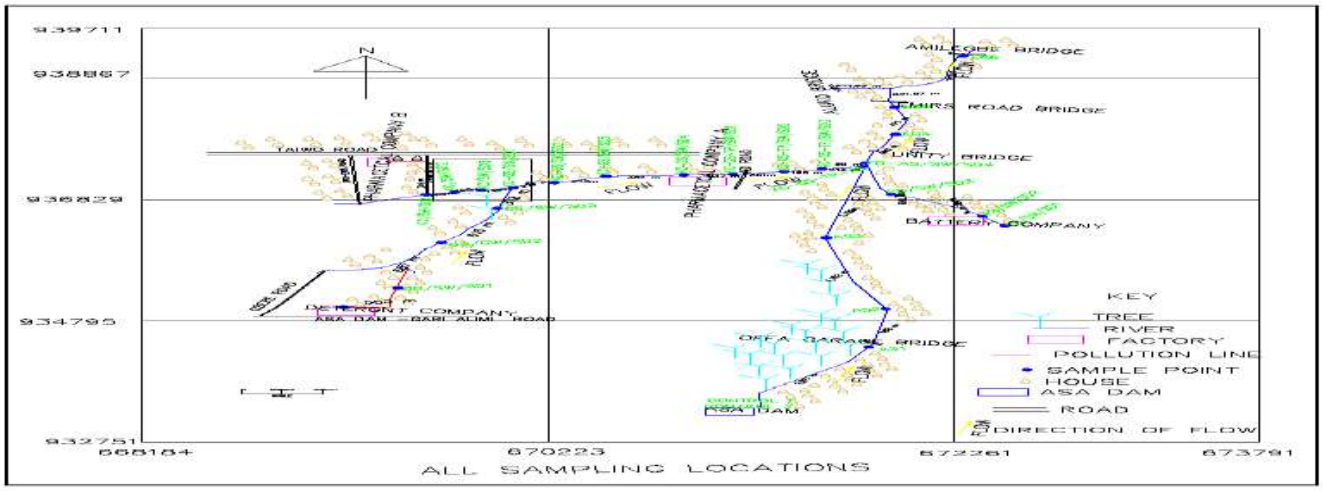

Figure 1: Study sites and sampling locations

Table 1. Sampling Location and site description

S/No	Sample Location	Longitude	Latitude	Site description
1	EW-GS-1	4º 32'14.55" E	8º 27'50.94"N	Effluent collected from a detergent company located at Asa-dam Road, Ilorin, Kwara State at the back close to the fence, which overflows passes into a gutter through an outlet. The effluent was soapy in nature.
2	EW-TP-2	4º 33' 0.39" E	8º 28' 24.52" N	Effluent collected from a pharmaceutical company **A** situated at New Yidi Road, Ilorin, Kwara State. It is white – brownish in colour.
3	EW-KC-3	4 º 32' 35.55" E	8º 28' 50.47" N	Effluent collected from pharmaceutical company **B** situated at Oko-erin road, Ilorin, Kwara State. Dirty white colour effluent water was obtained.
4	EW-FB-4	4º33' 58.63" E	8º 28' 11.64"N	Effluent collected from battery company situated at Gaa-imam road close to Stella Obasanjo multipurpose hall, Ilorin, Kwara State. A light colour water effluent was collected.
5	GS/SW1	4º32' 20.57" E	8 º27' 27.84"N	A soapy surface water /sediment was collected (553 m) away from the detergent industry.
6	KC-GS-TP/SW1	4º33'16.91'' E	8º28'36.21'' N	Meeting point one of pharmaceutical site B/detergent/pharmaceutical site A at New Yidi stream (4846 m) from the industries.
7	KC/SW1	4º32'26.62'' E	8º28'25.14''N	A stream located within Kwara State Stadium Complex, Taiwo Road, Ilorin was sampled (889 m) away from the industry B.
8	FB/SW1	4º34'1.36''E	8º28'7.97''N	An adjoining stream before the battery industry at Gaa – imam, Ilorin was sampled (1380 m).

2.2 Sample Preparation

Organic Compounds was determined using extraction by hexane and separation via gas chromatography. The industrial and surface water samples were filtered through a membrane filter with 0.45 nm pore size before extraction procedures. Water sample of 100 mL was transferred into a separating funnel and 100 mL of organic solvent (50 mL: 50 mL - hexane: dichloromethane) added and the mixture separated for 45minutes by thorough shaking, afterwards the extract was poured into beaker and left for few minutes to evaporate then the remaining extract filtered using cotton wool as a separating medium in a pasture pipette and anhydrous Sodium tetraoxosulphate (VI) Na_2SO_4 in excess was added to absorb the remaining water in the sample and this was totaled into a vial bottle up to 2 mL ready for Fourier Transform Infra red analysis.

3. Results and discussion

From the figure IR 1 and IR 2, it can be seen that EW-GS-1 and GS/SW1 array present apparent apex in the succeeding amplitudes. 3447.07-3454.2 cm^{-1}; 2075.52-2964cm^{-1}; 1636.96-1741.12 cm^{-1}; 1378.2-1461 cm^{-1}; 1032.2-1378.2 cm^{-1}; 744.73-764.22 cm^{-1} and 384.43-427.97cm^{-1}. The ample and energetic bandeau stationed in the bounds 3447.07-3454.2 cm^{-1} can be ascribed to primary amines of –N-H distends. The bandeau separating the bounds 2075.52-2964 cm^{-1} is assigned to the –C-H expands oscillations. The energetic peaks of 1636.96 cm^{-1} for effluent water, while 1621.9 cm^{-1} and 1741.12 cm^{-1} are for surface water respectively could be as a result of a –C=O distends in carboxylic or acetamide bands indicative of 1,3-diketones. -C≡C stretching weak absorption at 2075.52 cm^{-1} for effluent water. –C-O-C stretching at bands 1102.62 cm^{-1} for effluent water and 1032.2 cm^{-1} and 1110.2 cm^{-1} for surface water indicative of aliphatic ethers. All the peaks found in these sampling sites were expected due to the raw materials used by the effluent companies such as sodium benzoate, caustic soda, fatty alcohols, alkyl benzenes and carboxy methyl cellulose.

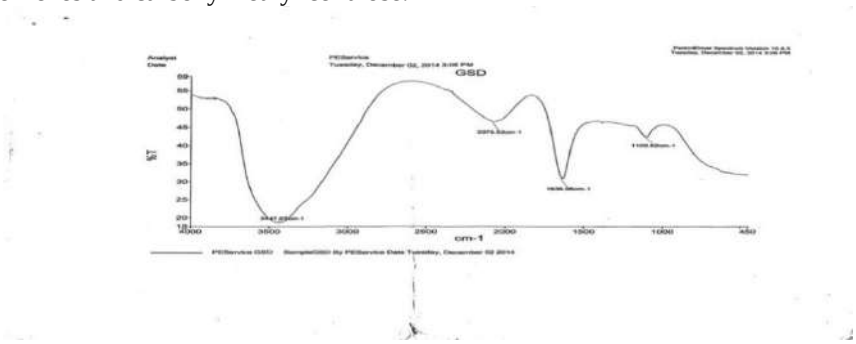

Figure IR 1: EW-GS-1

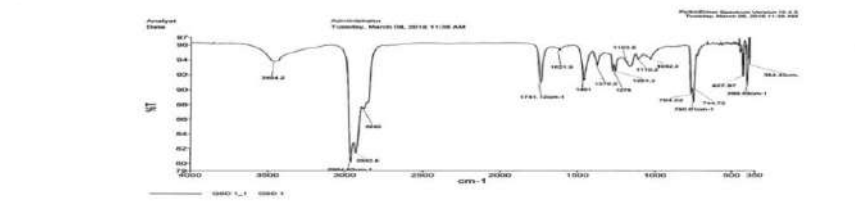

Figure IR 2: GS/SW1

From the figure IR 3 and IR 4, it can be observed that EW-TP-2 and KC-GS-TP/SW1 spectrum present specific apex in the succeeding amplitude: 3449.3-3897.2 cm^{-1}, 2879.2-2964.72 cm^{-1}, 1617-1745.3 cm^{-1}, 1256.4-1467.7 cm^{-1}, 1032.2-1154 cm^{-1}, 505.94-754.97 cm^{-1}, 371.83-391.33 cm^{-1}. C=C-H stretching for unconjugated alkenes was observed at 3449.3 cm^{-1}, C-H stretching situated at 2964.7cm^{-1} for effluent water and 2965.05 cm^{-1} for surface water as asymmetrical stretching indicative of straight chains alkanes. The strong and broad absorption overtone band at 1382 cm^{-1} and 1378 cm^{-1} respectively is assigned to C≡C-H distends. The band observed at 1258.7 cm^{-1} for effluent water and 1256.4 cm^{-1} for surface water was assigned to –C-H bend overtone of alkynes. The peaks observed at 1154 cm^{-1} and 1032.2 cm^{-1} is attributed to –C-O stretching resonance indicative of tertiary and primary alcohols respectively and also the bands ranges at 1276-1738.9 cm^{-1} indicated –C-O stretching of alcohols. Bands at 1466 cm^{-1} is assigned to –C-C stretch indicative of aromatic hydrocarbons for benzene ring. The strong characteristic bands observed at 1046.2 cm^{-1} for effluent water and 1032.2 cm^{-1} for surface water is assigned to –C-O-C stretching due to the strong dipole moment. The strong peaks at 1258.7 cm^{-1} for effluent water and 1256.4 cm^{-1} for surface water are attributed to asymmetrical stretch of alkyl aryl ethers.

The intense band at 1745.3 cm^{-1} and 1738.9 cm^{-1} is assigned to C=O stretch indicative of ketones (esters), acids, lactones and lactams (1738.9 cm^{-1}). Crest at 1276 cm^{-1} and 1256.4 cm^{-1} are indicative of α, β unsaturated esters. The peaks at 1467.7 cm^{-1}, 1382 cm^{-1} for effluent water and 1466 cm^{-1}, 1378.2 cm^{-1} for surface water was attributed to alkyl nitrite. The bands at 750.07 cm^{-1} for surface water and 754.97 cm^{-1} for surface water were assigned to-C-C stretching of mononuclear aromatic hydrocarbons which is benzene.

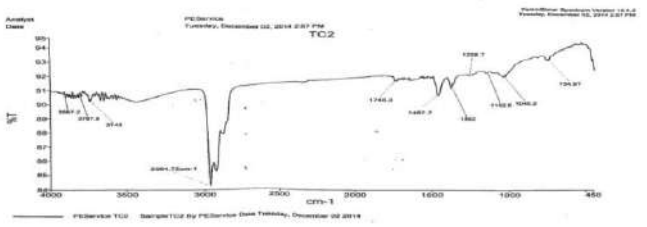

Figure IR 3: EW-TP-2

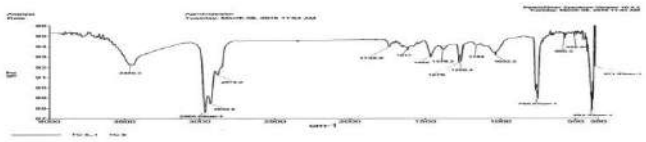

Figure IR 4: KC-GS-TP/SW1

From the figure IR 5 and IR 6, it can be observed that EW-KC-3 and KC/SW1 spectrum present specific crest in the succeeding amplitude: 3449.3-3897.2 cm^{-1}, 2879.2-2965.80 cm^{-1}, 1617-1745.3 cm^{-1}, 1256.4-1461 cm^{-1}, 1032.2-1154 cm^{-1}, 569.3-754.97 cm^{-1} and 391.43cm^{-1} respectively. The bandeau observed at 3449.3 cm^{-1} was indicative of C=C-H stretching for unconjugated alkenes. C-H stretching situated at 2964.7cm^{-1} for effluent water and 2965.05 cm^{-1} for surface water as asymmetrical stretching indicative of straight chains alkanes. The strong and broad absorption overtone band at 1382 cm^{-1} and 1378 cm^{-1} respectively is assigned to C≡C-H stretching. The band observed at 1258.7 cm-1 for effluent water and 1256.4 cm^{-1} for surface water was assigned to –C-H bend overtone of alkynes. The peaks observed at 1154 cm^{-1} and 1032.2 cm^{-1} is attributed to –C-O stretching oscillations indicative of tertiary and primary alcohols respectively and also the bands ranges at 1276-1738.9 cm^{-1} indicated –C-O distends of alcohols. Apex at 1466 cm^{-1} is attached to –C-C stretch indicative of aromatic hydrocarbons for benzene ring. The strong characteristic bands observed at 1046.2 cm^{-1} for effluent water and 1032.2 cm^{-1} for surface water is assigned to –C-O-C stretching due to the strong dipole moment. The strong peaks at 1258.7 cm^{-1} for effluent water and 1256.4 cm^{-1} for surface water are attributed to asymmetrical stretch of alkyl aryl ethers. The intense band at 1745.3 cm^{-1} and 1738.9 cm^{-1} is assigned to C=O stretch indicative of ketones (esters), acids, lactones and lactams (1738.9 cm^{-1}). Alps at 1276 cm^{-1} and 1256.4 cm^{-1} are indicative of α, β unsaturated esters. The peaks at 1467.7 cm^{-1}, 1382 cm^{-1} for effluent water and 1466 cm^{-1}, 1378.2 cm^{-1} for surface water was attributed to alkyl nitrite. The bands at 750.07 cm^{-1} for surface water and 754.97 cm^{-1} for surface water were assigned to-C-C stretching of mononuclear aromatic hydrocarbons which is benzene. All peaks found in this sampling site were expected due to the raw materials used by the effluent company of pharmaceuticals such as benzene, methanol, glycerin, acetone, hydrochloric acid, starches and sugar.

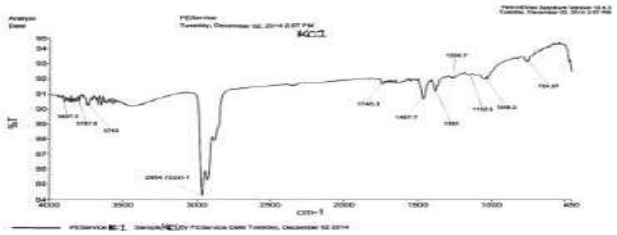

Figure IR 5: EW-KC-3

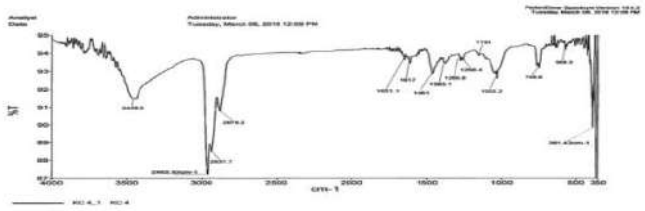

Figure IR 6: KC/SW1

From the figure IR 7 and IR 8, it can be seen that EW-FB-4 and FB/SW1 spectrum present specific crest in the succeeding amplitude: 3439.6-3444.5 cm^{-1}, 2850-2964.96 cm^{-1}, 1617-1743.7 cm^{-1}, 1227.2-1466 cm^{-1}, 1032.2-1159 cm^{-1}, 749.6-764.22 cm^{-1} and 371.85-391.39 cm^{-1}. Crest of 2964 cm^{-1} and 2928 cm^{-1} are assigned to C-H stretching and the range of 2850-2964 cm^{-1} indicated $–CH_3$ and $–CH_2$ of alkanes asymmetrical stretching respectively. C-C stretches was indicated at peaks 1154 cm^{-1} and 1032.2 cm^{-1} with the band range of 1032.2-1159 cm^{-1} indicated alkanes. The peak range at 3439.6-3444.5 cm^{-1} is assigned to C=C-H stretching indicative of alkenes and also intermolecular hydrogen bonding occurs as concentration increases, accompanied by a shift to lower frequency at the expense of the free OH bend. The intense bands observe at 1743.7 cm^{-1}, 1617 cm^{-1} is designated to C=O distends of carbonyls for lactones, aldehydes, acids, esters and acid halides. The broad and strong absorption bandeau from amplitude 1227.2-1466 cm^{-1} is imputed to -C≡C-H bending. Alps 1466 cm^{-1} is imputed for –C-C distends for aromatic, while the peaks at 1271 cm^{-1}, 1261.3 cm^{-1}, 1154 cm^{-1} and 1032.2 cm^{-1} respectively were assigned to C-H stretching in plane bends of aromatics. The peak 1738.9 cm^{-1}, 1667 cm^{-1} for primary alcohol and 1466 cm^{-1} and 1373 cm^{-1} for tertiary alcohol were assigned to C-O stretching vibrations for alcohols. The energetic alp at 1271 cm^{-1} is assigned to –C-O-C distends indicative of alkyl aryl ether because of strong dipole moment.
All the peaks found in these sampling sites both in effluent and surface waters were expected due to the raw materials used by the battery company and other accompany companies nearby which uses paraffin waxes, catechols, sulphur, acids, sodium chloride and tar.

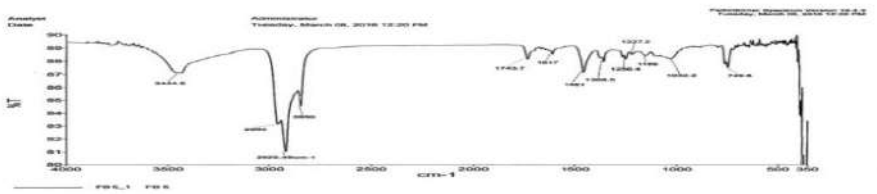

Figure IR 7: EW-FB-4

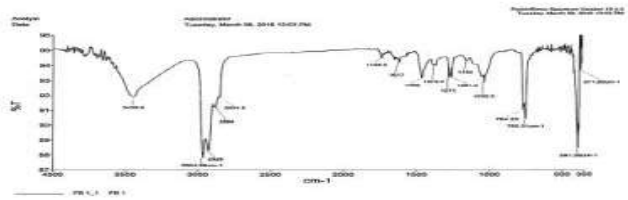

Figure IR 8: FB/SW1

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Identifying and modeling factors affecting the special value of the green brand in women's recreational-sports activities

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Abstract

The main issue in this research is the prioritization of the special value components of the Green brand from the point of view of the women of Hijab Park in Mashhad. The present research is based on the Konknik (2007) model. The main hypothesis of the research is that there is a positive and significant relationship between recreational and sports activities of women and the value of the green brand visa. According to Konknik's model, brand equity has four dimensions: brand awareness, brand image, perceived quality, and brand loyalty, so the sub-hypotheses (brand trust, brand satisfaction, and brand experiences) research positive relationship and meaning. There is a correlation between recreational and sports activities of women on the special value of the green brand, it has been evaluated. This research was done by survey method using questionnaire tool. The statistical population includes women who used the recreational and sports services of Hijab Park in Mashhad between April 5 and May 5, 2017. The statistical sample of the current study was 289 women using the Hijab Women's Park in Mashhad, who were randomly selected. Construction of women's park; In fact, it is a response to a need that has arisen for women due to society's limitations or personal preference, and according to some sociologists, this issue can lead to the draining of women's emotions to some extent. The purpose of this research is to investigate the effective factors of the special value of the green brand in the leisure-sports activities of women in Mashhad city with the method of exploratory and confirmatory factor analysis. The descriptive research method is survey type. The tool for data collection is a questionnaire based on the conducted research, research objectives, and the opinions of supervisors and advisors. Cronbach's alpha method was used to calculate the reliability of the tool (&0.88) with 39 questions on the Likert scale, it evaluates the factors affecting the special value of the green brand in the recreational-sports activities of women in Mashhad. Descriptive and inferential statistics are used to analyze the data. Using inferential statistics methods (Kolomgorov Smirnov test, Spearman correlation coefficient test, binomial distribution test and Friedman test) the research hypotheses have been tested. It is necessary to explain that all calculations in this research were done using SPSS 22, Excel 2010 and LISREL 8.80 software. Based on factor analysis, seven factors of brand image, perceived quality, brand loyalty, brand awareness, brand satisfaction, brand experiences, and brand trust were identified as factors affecting the special value of the green brand in recreational and sports activities of women in Mashhad. The importance of the factors was examined from the perspective of the subjects. Therefore, the highest mean among the components is related to the components of "Brand Loyalty" (SD = 0.73, 4.09) and the lowest mean is related to the component "Brand Awareness" (SD = 0.69, = 3.69). Therefore, it is suggested to pay special attention to brand loyalty, in order to increase the various aspects of women's health, to improve useful social relationships along with their cheerful spirit. At the end, the results have been discussed and made suggestions for more well-being. Hijab park ladies are provided.

Key Words: *Green marketing, Special brand value, Women's leisure-sports activities, Environment*

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Determination of Usability of Wastewater for Irrigation Purposes in Agriculture in Kırklareli Region

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Abstract
Water, which is one of the basic elements of life, is used in many fields such as drinking-use, energy production, agriculture and industry. As a result of the rapid increase in population, agricultural practices, industrialization, and climate change, pressures on water resources in terms of quantity and quality are increasing. Since 70% of the total water consumption in the world is used for agricultural purposes, the use of treated wastewater in agricultural irrigation has an important place in preserving the amount and quality of water resources.The sewage waters of the city of Kırklareli are treated in the existing domestic and industrial treatment plants and discharged into the Kırklareli stream. This study was carried out in order to determine the irrigation water quality and pollution status of the waters released from the waters of the creek and treatment plants and to reveal their suitability for agricultural use. 10 different stations were determined for water samples on Kırklareli Stream. From these stations, sampling was made once seasonally. Physical and inorganic-chemical parameters were investigated. The data obtained from the study was determined according to the Classes of Inland Surface Water Resources (KYSKK) in the Water Pollution Control Regulation. Accordingly; In terms of physical and inorganic-chemical parameters of Kırklareli stream water samples, it is seasonally classified as IV. class has been determined. It has been determined to be in the C3S1 class according to the US Salinity Laboratory Classification system based on electrical conductivity (EC) and sodium adsorption rate (SAR) values. According to the results obtained, it has been determined that it should be used with caution due to its excessive salt content. Analysis of variance, one-way analysis of variance (ANOVA) and correlation analysis were performed in a repeated measurement experiment on the measurement values of water samples. Significant differences and relationships between parameters were determined statistically.
Key Words: *Wastewater, domestic waste, industrial waste, water quality. water pollution, reuse.*

Kırklareli Yöresindeki Atıksuların Tarımda Sulama Amaçlı Kullanılabilirliğinin Belirlenmesi

Özet
Yaşamın temel ögelerinden olan su, içme-kullanma, enerji üretimi, tarım ve sanayi gibi birçok alanda kullanılmakta olup, ancak; nüfusun hızla artması, tarımsal uygulamalar, sanayileşme, iklim değişikliği gibi etkiler sonucu su kaynaklarına miktar ve kalite açısından baskılar giderek artmaktadır. Dünyadaki toplam su tüketiminin %70'inin tarımsal amaçlı kullanılması nedeniyle, arıtılmış atık suların tarımsal sulamada kullanılması, su kaynaklarının miktarı ve kalitesinin korunmasında önemli bir yere sahiptir. Kırklareli il merkezinin kanalizasyon suları mevcut evsel ve endüstriyel arıtma tesislerinde arıtılarak Kırklareli deresine deşarj edilmektedir. Bu çalışma derenin suları ve arıtma tesislerinden salınan suların, sulama suyu kalitesi ve kirlilik durumunun belirlenerek tarımsal amaçlı kullanıma uygunluğunu ortaya koymak amacıyla gerçekleştirilmiştir. Kırklareli Deresi üzerinde su örnekleri için 10 farklı istasyon belirlenmiştir. Bu istasyonlardan mevsimsel olarak birer kez örnekleme yapılmıştır. Örnekler üzerinde fiziksel ve inorganik-kimyasal parametreler incelenmiştir. Çalışmadan elde edilen değerler, Su Kirliliği Kontrol Yönetmeliğinde yer alan Kıta İçi Yerüstü Su Kaynaklarının Sınıflarına (KYSKK) göre kalite belirlenmiştir. Buna göre; Kırklareli deresi su örneklerinin fiziksel ve inorganik-kimyasal parametreleri açısından mevsimsel olarak kalite sınıfının IV. sınıf olduğu, elektriksel iletkenlik (EC) ve sodyum adsorpsiyon oranı (SAR) değerlerini temel alan ABD Tuzluluk Laboratuvarı Sınıflandırma sistemine göre ise C3S1 sınıfında olduğu, fazla tuzlu olmasından dolayı dikkatle kullanılması gerektiği tespit edilmiştir. Su örnekleri ölçüm değerleri üzerinde yapılan tekrarlanan ölçümlü deneme düzeninde varyans analizi, tek yönlü varyans analizi (ANOVA) ve korelasyon analizi yapılmıştır. İstatiksel açıdan parametreler arasındaki belirgin farklar ve ilişkiler belirlenmiştir
Anahtar Kelimeler: *Atıksu, evsel atık, endüstriyel atık, su kalitesi, su kirliliği, yeniden kullanım.*

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Effects of Inorganic and Organic Fertilizers on Irish Potato (*solanum tuberosum* L.): Growth, Yield and Pocessing Quality in Volcanic soil-Musanze district

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Abstract

The Irish potato (*solanum tuberosum* L.) is one of Rwanda's most important tuber crops, but its yield and processing quality fall short of desired levels. This study was done on two potato varieties namely Kinigi and Rwangume to assess the effect of different inorganic and organic fertilizers on their growth, yield and processing quality (Specific gravity and dry matter content). Field trial was conducted in Musanze district-Busogo sector with the following combination of fertilizers and varieties: T_1, T_2, T_3,…,T_{10} where T_1: Control +Rwangume , T_2: Control +Kinigi , T_3: Organic manure (Farm yard manure) + Rwangume, T_4: Organic manure (Farm yard manure) +Kinigi, T_5: Yara Winner (15-9-20+S, B, Zn, Mg, Mn) + OM +Rwangume, T_6: Yara Winner (15-9-20+S, B, Zn, Mg, Mn) + OM +Kinigi, T_7: NPK 17-17-17 + OM +Rwangume, T_8: NPK 17-17-17 + OM +Kinigi, T_9: Nitrabor (15N-25.6% CaO+B) + DAP + OM +Rwangume, T_{10}: Nitrabor (15N-25.6% CaO+B) + DAP + OM +Kinigi .

The experiment was set by splitting the main plot into two subplots. In each subplot we planted the potato varieties (Rwangume or Kinikigi) separately. In total we had 5 main plots treated with different treatments due to the combination of fertilizers. Each treatment was replicated into two replications. The parameters studied were emergence rate, number of stems per plant, leaves canopy, plant height, tuber size, number of tubers per plant, weight of tubers and total yield. In addition, the processing quality (dry matter content and specific gravity of tubers) were taken into consideration.

The ANOVA tables with Tukey HSD showed that the studied potato varieties were at 5% level of significant statistically different for all parameters except for specific gravity. The average quantities for kinigi variety were higher than rwangume variety for all measured parameters which implies that kinigi is better than rwangume. The treatments containing Yara Winner (15-9-20+S, B, Zn, Mg, Mn) + OM and Nitrabor (15N-25.6% CaO+B) + DAP + OM were found to perform well for almost all measured parameters and the ones including NPK 17-17-17 followed.

The kinigi variety is better than rwangume variety for all parameters that were studied. The combination of fertilizers with macro elements (Nitrogen, Phosphorus and Potassium) and micro elements applied at right time and right rate was found to perform well than organic manure only

***Key words**: Growth, Fertilizers, Yield, Processing quality, dry matter content, Specific gravity*

Introduction

Around 150 countries grow potato (*Solanum tuberosum* L.) and is the world's most vital non-cereal crop, playing a critical position in the worldwide food chain (Marwaha, 2009)

High yields require both organic and mineral fertilization (Anna et al., 2004), in the potato sector, processing quality has become increasingly crucial (Asunta *et al.*, 2008). The main quality characteristics of interest to both french fry and crisp producers are tuber size and shape, flesh colour, dormancy and storability, lowering sugar content and dry matter content (Genet, 1992).

In Rwanda, the potato is a strategic item that has the ability to increase food and nutrition security while also generating revenue. Potato intensification is low, despite its potential, resulting in low yield as well low quality for processing. A decline in soil fertility is the primary cause of the low yield. Farmers also use a wide range of fertilizer rates and types that are insensitive to the crop's actual needs. (Turamyenyirijuru, 2020). Potatoes with high dry matter content, low reducing sugar content, decent shape, and shallow eyes, for example, are required by established potato processing enterprises (USAID, 2016).

Materials And Methods

Experimental Site

The research was conducted in Northern Province, Musanze district (clay loam of volcanic soil) (Soil cares, Kigali City KK697, Bicumbi /Rwanda), Busogo sector. The site is geographically located at 1.56° or 1° 32' 16.7" south latitude and 29.55° or 29° 33' 44" east longitude. Its altitude is at 2,100 metres above sea level. The average annual temperature is 15.9 °C. The rainfall is around 1845 mm per year. (Rwanda Meteorology Agency (2020-2021)

Soil characteristics

The soil texture was clay loam which needed Nitrogen (N) 85kg, Sulphur (S) 2kg and Lime 250 kg with suitable crops of potatoes, beans, grains and vegetables for that soil type.

Table 1 Soil characteristics of study area

S/N	Parameter	Unit	Analysis Result	Level in soil
1	pH (water)	pH Value	7.0	adequate
2	Organic carbon	g/kg	57	high
3	Total Nitrogen	g/kg	5.1	high
4	Total Phosphorus	g/kg	2.2	high
5	Total Sulphur	g/kg	0.6	high
6	Potassium (exch.)	Mmol+/kg	10.5	high
7	Calcium (exch.)	Mmol+/kg	158.1	high
8	Magnesium (exch.)	Mmol+/kg	17.8	high
9	Zinc (M3)	mg/kg	7.8	high
10	Copper (M3)	mg/kg	0.9	low
11	Cation Exchange Capacity	Mmol+/kg	54	low
12	Total Aluminium	g/kg	82.4	adequate
13	Total Potassium	g/kg	36.8	high
14	Total Silicium	g/kg	242	adequate
15	Total Iron	g/kg	38.1	adequate

Source: Soil cares, Kigali City KK697, Bicumbi /Rwanda

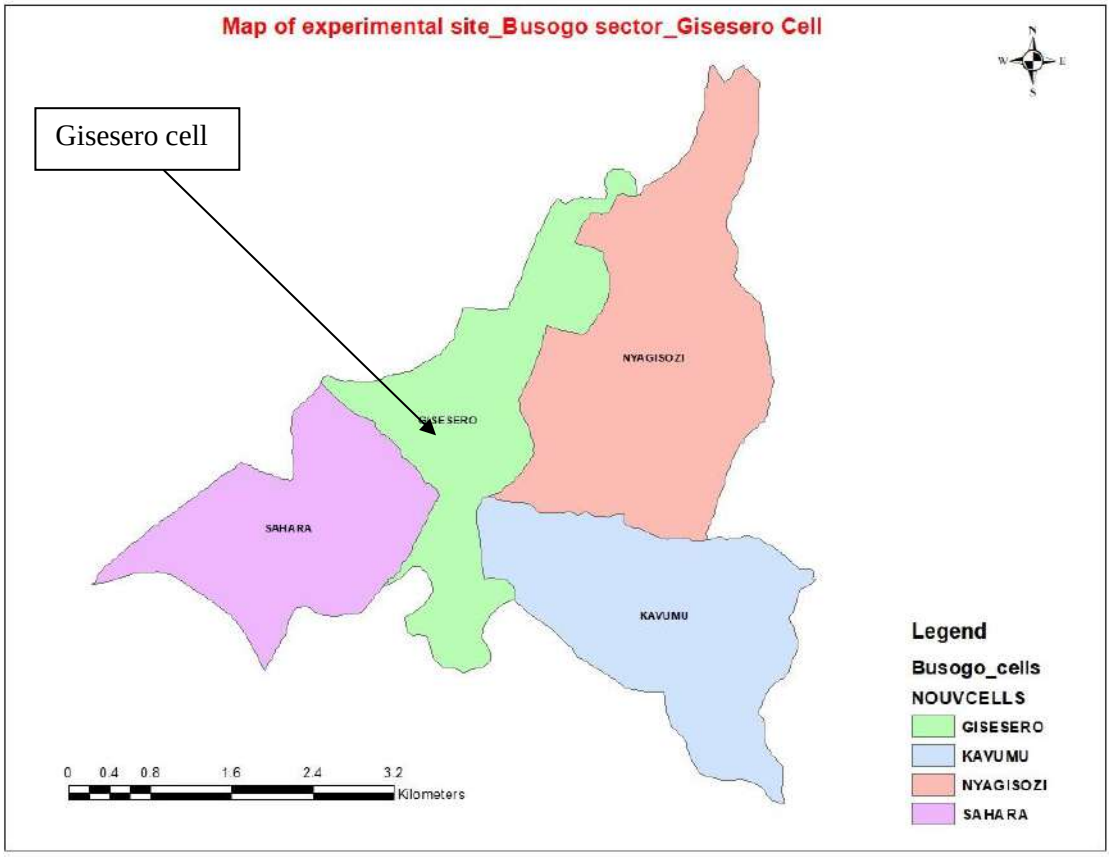

Figure 1 Map of experimental site

Table 2 Data from Rwanda Meteorology Agency

season A (October, 2020-January, 2021)						
Climate data / Month	RH (%)	Precipitation (mm)	Solar radiation (watt/m^2)	Temperature (^{o}C)		
				T max	T min	T average
October	81.57	8.52	157.15	20.48	11.13	15.28
November	79.99	3.29	175.85	14.52	7.07	15.10
December	80.79	4.35	182.49	22.11	12.58	17.25
January	76.71	5.7	169.96	22.45	11.87	17.16
season B (April-July, 2021)						
Climate data / Month	RH (%)	Precipitation (mm)	Solar radiation (watt/m^2)	Temperature (^{o}C)		
				T max	T min	T average
April	-39.68	10.97	4.22	21.63	12.44	16.59
May	-99	6.90	-99	21.94	12.24	16.45
June	-99	2.57	-99	20.78	12.09	16.13
July	-99	1.30	-99	20.26	11.39	15.82

Source: Rwanda Meteorology Agency (2020-2021)

Plant Materials

The potato varieties used are:

- Kinigi, where Mbowa and Mwesigye, (2016) reported that Kinigi is grown in high land regions and is high yielded; early matured and resistant to diseases also is able to support industry scale processing businesses as is chosen by processors.
- Rwangume has also almost the same characteristic to Kinigi, where Mbowa and Mwesigye, (2016) reported that Kinigi is grown in high land regions and is high yielded; early matured and resistant to diseases also is able to support industry scale processing businesses as is chosen by processors. This would be given the priorities.

These two varieties are being processed by Hollanda Fair Foods Ltd (Winnaz), needed to be improved in their growth, yield and processing quality for their crisps.

Land Preparation And Experimental Layout

Experimental plot size of land was 30mx15m from UR-CAVM Busogo campus farm and was cleared, cultivated manually with hand hoe; first cultivation was done followed by second cultivation before planting.

The Experimental design used was Split plot for Season A & B, 2020-2021. A plot treatment was the fertilizers and subplots were the potato varieties. The treatments of fertilizers are the following:

- (T_1) Control +Rwangume
- (T_2) Control +Kinigi
- (T_3) Organic manure (Farm yard manure) + Rwangume
- (T_4) Organic manure (Farm yard manure) +Kinigi
- (T_5) Yara Winner (15-9-20+S, B, Zn, Mg, Mn) + OM +Rwangume
- (T_6) Yara Winner (15-9-20+S, B, Zn, Mg, Mn) + OM +Kinigi
- (T_7) NPK 17-17-17 + OM +Rwangume
- (T_8) NPK 17-17-17 + OM +Kinigi
- (T_9) Nitrabor (15N-25.6% CaO+B) + DAP + OM +Rwangume
- (T_{10}) Nitrabor (15N-25.6% CaO+B) + DAP + OM +Kinigi

Fertilizers And Their Application

Fertilizers used in the study are: None Fertilizer as control, Organic manure (Farm yard manure), Yara Winner (15-9-20+S, B, Zn, Mg, Mn), NPK 17-17-17, Nitrabor (15N-25.6% CaO+B) + DAP (18-46-0) applied uniformly at planting time. The fertilizers were applied at planting just below the seed tuber with light covering of soil to avoid direct contact with the seed.

The fertilizers are chosen due their different content as compound fertilizers, the mixed were Nitrabor (15N-25.6% CaO+B) and DAP (18-46-0) as they contain macro elements which are essential for potato growth and micro elements or trace elements work in synergism to assess how they can affect the growth, yield and processing quality of irish potato (*Solanum tuberosum* L.)) for the french flies, chips and crisps.

For Organic manure, 12 tons/ha were applied at planting time where for each hole is applied 0.1kg of farmyard manure at planting time**.** For mineral fertilizers, 6 grams per hole were applied per hole**,** for the whole hectare 764 kg of NPK 17-17-17 were applied as 130 kg of Urea was required, 866 kg/ha of Yara winner (15-9-20+S, B, Zn, Mg, Mn) and 866 kg/ha of Nitrabor (15N-25.6% CaO+B) applied at planting time (Soil cares, Kigali City KK697, Bicumbi /Rwanda)

Planting

Planting was done in October, 2020 for season A and in April, 2021 for season B. The seeds had oval shape with good planting size of range 28 to 35mm, had also the first sprouts for emergence, at least three eyes had sprouts of about 3 cm height. The planting spacing was 80cm between rows and 30 cm within plants. 12 plants for Kinigi variety and 12 plants for Rwangume planted as subplots of $3m^2$ for each variety with one tuber per hole with planting depth at 8 cm.

Exeprimental Follow Up

All other crop husbandry practices were carried out. Weeding done at 21st day after planting, earthing up done at 45th day after planting using hand hoe. Plants with diseases were uprooted and rejected far from the experiment field. To adequately protect growing plants against late blight of potato, fungicide mancozeb 85% WP was treated once a week, Dudu acelamectin applied to control the insect pests.

Data Collection Parameters

The data were recorded manually by writing in notebook, managed and entered in computer. Among of measured parameters are:

- Emergence was evaluated after 3 weeks after planting by accounting among 12 plants grown in subplot,
- The number of stems per plant was counted for each plant from experimental plots of 12 plants in subplot at blooming stage, Only stems that originated from the mother tuber were measured
- Leaves canopy for plant at flowering stage measured using tape measure,
- Plant height at flowering stage measured using the tape measure and ruler from the ground of plant up the top at blooming phase
- Tuber size measured by passing a tuber through a free space from Potato calibrating tool
- Number of tubers for plant accounted considering the tuber size from 28 mm and above
- Weight of tubers per plant for yield at harvesting time, 4 months after planting using weighing balance
- Dry matter content measured digitally by advice called PW-2050 Digital Dry Matter Weigher
- Specific gravity for processing quality digitally by advice called PW-2050 Digital Dry Matter

Data Analysis

The data was analyzed through Excel sheet to show the results and verify the hypothesis. The data were analyzed using Microsoft excel by showing the ANOVA tables with Tukey HSD among of parameters with considered p-value equal to level of 0.05.

Results And Discussion

Emergence

The Yara Winner (15-9-20+S, B, Zn, Mg, Mn) performed well on Kinigi variety on emergence as it contains the macroelements and microelements that influence on germination rate and followed by control and NPK 17-17-17, Nitrabor (15N-25.6% CaO+B) + DAP and Organic manure (Farm yard manure) while Rwangume combined with these applied fertilizers did not show the difference on emergence, it seemed soil characteristics showed that had Organic Carbon, total Nitrogen, total Phosphorus, total Sulphur, Zinc, total Potassium were on high level for growth of potato and its quality. As reported by Li *et al.*, (2019) significant effects of K inputs on potato plant emergence were observed and Different fertilizer application strategies affected the crop emergence rate and also the emergence rate that might also due the climate factors fluctuation that affect the varieties to have different emergence performance, research showed that crop emergence and leaves canopy are both important significant physiological characteristics to consider when evaluating potato (Solanum tuberosum L.) cultivars and managing nutrients.

Number of stems per plant

The applied fertilizers on Rwangume for stem number did not show the difference while Yara Winner (15-9-20+S, B, Zn, Mg, Mn) and Nitrabor (15N-25.6% CaO+B) + DAP performed well on Kinigi variety, P and K have considerable effects, according to reports of Niguse (2016), fertilization on stem number per hill at early maturity were statistically significant, but not their interaction.

Leaves canopy

NPK 17-17-17 and Nitrabor (15N-25.6% CaO+B) and control were well to Rwangume variety whereas Yara Winner (15-9-20+S, B, Zn, Mg, Mn) and Nitrabor (15N-25.6% CaO+B) + DAP were well to kinigi variety on

leaves canopy. Considering that soil of study site had high macroelements, it seemed soil characteristics showed that had Organic Carbon, total Nitrogen, total Phosphorus, total Sulphur, Zinc, total Potassium were on high level for growth of potato and its quality

A large benefit of adequate P supply is quicker and complete canopy formation as mentioned by Jenkins and Ali (1999); Dyson and Watson (1971); Sale (1973); McCollum (1978b); Dyson and Watson (1971).

Rapid canopy development, root cell division, tuber set, and starch synthesis are all aided by phosphorus, The fact that Leaf Area Index (LAI) distribution in potato crop canopy was uneven probably represents a strategy to maximize carbon assimilation (Gastal and Lemaire, 2002; Yin *et al*., 2003).

However, carbon uptake of the crop is also influenced by crop N obtained via the growth of leaf area, which is less well-known, Furthermore, as of changes N intake throughout the soil for the period of crop growth, various depending on the amount of nitrogen supplied; foliage in the canopy can proliferate. Whereas leaf production stays constant (Gastal and Lemaire, 2002) and according to Villa *et al*., (2017) confirmed that nitrogen supply is a decisive factor for potato crop canopy formation.

Plant height

NPK 17-17-17 and Nitrabor (15N-25.6% CaO+B) + DAP performed well to Rwangume and NPK 17-17-17 and Organic manure (Farm yard manure) performed well to Kinigi variety on plant height. The applied fertilizers contained potassium showed performance on plant height (table 6) as Niguse, (2016) reported that K treatments resulted in a considerable increase in potato plant height and Similarly, Al-Moshileh and Errebi (2004) found that K fertilizer had a substantial impact on plant height.

Number of tubers per plant and Tuber Size

The tuber size showed the significant difference varieties and no difference among the applied fertilizers. Yara Winner (15-9-20+S, B, Zn, Mg, Mn) and Organic manure (farm yard) responded well to Rwangume variety and Yara Winner (15-9-20+S, B, Zn, Mg, Mn), NPK 17-17-17 and Nitrabor (15N-25.6% CaO+B) + DAP responded well to kinigi variety.

The tubers number showed the significant difference varieties and no difference among the applied fertilizers, Yara Winner (15-9-20+S, B, Zn, Mg, Mn), Nitrabor (15N-25.6% CaO+B) + DAP and Organic manure (farm yard) responded well on Rwangume whereas Organic manure (farm yard), Yara Winner (15-9-20+S, B, Zn, Mg, Mn) and NPK 17-17-17 responded well to Kinigi. The variety with high number of tubers per plant was Kinigi with organic manure.

Tuber size showed the high size for kinigi variety in average and by reaching the size of more 70 mm as the highest tuber size measured from Kinigi whereas Rwangume has the smallest tuber size of about 70 only.

The results showed the difference on number of tubers and tube size where the Yara Winner (15-9-20+S, B, Zn, Mg, Mn) responded well on both varieties on number of tubers, the high number of tubers per plant may be related to the richness of the experimental site in macroelements of Nitrogen, Phosphorus and Potassium which influence the number of tubers per plant and tubers size whereas both varieties has reached the 70mm diameter. But in average, Kinigi has large tuber size in diameter. The amount of phosphorus in the soil had a substantial impact on seed tuber output, according to the findings (Akoto et al., 2020). For french fried, large tubers with a high specific gravity or high starch content is required by processors (WHITE *et al*., 1974).

Weight of tubers per plant

Yara Winner (15-9-20+S, B, Zn, Mg, Mn) responded well to Kinigi variety as weighed more than Rwangume where all fertilizers did not show the difference to Rwangume.

Kinigi had high yield (147.45 kg season A and 139.7 kg season B) than Rwangume (114.35 kg and 126.4 kg) equivalent to 31.9 tons/ha for kinigi variety and 26.75 tons/ha of Rwangume variety, Yara winner influenced more on tuber weight to kinigi variety (table 9)

According to findings of Nyiransabimana (2011) and (Fashaho et al., 2013), in Busogo (northern Rwanda), nitrogen application rates of 140 kg N/ ha resulted in tuber yields ranging from 31 to 37.7 tons/ ha while nitrogen application rates of 150 kg N/ ha resulted in tuber yields of more than 42 tons/ha.

Dry matter content

Yara Winner (15-9-20+S, B, Zn, Mg, Mn) responded well to Rwangume variety and no difference of applied fertilizers to Kinigi variety on dry matter content.

Combination of applied fertilizers and varieties gave the range of desired dry matter content for crisps processing, in this study, the yara winner perfomed well on Rwangume variety with least significance difference but the Kinigi variety has the high dry matter content (21.06%), and applied fertilizers did not show the difference for Kinigi variety. Mohamed, E. M., *et al*., (2017) found that Organic green manure accumulated more dry matter in tubers and throughout the plant over time than mineral fertilizer, resulting in higher rates of dry matter accumulation in tubers and throughout the plant.

Specific gravity

The specific gravity did not show significant differences with the combination of fertilizers and varieties.

The specific gravity ranged from 1.072 to 1.085 for Kinigi and 1.058 to 1.079 for Rwangume, fertilized by organic manure. Findings reported that Excessive application rates of nitrogen and potassium, along with excessive soil levels of either nutrient, may reduce tuber solids (Laboski & Kelling, 2007)

The soil's chemical and physical qualities, as well as the climate, determine the specific gravity as reported by Khan et al., (2012) and the K-source of fertilizer has an impact on specific gravity of tubers (Westerman, 1994)

The best average daily temperature for improved productivity and quality potato production, according to Govindakrishan and Haverkort (2006), is below 21 ^{0}C and above 5 ^{0}C. To get more chips, manufacturers prefer tubers with a superior specific gravity than tubers with a lower specific gravity (Solaiman *et al*., 2015) as found in the results, are in best range for processing standard.

Conclusions And Recommendations

Generally, Kinigi variety showed good results comparatively to Rwangume in all measure parameters. The fertilizers containing more all macroelements (Nitrogen, Phosphorus and Potassium) are good for potato production as well microelements in supplements nutrition to potato crop and about processing qualities, Kinigi variety dominate Rwangume by applying among of Yara winner, NPK and/or Nitrabor + DAP combined by organic manure as resulted in this study.

As recommendation, the farmers can grow Kinigi variety for its great tuber size more than Rwangume where in average reached 70 mm diameter by Yara winner, NPK and Nitrabor + DAP and high specific gravity of 1.08

Acknowledgement

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Appendices

Table 1 Mean separations of emergence

Control+Rwangume	9.5a
Control+Kinigi	11ab
OM+Rwangume	10a
OM+Kinigi	8.5c
Winner+OM+Rwangume	10.5a
Winner+OM+Kinigi	12a
NPK+OM+Rwangume	9.5a
NPK+OM+Kinigi	11ab
Nitrabor+DAP+OM+Rwangume	10a
Nitrabor+DAP+OM+Kinigi	10.5b

LSD: 1.1507

Table 2 Mean separations of stem numbers

Control+Rwangume	19a
Control+Kinigi	22.5ab
OM+Rwangume	17a
OM+Kinigi	22.5ab
Winner+OM+Rwangume	16.5a
Winner+OM+Kinigi	26a
NPK+OM+Rwangume	19.5a
NPK+OM+Kinigi	19.5ab
Nitrabor+DAP+OM+Rwangume	18.5a
Nitrabor+DAP+OM+Kinigi	26.5a

LSD: 5.55

Table 3 Mean separations of leaves canopy

Control+Rwangume	54.5a
Control+Kinigi	52.75b
OM+Rwangume	43.75b
OM+Kinigi	50.55b
Winner+OM+Rwangume	42.3c
Winner+OM+Kinigi	69.05a
NPK+OM+Rwangume	56.5a
NPK+OM+Kinigi	47b
Nitrabor+DAP+OM+Rwangume	62a
Nitrabor+DAP+OM+Kinigi	70.25a

LSD: 7.814

Table 4 Mean separation of plant height

Control+Rwangume	73.5b
Control+Kinigi	66.5ab
OM+Rwangume	65.5b
OM+Kinigi	74a
Winner+OM+Rwangume	65.5b
Winner+OM+Kinigi	66.35ab
NPK+OM+Rwangume	83.5a
NPK+OM+Kinigi	73.5a
Nitrabor+DAP+OM+Rwangume	89.5a
Nitrabor+DAP+OM+Kinigi	59.35b

LSD : 8.334

Table 5 mean separations for tuber size

Control+Rwangume	31.5c
Control+Kinigi	52.5b
OM+Rwangume	70a
OM+Kinigi	60.9375ab
Winner+OM+Rwangume	70a
Winner+OM+Kinigi	70a
NPK+OM+Rwangume	50b
NPK+OM+Kinigi	70a
Nitrabor+DAP+OM+Rwangume	50b
Nitrabor+DAP+OM+Kinigi	70a

LSD: 10.58

Table 6 mean separations of tubers number

Control+Rwangume	34b
Control+Kinigi	43.b5
OM+Rwangume	69.5a
OM+Kinigi	72.5a
Winner+OM+Rwangume	56.5a
Winner+OM+Kinigi	71.5a
NPK+OM+Rwangume	28.5b
NPK+OM+Kinigi	64.5a
Nitrabor+DAP+OM+Rwangume	68.5a
Nitrabor+DAP+OM+Kinigi	59ab

LSD: 19.477

Table 7 mean separations of weight of tubers

Control+Rwangume	4.975a
Control+Kinigi	4.75b
OM+Rwangume	3.225a
OM+Kinigi	5.45b
Winner+OM+Rwangume	5.35a
Winner+OM+Kinigi	8.875a
NPK+OM+Rwangume	4a
NPK+OM+Kinigi	4.125b
Nitrabor+DAP+OM+Rwangume	3.85a
Nitrabor+DAP+OM+Kinigi	5.75b

LSD: 2.425

Table 8 mean separation of dry matter content

Control+Rwangume	18.1b
Control+Kinigi	20.29a
OM+Rwangume	18.71ab
OM+Kinigi	20.445a
Winner+OM+Rwangume	19.5a
Winner+OM+Kinigi	20.27a
NPK+OM+Rwangume	18.525ab
NPK+OM+Kinigi	20.27a
Nitrabor+DAP+OM+Rwangume	18.015b
Nitrabor+DAP+OM+Kinigi	21.06a

LSD: 1.3065

At P=0.05, numbers in columns with the same letter are not statistically distinct.

ID: 766

Development of Prebiotic Edible Films for Food Applications

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Abstract

Due to the increasing environmental pollution caused by non-degradable synthetic polymers, significant effort was directed towards developing biodegradable, environmentally friendly, biopolymer films that could be used either to replace the conventional food packaging materials or as a nutritional supplement in the form of edible films. The functionality of these edible films can be achieved by the use of selected plant polymers, which act as prebiotics for the regulation of the customer's digestive system, once consumed with the food. In our study potential food packaging material has been formulized by blending guar gum (GG) and konjac glucomannan (KGM) polysaccharides and using glycerol (G) as a plasticizer. The most important feature that distinguishes this film from other materials is that a prebiotic derivative, konjac glucomannan (KGM), is extremely beneficial to the health of the human digestive system and is renewable and completely natural. Stock solutions of 0.8% (w/w) guar gum (GG) and 0.8% konjac glucomannan (KGM) were used in the generation of different formulations of polymer blends in ratios of 1:0, 3:1, 1:1, 1:3, and 0:1, plasticized with 30% (w/w solids) glycerol (G). The films were obtained by solution casting method. The physical and chemical properties of the prebiotic films were determined by measurement of their thickness, water vapor permeation ratio (WVPR), transparency, water solubility, and antioxidant content, total phenolic content, tensile stress, and elongation.

The thickness of the edible films varied between 0.0356 and 0.0487mm, their opacity between 2.8 and 5.3, solubility between 54.0% and 87.3 %. Films' WVPR was around 55.2 mg/day, and their antioxidant activity was measured as approximately 20% inhibition. The mechanical test revealed that films withstand tensile strength between 21.6 and 54.1 MPa and endure elongation between 5.11% and 24.17%.

The results showed that the GG/KGM/G composite is a promising candidate to be used as a prebiotic edible material for food packaging applications.

Key Words: *Edible Film, Prebiotic, Guar gum, Konjac glucomannan.*

Gıda Uygulamaları için Prebiyotik Yenilebilir Filmlerin Geliştirilmesi

Özet

Bozunmayan sentetik polimerlerin neden olduğu artan çevre kirliliği nedeniyle, geleneksel gıda ambalaj malzemelerinin yerini almak için veya besin takviyesi olarak kullanılabilecek yenilebilir, biyolojik olarak parçalanabilir, çevre dostu biyopolimer filmlerin geliştirilmesine yönelik önemli araştırmalara yönelindi. Bu yenilebilir filmlerin işlevselliği, bir kez yemekle birlikte tüketildiğinde müşterinin sindirim sisteminin düzenlenmesi için prebiyotik görevi gören seçilmiş bitki polimerlerinin kullanılmasıyla elde edilebilir. Çalışmamızda, guar gam (GG) ve konjak glukomannan (KGM) polisakkaritleri ve plastikleştirici olarak gliserol (G) kullanılmasıyla potansiyel gıda ambalaj malzemesi formüle edilmiştir. Bu filmi diğer malzemelerden ayıran en önemli özelliği prebiyotik türevi olan konjak glukomannanın (KGM) insan sindirim sistemi sağlığına son derece faydalı olması, yenilenebilir ve tamamen doğal olmasıdır. %0,8 (a/a) guar gam (GG) ve %0,8 konjak glukomannan (KGM) stok çözeltileri, 1:0, 3:1, 1:1, 1:3 ve 0:1 oranlarında formülasyonlarının üretilmesinde kullanıldı. %30 (a/a katılar) gliserol (G) ise plastikleştirici olarak ilave edildi. Filmler çözelti döküm yöntemi ile elde edildi. Prebiyotik filmlerin fiziksel ve kimyasal özellikleri, kalınlık, su buharı geçirgenlik oranı (SBGO), şeffaflık, suda çözünürlük ve antioksidan ve toplam fenolik içerik, çekme gerilimi ve uzama ölçümleri yapılarak belirlendi.

Yenilebilir filmlerin kalınlığı 0,0356 ile 0,0487 mm arasında, opaklıkları 2,8 ile 5,3 arasında, çözünürlükleri %54,0 ile %87,3 arasında değişmiştir. Filmlerin SBGO 55,2 mg/gün civarındaydı ve antioksidan aktiviteleri yaklaşık %20 inhibisyon olarak ölçüldü. Mekanik testler, filmlerin 21,6 ile 54,1 MPa arasında gerilme mukavemetine ve %5,11 ile %24,17 arasında uzamaya dayandığını ortaya koydu.

Sonuçlar, GG/KGM/G kompozitinin, gıda paketleme uygulamaları için prebiyotik yenilebilir malzeme olarak kullanılmak üzere umut verici bir aday olduğunu gösterdi.

Anahtar Kelimeler: *Yenilebilir Film, Prebiyotik, Guar gam, Konjak glukomannan*

ID: 767

Selenium And Its Effects In Horticulture

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Abstract
Selenium (Se), an essential microelement for human health, helps cells clean themselves and prevent cancer. Se is required by horticultural plants for human nutrition as well as for its actions in plant metabolism and function. Effects of selenium on resistance to abiotic and biotic stresses. Temperature is an important environmental factor affecting the cultivation of horticultural crops, especially out-of-season vegetable crops. This review aimed to provide a theoretical basis for practical applications for selenium and to review its functions and studies in horticultural crops.
Key Words: *Horticultural Plants, Se,abiotic stress,biotic stress*

Bahçe Bitkilerinde Selenyum ve Etkileri

Özet
İnsan sağlığı için gerekli bir mikro element olan Selenyum (Se), kanseri önlemede, bağışıklığı artırmada, hücreleri detoksifiye etmede işlev görür. Bahçe bitkileri, insanların beslenmesi için Se'ye ihtiyaç duyar ve bitki metabolizması ve fonksiyonlarındaki mekanizmaları gereklidir. Selenyumun abiyotik ve biyotik streslere karşı direnç üzerindeki etkileri sıcaklık, bahçe bitkilerinin, özellikle de mevsim dışı sebze bitkilerinin yetiştirilmesini etkileyen önemli bir çevresel faktördür.Bu derleme, selenyum için pratik uygulamalara teorik bir temel sağlamak amacıyla ve bahçe bitkilerindeki işlevlerini, yapılan çalışmaları gözden geçirmeyi hedeflemiştir.
Anahtar Kelimeler: *Bahçe bitkileri,Se, abiyotik stres, biyotik stres*

Giriş

Toprağın kimyası içerisinde geniş bir konuma sahip olan konulardan biri de bitki besin elementleridir. Bitki büyüme ve gelişmesini başarılı bir şekilde gerçekleştirmesi için çevreden bir miktar besin elementi alması gerekmektedir. Bitkide bir besin elementinin gerekliliği için iki kriter göz önünde bulundurulur (Epstein ve Bloom, 2005). Bunlardan ilki besin maddesinin bir bitkinin yapısında veya metabolizması içerisinde içsel bir bileşeni olan bir molekülün parçası olması bir diğeri ise söz konusu besin elementi büyümeden çıkarıldığında bitkinin büyüme ve gelişmesinde farklılık görünmesi durumunda besin elementi bitki için gereklidir. Bitki besin elementleri makro ve mikro olarak sınıflandırılmaktadır. Makro besin elementleri, mikro besin elementleri ile birçok yönden kıyaslanabilmektedir. Bunlardan en önemlisi bitkiler; makro besin elementlerine, mikro besin elementlerine göre büyük miktarda ihtiyaç duymaktadır. Mikro besin elementleri ise bitkiler için eser miktarda gereklidir (Fageria, 2016). Ancak mikro besin elementlerinin yokluğunda veya fazlalığında bitki büyüme ve gelişimi olumsuz etkilenmektedir. Sadece verim üzerine değil elde edilen ürünün kalitesinin bozulmasına da neden olmaktadır (Can ve ark.).
Selenyum (Se) mikro elementler içerisinde yer almaktadır. 1817 yılında İşveçli kimyager Jons Jacob Berzelius (Berzelius, 1817) tarafından keşfedilmiştir .Uzun süre boyunca toksik bir element olarak kabul görülmüştür ancak 1957 yılında bitki için gerekliliği anlaşılmıştır (Schwarz ve Foltz, 1957). Selenyumun insanlar ve hayvanlar için eser bir element olarak bilinmekte ayrıca ikisi arasındaki bağ tam olarak bilinmemekte ve birçok değişkene bağlanmaktadır (Fan ve ark., 2002; Salhani ve ark., 2003).

Selenyumun İşlevleri

Selenyum (Se) mikro elementler içerisinde yer almaktadır. 1817 yılında İşveçli kimyager Jons Jacob Berzelius (Berzelius, 1817) tarafından keşfedilmiştir .Uzun süre boyunca toksik bir element olarak kabul görülmüştür ancak 1957 yılında bitki için gerekliliği anlaşılmıştır (Schwarz ve Foltz, 1957). Selenyumun insanlar ve hayvanlar için eser bir element olarak bilinmekte ayrıca ikisi arasındaki bağ tam olarak bilinmemekte ve birçok değişkene bağlanmaktadır (Fan ve ark., 2002; Salhani ve ark., 2003). Selenyum, insanlarda, hatta COVID-19 enfeksiyonlarıyla mücadelede hayati bir rol oynar (Alexander ve ark., 2020; Bae ve Kim, 2020; Hiffler ve Rakotoambinina, 2020; Moghaddam ve ark., 2020; Zhang ve ark., 2020). Bitkilerde az miktarda bulunan bu mikro element, çoğu hayvan ve insanlarda antioksidan etkisi vardır fakat amino asitlerde bulunan kükürtün selenyum ile yer değiştirmesi ile birlikte yüksek konstrasyonlarda toksik etki yapmaktadır. Bunun sonucu olarak da proteinlere zarar vererek yanlış katlanmasına neden olmaktadır.
Son yıllarda yapılan çalışmalarda selenyumun insan sağlığı açısından temel bir öneme sahip olduğu anlaşılmaktadır. İnsanları çeşitli hastalıklardan koruyarak antioksidan etki yapmaktadır. Bugüne kadar yapılan

çalışmalar ile insan vücudunda en az 25 selenoprotein bulunmuştur. Bunlar arasında glutatyon peroksidaz (GPx) (Arthur, 2001) tioredoksin redüktaz (TRx) (Kurozumi ve ark., 2000), deiyodinaz ve selenoprotein P'nin (SeP) önemli biyolojik fonksiyonlara sahip olduğu bilinmektedir (Renko ve ark., 2017).GPx, insan vücudunda çeşitli peroksitleri temizleyen ve dokuları ve hücreleri peroksidasyondan koruyan önemli bir peroksidazdır. Birçok çalışma selenyumun kanser önleyici etkiler gösterdiğini doğrulamıştır (Álvarez-Pérez ve ark., 2018; Elhodaky ve Diamond, 2018; Gandin ve ark., 2018).Selenyum eksikliği, bağışıklık, tiroid ve üreme bozukluklarının yanı sıra kanser ve hatta ölüm dahil olmak üzere çeşitli insan sağlığı sorunlarına neden olmaktadır (Řezáčová ve ark., 2016; Gupta ve Gupta, 2017).

Selenyumun Alımı ve Taşınması

Selenyum doğada inorganik ve organik formlarda bulmaktadır. İnorganik formlar selenattır ;selenit, selenid, elemental olarak Se ile ifade edilmekte ve başlıca organik formlar SeCys ve SeMet'tir (Sors ve ark., 2005; Bodnar ve ark., 2012; Wu ve ark., 2015).Bitkide selenyum köklerinde ağırlıklı olarak selenat şekilde alınır. Fakat bitkiler selenit ve organik selenyum olarak da kolayca alır (Sors ve ark., 2005).Selenyumun organik formları, inorganik formlardan daha hızlı alınmakta ve organik formların alımı ile bir protein veya spesifik alım mekanizması arasındaki korelasyon hakkında az şey bilinmektedir. Selenyum alımının uygun dozlarda bitkiye birçok faydası bulunur (Şekil-1). Bitkileri oksidatif hasarlardan korur bunun yanında bitkinin antioksidan özelliklerini geliştiren, strese ve yaşlanmaya karşı bitkinin direncini artırır (Xue, Hartikainen, ve Piironen 2001; Pennanen, Xue, ve Hartikainen 2002) . (Bañuelos ve ark., 2020), doğal olarak yüksek seviyelerde Se ve Bor içeren tuzlu topraklarda brokoli, kırmızı lahana, yeşil lahana, Savoy lahanası ve İsviçre pazısı üzerinde biyofortifikasyon oluşup oluşmadığını gözlemlenmişlerdir. Biyofortifikasyon, insanlarda yaygın olarak eksikliği görülen vitamin ve minerallerin toplum tarafından en çok tüketilen ürünlerdeki konsantrasyonlarının arttırılarak, insanlardaki noksanlığının giderilmesi prensibine dayanmaktadır. Bitki içi dokularında, selenyum tür analizleri, selenyum içeren bileşiklerin en büyük yüzdelerinin organik selenyum formlarında (monometillenmiş) ve inorganik Se formlarında selenat olarak bulunduğu belirlenmiştir. Bor ve Selenyum içeriği yüksek tuzlu topraklardan üretilen selenyumla zenginleştirilmiş sebzeler, biyoaktif gıda ürünleri olarak tüketilebilen doğal bir Se ile biyo-takviyeli gıda kaynağı olabileceği sonucuna varmışlardır.

Selenyumun taşınması formlarına göre farklılık göstermektedir. Selenit, bir fosfat taşıma mekanizması kullanılarak taşınır (Li ve ark., 2008), selenat ise sülfat taşıyıcıları ve kanalları kullanılarak taşınır (Zhang ve ark., 2003). Selenit köklerde hızla organik Se bileşiklerine dönüşür, selenat ise hemen ksileme verilir (Ximénez-Embún ve ark., 2004; Li ve ark., 2008).Selenit, meyveler, yapraklar veya kök olmayan diğer yenilebilir kısımlarda selenata kıyasla nispeten güvenlidir. Bununla birlikte, organik selenyumun dönüştürülmesi kesinlikle güvenli bir mekanizma değildir, çünkü Se'nin organik formları, özellikle proteinlere spesifik olmayan bir şekilde dahil edildiğinde SeCys olmak üzere toksisiteye neden olabilir (Brown ve Shrift, 1982).

Se'nin abiyotik ve biyotik streslere karşı direnç üzerindeki etkileri

Selenyumun abiyotik ve biyotik streslere karşı direnç üzerindeki etkileri sıcaklık, bahçe bitkilerinin, özellikle de mevsim dışı sebze bitkilerinin yetiştirilmesini etkileyen önemli bir çevresel faktördür. Uygun olmayan sıcaklıklar genellikle mahsul veriminde ve kalitesinde büyük düşüşlere yol açar. Bu nedenle, bitki sıcaklık adaptasyon mekanizmaları ve ani sıcaklık değişimleriyle başa çıkmak için etkili ve güvenli bitki büyüme düzenleyicileri önemli araştırma alanlarıdır. Yüksek sıcaklık stres koşulları altında net fotosentez, büyüme ve üretkenlikle ilişkili özelliklerde Se kaynaklı gelişmeler, gelişmiş antioksidan aktiviteler ve ozmolit birikimleri ile bağlantılıdır.

Bahçe bitkileri yetiştiriciliğinde ekonomik olarak yetiştiricilikte suya ihtiyaç duyulmaktadır. Su stresi veya fizyolojik kuraklık, mahsullerin büyümesini ve gelişmesini genellikle farklı düzeylerde etkiler. Dolayısıyla verimi de önemli ölçüde etkilemektedir. Son yıllarda yapılan çalışmalarda ise selenyumun kuraklık koşulları altında bitkilerin su durumunu düzenleme yeteneğine sahip olduğu gösterilmiştir (Kuznetsov ve ark., 2003).Kuraklık stresine maruz kalan çilek bitkilerine selenyum uygulaması yapılarak, SiO2 nanoparçacıkları içeren çözeltilerin püskürtülmesi, Se ve Se/SiO2 (50 ve 100 mg L-1), normal ve kuraklık stresi koşullarında (30, 60 ve %100 FC) yetiştirilen çilek bitkilerinin büyüme ve verim parametrelerini iyileştirdiğini bunun yanında bağıl su içeriğini (RWC), membran stabilite indeksini (MSI) ve su kullanım verimliliğini (WUE) de artırmıştır. Se/SiO2'nin dışarıdan püskürtülmesi, katalaz (CAT), askorbat peroksidaz (APX), guaiakol peroksidaz (GPX) ve süperoksit dismutaz (SOD) gibi antioksidan enzimlerin aktivitesini artırarak ve ayrıca lipid peroksidasyonunu ve hidrojeni azaltarak kuraklık toleransını artırdığı gözlenmiştir (Zahedi ve ark., 2019).Araştırmacılar bamyadaki kuraklık toleransını iyileştirmede Selenyum (Se) rolünü değerlendirmek için çalışmışlardır. Kuraklık stresini (üç gün (kontrol), altı gün (hafif stres) ve dokuz gün (şiddetli stres)) ve dört doz Se (0, 1, 2 ve 3 mg L-1) ekimden 30 gün sonra uygulamışlardır. Kuraklık stresi altında Se'nin yapraklara uygulanmasıyla vejetatif ve verim parametrik kalitede bamya bitkisindeki görsel azalma önemli ölçüde azaltılmıştır. 3 mg L-1 Se uygulaması yaprak sayısını, bitki boyunu, dal sayısını, gövde kuru ağırlığını, kök kuru ağırlığını, meyve çapını, bitki başına meyve sayısını ve 1000 tohum ağırlığını önemli ölçüde artırmıştır(Ali ve ark., 2020).

Sebze endüstrisi içerisinde toprak ve sebzelerin kadmiyum (Cd) kontaminasyonu önemli sorunlardan birisidir. Selenyum uygulamaları yapılan çalışmalarda kadmiyum stres toleransını etkilemektedir. Kurşun ve kadmiyum stresine maruz kalan salatalık üzerinde çiçeklenme indeksleri, çiçeklerin cinsiyet tayini ve verimi üzerine selenyumun etkisini araştırılmıştır ve deneme süresince üç aşamada uygulanan selenyum (0, 4, 6, 8 mg) ve kadmiyum (0, 20, 25 mM) ve kurşun (0, 60, 100 mM) ağır metallerinden oluşan uygulamalar yapmışlardır. Çalışma sonucunda kadmiyum ve kurşun ile muamele edilen bitkilerde gecikmiş meyve verme ve meyve büyüme indekslerinde ve toplam verimde önemli düşüşler gözlemişler ve kültür ortamına selenyum eklenmesi çiçeklenmeyi hız kazandırmış ayrıca daha fazla erkek çiçeğin ortaya çıkması stres altındaki bitkilerde dişi çiçek sayısının erkek çiçeklere oranını artırdığı gözlenmiş ve bu elementin en yüksek etkisi 6 mg/L konsantrasyonunda gözlemlemişlerdir. Sonuç olarak stresli ve stressiz koşullarda 4 ve 6 mg/L selenyumun uygulanması meyve vermeyi kayda değer biçimde artırmıştır. Çalışma sonucunda selenyumun, ağır kurşun ve kadmiyum elementlerinin stresi altında salatalık bitkisinde stres koşullarının kontrolü ve çiçeklenme indekslerinin ve toplam verimin iyileştirilmesi üzerinde olumlu bir etki yaptığını belirtmişlerdir (Shekari ve ark., 2019). Biyolojik stres açısından selenyum arasındaki ilişki tam olarak belirlenmemekle birlikte Sodyum Se, antioksidan potansiyelini ve fenolik bileşik seviyelerini değiştirerek domatesi fusarium solgunluğundan koruduğu belirlenmiştir (Chen ve ark., 2014).

Selenyumun diğer elementler ile ilişkisi

Selenyumun bazı elementler ile sinerjit ilişki ilişki içerisinde olurken bazıları ile antagonistik ilişki içerisindedir. Beslenme üzerinde farklı elementlerin selenyum ile nasıl birleştiği hatta kombinasyon uygulamalarının da bilinmesi son derece önemlidir. (Grujcic ve ark., 2021),azot uygulamalarının sürgünlerde Selenyum konsantrasyonu ve birikimi üzerine etkisinin olmadığını bildirmiştir. P kaynağındaki bir artış, kök hücre duvarında Se birikimini önemli ölçüde inhibe eder, ancak organellerdeki Se dağılımını ve kök hücrelerinin çözünür fraksiyonlarını arttırır (Liu ve ark., 2018).Sofralık üzüm kalitesine yaprak selenyum gübresi püskürtme ile bazı parametreleri incelemek istemişlerdir. Se gübresi çözünür şeker, Vc, çözünür protein, çözünür katı, indirgenmiş organik asit dahil olmak üzere beslenme kalitesini arttırırken, Avrasya türlerinin polifenol antioksidanları üzerinde hiçbir etkisi olmamıştır. Üzüm meyvelerinin K ve Ca içeriği önemli ölçüde artmış ve ağır metallerin Pb, Cr, Cd, As, Ni birikimini azaltmıştır. Se gübresi, özellikle Avrupa ve Amerika türleri için üzümün Se içeriğini artırmak için, üzüm besleme kalitesini artırmanın önemli etkisi ve ağır metalleri düşürmenin etkili bir yolu ile kullanılabilir (Zhu ve ark., 2017). Selenyumun toprak ilavesi ile uygulanması, domateslerde yapraktan ilaçlamadan daha etkili olduğu belirlenmiştir (Rady ve ark., 2020). Aşırı fosfor gübrelemesi, ürünler tarafından selenyum alımının artmasına katkıda bulunmaktadır (Altansuvd ve ark., 2014).Önemli olan selenyum ile zenginleştirilmiş tarım ürünlerinin hasat edilmesi için, Se düzeyi yüksek çeşitlerin seçilmesi ve yüksek selenyumu korumak için uygun yetiştirme koşulları ve tekniklerinin seçilmesidir. Asıl amacı beslenme ve sağlık üzerine olan meyve ve sebze işlenmiş ürünlerde, ürünlerdeki doğal Se içeriklerini korumak için uygun işleme teknolojileri kullanılmalıdır. Şu anda, bu alandaki araştırmalar hala eksiktir.

Ayrıca fosfor arzındaki bir artış, bitki gövdelerinin hücre duvarlarında ve yaprakların hücre organellerinde selenyum birikimini arttırır, ancak gövde ve yaprakların çözünürlükleri Se dağılımını engeller (Liu ve ark., 2018).Ayrıca, toprağın uzun süreli fosfor gübrelemesi, ürünler tarafından Se alımının artmasına katkıda bulunur (Altansuvd ve ark., 2014).Se, Na+ ve K+ düzenlenmesine katılarak tuz stresini azaltabilir (Jiang ve ark., 2017).Yapılan bir çalışmada çilek meyvelerinde selenyum-nanopartiküllerin yaprak spreyi ile püskürtülerek bitkilerinin büyüme ve verimi üzerindeki olumsuz etkilerini fizyolojik ve biyokimyasal mekanizmalar aracılığıyla hafifletmedeki yararlı rolünü araştırmışlardır. Se-NP'lerin (10 ve 20 mg L-1) yaprak spreyi, tuzlu olmayan ve farklı tuzlu topraklarda (0, 25, 50 ve 75 mM NaCl) yetiştirilen çilek bitkilerinin büyüme ve verim parametrelerini iyileştirdiği, Se-NPS'nin yapraktan uygulanması, süperoksit dismutaz ve peroksidaz gibi antioksidan enzimlerin aktivitelerini artırarak stres kaynaklı lipid peroksidasyonunu ve H2O2 içeriğini azaltarak çileklerde tuzluluk toleransını iyileştirdiğini saptamışlardır. Ayrıca, tuzlu koşullar altında Se-NP'lerle muamele edilmiş çilek bitkilerinin meyvelerinde organik asitlerin (örneğin malik, sitrik ve süksinik asitler) ve şekerlerin (örneğin, glikoz, fruktoz ve sakaroz) artan seviyeleri, Se-'nin olumlu etkilerini gösterdiğini sapmışlardır (Zahedi ve ark., 2019). Selenat formunda Mg, Zn ve Mn birikimlerini artırma eğilimindeyken, selenat/selenit karışımı olarak Ca, Mg, Zn ve Mn birikimlerini azaltma eğilimindedir (Longchamp ve ark., 2016).

Bahçe Bitkilerindeki Se içeriği ve etkileri

Beslenme ile selenyum alımı, büyük ölçüde topraktaki Se içeriğine ve insan Se'sinin ana kaynakları olan ürünler için biyoyararlanımına bağlıdır (Winkel ve ark., 2015). Bu nedenle bitkilerde selenyum ile ilgili araştırmalar ciddi önem taşımaktadır.

Domates, salatalık, turp gibi bahçe bitkilerinde selenyum konsantrasyonları ve tedaviler arasında büyük farklılıklar gösterebilmektedir (Balal ve ark., 2016; Schiavon ve ark., 2016; Zhu ve ark., 2018). Se konstrasyonunu belirlemek amacıyla "Jinyou 315" salatalık bitkisine Si (1 mM) ve Se (0.025 mM) ayrı ayrı veya kombinasyon halinde yapraktan ilaçlama uygulamışlar ve bunların büyüme, verim ve meyve kalitesi üzerindeki etkileri araştırılmıştır.

Araştırma sonucunda, Si ve Se uygulamasının ayrı ayrı veya kombinasyon halinde salatalığın fotosentezi, büyümesini ve verimini arttırdığını ve sırasıyla Si ve Se'nin uygulanması, meyvedeki çözünür şekerlerin ve amino asitlerin konsantrasyonlarını ve birikimlerini artırdığı gözlenmiştir. Se ilavesi, sitrik asit, malik asit ve oksalik asit seviyelerini artırarak toplam organik asit birikimini artırdığı gözlenmiş ayrıca eklenen Si, meyvedeki C vitamini konsantrasyonunu artırırken, eklenen Se, toplam fenolik ve flavonoid konsantrasyonlarını artırmış ve nitrat birikimini azaltmıştır. Bu sonuçlar ile birlikte, Si ve Se'nin ayrı ayrı veya kombinasyon halinde uygulanmasının salatalık büyümesini, verimini ve beslenme kalitesini arttırdığını ve Si ve Se'nin birleşik etkisinin, bireysel uygulamalarından daha açık olduğu belirlemişlerdir. Bu çalışma, Si ve Se'nin yüksek kaliteli salatalık üretiminde uygulanması için teorik bir temel sağlayabileceği önerisinde bulunmuşlardır (Hu ve ark., 2019).
Selenyumun bitki büyümesi ve verimindeki rolü konsantrasyona bağlıdır. Eğer uygun selenyum konsantrasyonlarında uygulama yapılırsa pozitif bir etki yapmaktadır. Aşırı uygulanan selenyum konsantrasyonlarında negatif etkisi söz konusudur (Hossain ve ark., 2021).Uygun selenyum konsantrasyonlarının uygulanması patates, biber, kuzu marulu, şalgam ve fasulyenin büyümesine fayda sağlar (Aggarwal ve ark., 2011; Li ve ark., 2015; Hawrylak-Nowak ve ark., 2018; Haghighi ve ark., 2019).Hem selenat hem de selenit takviyelerinin düşük dozları sürgün biyokütlesini arttırmaktadır (Boldrin ve ark., 2016).Erken fide gelişimi sırasında, nitrik oksit (NO) içeriği azalır, ancak hidrojen peroksit seviyeleri artar. Se fazlalığı olduğunda oksin azalır ve etilen artar (Lehotai ve ark., 2012).Selenyumun meyve tatlılığında bir artış tespit edilmiş ve bu da Se ilavesi ile meyve kalitesinde bir iyileşme olduğunu düşündürmüştür (Mimmo ve ark., 2017; Lanza ve Dos Reis, 2021).Bamya bitkilerine yetiştirme mevsimi boyunca farklı tuzluluk seviyelerinde (4, 8 ds.m-1 NaCl) üç selenyum (0,10, 20 mg.L-1) uygulaması püskürtülerek yapılmıştır .Çalışma sonucu olarak artan dozlarda selenyum püskürten bitkiler, verim göstergelerinde önemli bir artışa yol açtığı saptanmıştır.(Abdullah ve Haamed, 2018) Nar meyvesi üzerine tam çiçeklenme ve tam çiçeklenmeyi takiben 1 ay sonra uygulanan 1 ve 2 µM'de selenyum (sırasıyla Se1 ve Se2, N-Se1 ve N-Se2) püskürtülmüştür. Yüksek bir N-Se konsantrasyonunun düşük bir konsantrasyondan daha büyük ve daha faydalı bir etkiye sahip olduğu sonucuna varmışlardır (Zahedi ve ark., 2019).Şeftali ve armutta meyve büyüme ve gelişmesi üzerine sodyum selenatın selenyumun birikimi üzerine etkisi araştırmak amacıyla iki yetiştirme mevsimi boyunca uygulanmıştır. Birinci yıl şeftali ve armutta 0.1-1,0 mg/L-1 uygulanmış, ikinci yıl da 1,0 mg/L-1 selenat uygulaması yapmışlardır. Yapraktan selenat ilavesi hem yapraklarda hem de meyvelerde Se konsantrasyonunda artışa neden olmuştur. Meyvede daha yüksek Se içeriği, et sertliğinde bir artışa ve çözünür katı içeriğinde bir azalmaya neden olmuştur. Artan Se konsantrasyonu meyvenin raf ömrünü etkilemiş, meyve eti sertliğindeki azalmaya neden olmuş bu durum meyve depolamayı olumlu yönde etkilediğini vurgulamışlardır (Pezzarossa ve ark., 2012).

Sonuçlar Ve Öneriler

Selenyum bahçe bitkileri üzerinde birçok faydası bulunmaktadır. Bahçe bitkileri tür ve çeşitler içerisinde selenyum uygulamalarına ve büyüme koşullarına göre farklılık göstermektedir. Her çeşit için uygun selenyum miktarı belirlenmeli ve standartları oluşturulmalıdır. Bahçe bitkilerinde oldukça yeni bir büyüme düzenleyici madde olarak Selenyum, yüksek verimlilik ve çevre koruma özelliklerine sahiptir. Bu nedenle, gelişimi ve kullanımı, bahçe bitkilerinin sağlıklı büyümesini büyük ölçüde destekleyecek, gübre kullanım oranını iyileştirecek ve bitki hastalıklarının oluşumunu azaltacaktır. Gübre ve zirai ilaç sıfır büyüme planı uygulamasında kullanılabilir, bu sayede önemli bir rol oynamaktadır Selenyum eksikliği eksiklik olmayan topraklarda bile strese karşı pozitif etkisinden dolayı tavsiye edilmektedir.

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ID: 768

Biological Activities of Extracts of Red and Yellow Hawthorn Fruits in Different Solvents

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Abstract
Hawthorn is a type of wild fruit that grows naturally in almost every region of the world. It has been reported that there are 50 species of the hawthorn distributed in the northern hemisphere and more than 20 species in Turkey. Although hawthorn is generally consumed as a fresh fruit, marmalade, jam and vinegar are also made from its fruit. In this study, the presence of biological activities of extracts of red and yellow hawthorn fruits grown in Afyonkarahisar province and its surroundings in different solvents (methanol, ethanol and acetone) were investigated. As a result of the study, it was determined that the highest anti-bacterial effect was against *Listeria monocytogenes* (12.06 mm zone diameter) in red hawthorn ethanol extract while the highest anti-fungal effect was against *Aspergillus flavus* (17.22 mm zone diameter) in yellow hawthorn ethanol extract. In addition, the lowest minimum inhibitory concentration values were determined to be on *Listeria monocytogenes* (46.87 µg/mL) in red hawthorn ethanol extract and *Aspergillus flavus* (35.15 µg/mL) in yellow hawthorn ethanol extract. The lowest minimum bactericidal and fungicidal concentration values were determined to be against *Staphylococcus aureus* (93.75 µg/mL) in red hawthorn ethanol extract and *Aspergillus flavus* (23.75 µg/mL) in yellow hawthorn ethanol extract. It was revealed that the highest anti-bacterial effect on the microorganisms used in the study was in the red hawthorn ethanol extract, and the highest anti-fungal effect was in the yellow hawthorn ethanol extract.
Key Words: *Hawthorn, Anti-bacterial effect, Anti-fungal effect, Listeria monocytogenes, Aspergillus flavus*

Kırmızı ve Sarı Alıç Meyvelerinin Farklı Çözücülerdeki Ekstraktlarının Biyolojik Aktiviteleri

Özet
Alıç, hemen hemen dünyanın her bölgesinde doğal olarak yetişen bir yabani meyve türüdür. Alıcın kuzey yarım kürede yayılış gösteren 50, Türkiye'de ise 20'den fazla türü bulunduğu bildirilmiştir. Alıç, genel olarak taze meyve olarak tüketilmekle beraber, meyvesinden marmelat, reçel ve sirke de yapılmaktadır. Bu araştırmada Afyonkarahisar ili ve çevresinde yetişen kırmızı ve sarı alıç meyvelerinin farklı çözücülerdeki (metanol, etanol ve aseton) ekstraklarının biyolojik aktivitelerinin varlığı araştırılmıştır. Çalışma sonucunda en yüksek anti-bakteriyel etki; kırmızı alıç etanol ekstraktında *Listeria monocytogenes*'e karşı (12,06 mm zon çapı), en yüksek anti-fungal etki ise, sarı alıç etanol ekstraktında *Aspergillus flavus*'a karşı (17,22 mm zon çapı) olduğu tespit edilmiştir. Araştırma ile ayrıca, en düşük minimum inhibitör konsantrasyon değerlerinin, kırmızı alıç etanol ekstraktında *Listeria monocytogenes* (46,87 µg/mL) ve sarı alıç etanol ekstraktında *Aspergillus flavus* (35,15 µg/mL) üzerinde olduğu belirlenmiştir. En düşük minimum bakterisidal ve fungusidal konsantrasyon değerleri ise; kırmızı alıç etanol ekstraktında *Staphylococcus aureus* (93,75 µg/mL) ve sarı alıç etanol ekstraktında *Aspergillus flavus* (23,75 µg/mL)'a karşı olduğu saptanmıştır. Araştırmada kullanılan mikroorganizmalar üzerinde en yüksek anti-bakteriyel etkinin kırmızı alıç etanol ekstraktında, en yüksek anti-fungal etkinin ise, sarı alıç etanol ekstraktında olduğu ortaya konulmuştur.
Anahtar Kelimeler: *Alıç, Anti-bakteriyel etki, Anti-fungal Etki, Listeria monocytogenes, Aspergillus flavus*

ID: 769

Effects of Construction on the Visual Quality of Campus Landscapes: The Case of Burdur Mehmet Akif Ersoy University, Türkiye

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Abstract

The purpose of this study is to determine how construction activities at the Istiklal Campus of Burdur Mehmet Akif Ersoy University affect visual quality. For this purpose, a method based on visual resource management and expert opinions was used in this study. The area was visited by 5 experts and observations were made at 5 points that best describe the area. The obtained data were analysed in a table. As a result, it was found that observation point 3 has the highest visual quality and observation point 5 has the lowest visual quality. Observation point 3 is classified as class I and observation point 5 is classified as class III. Landform, colour, and cultural design had the greatest influence on the visual quality rating. Construction activities that do not fit into the existing landscape fabric have visually impacted the campus landscape. Although the campus landscape is impaired, it has a quality rating of II. The visual quality of the campus should be maintained and enhanced with new development that fits into the existing landscape fabric.

Key Words: *Burdur, Visual Resource Management, Visual Quality, Campus Landscape, Construction*

Yerleşke Peyzajlarındaki Yapılaşmanın Görsel Kaliteye Etkisi: Burdur Mehmet Akif Ersoy Üniversitesi Örneği

Özet

Bu araştırmanın amacı Burdur Mehmet Akif Ersoy Üniversitesi İstiklal Yerleşkesi'nde gerçekleşen yapılaşma faaliyetlerinin görsel kaliteye etkisinin belirlenmesidir. Bu amaçla bu çalışmada görsel kaynak yönetimine ve uzman görüşüne dayalı bir yöntem izlenmiştir. Alan 5 uzman tarafından ziyaret edilmiş alanı en iyi tanımlayan 5 noktada gözlemler gerçekleştirilmiştir. Elde edilen veriler tablo oluşturularak yorumlanmıştır. Sonuç olarak, 3 numaralı gözlem noktasının en yüksek, 5 numaralı gözlem noktasının ise en düşük görsel kaliteye sahip olduğu belirlenmiştir. 3 numaralı gözlem noktası I. Sınıf, 5 numaralı gözlem noktası III. Sınıf olarak sınıflandırılmıştır. Görsel kalite puanına en yüksek etkiyi arazi şekli, renk ve kültürel düzenlemeler göstermiştir. Mevcut peyzaj yapısına uygun olmayan yapılaşma faaliyeti yerleşke peyzajının görsel açıdan olumsuz etkilemektedir. Her ne kadar yerleşke peyzajı olumsuz etkilense de II. Sınıf bir kaliteye sahiptir. Yerleşkenin sahip olduğu görsel kalitenin korunarak arttırılması için yeni düzenlemeler mevcut peyzaj yapısına uygun olmalıdır.

Anahtar Kelimeler: *Burdur, Görsel Kaynak Yönetimi, Görsel Kalite, Yerleşke Peyzajı, Yapılaşma*

Giriş

Peyzaj, görüş alanı içerisinde yer alan doğal ve kültürel yapılara ait değerlerden meydana gelmektedir (Kiper vd., 2017). Aynı zamanda peyzaj, çevresel kimliğin tanınması ve mevcut çevre ile insanları birbirine bağlaması yönüyle en önemli bileşenlerden ve araçlardan biridir. İnsanlar her ne kadar farklı duyuları ile çevreyle bağlantı kursa da bağlantının %80'i gözlem yoluyla gerçekleşmekte (Golchin vd., 2012) ve insan algısının %80'inden fazlasını görme duyusu yönetmektedir (Polat, 2015). Peyzajın gözlenmesi ve algılanması, mevcut çevrenin tanınmasında ve peyzajın estetik açıdan uygunluğunun belirlenmesinde oldukça önemlidir (Golchin vd., 2012). Görsel algıyı görsellik, güzellik, hoşnutluk ve estetik gibi kavramlar ifade etmektedir (Kiper vd., 2017). Görsel kalite hem estetiğin bir göstergesi hem de sürdürülebilirlik açısından toplumsal bir ihtiyaç olarak karşımıza çıkmaktadır (Gilani vd., 2017). Brundtland Raporu ile birlikte sürdürülebilirlik kavramı devletler, şirketler ve farklı kuruluşlar için çok önemli bir hale gelmiştir. Raporda sürdürülebilir kalkınma "bugünün ihtiyaçlarını, gelecek nesillerin kendi ihtiyaçlarını karşılama kabiliyetinden ödün vermeden karşılayan kalkınma" olarak tanımlanmaktadır (Tiyarattanachai ve Hollmann, 2016).

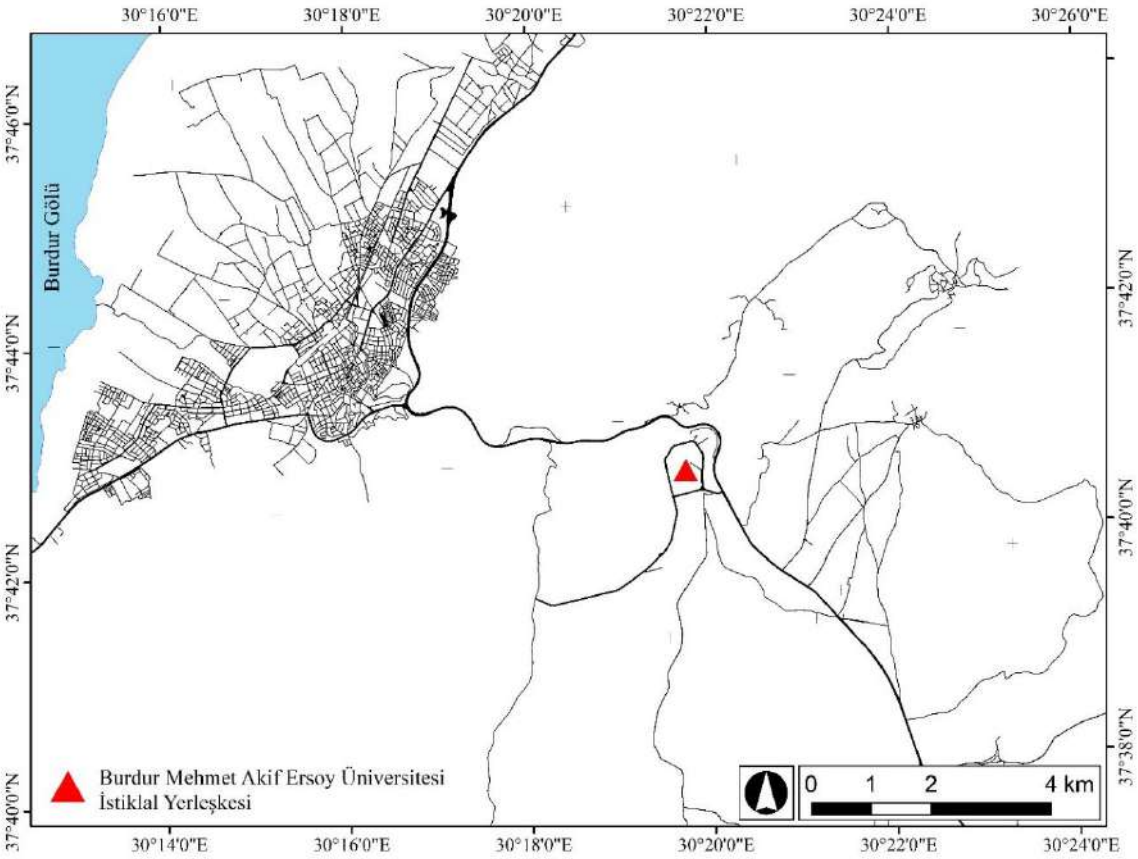
Görsel peyzaj abiyotik, biyotik görsel ve kültürel bileşenlerin birbiriyle etkileşiminden meydana gelmektedir. Arazinin şekli, bitki örtüsü, yapılar, zamansal alan kullanımı, kültürel yapı, yaban hayatı ve mevsimlere bağlı değişim gibi bileşenler peyzajın değerini etkilemektedir (Aşur ve Alphan, 2018). Fiziksel çevrenin estetik değerini arttırmak için görsel kaliteyi ölçmeye ihtiyaç vardır. Son yarım asırda çevresel kaliteyi ölçmeye yönelik araştırmalar gelişme göstermektedir (Oludare vd., 2021). Görsel kalitenin analiz edilmesi, doğal ve kültürel çevrenin değerlendirilmesi ve rehabilitasyonu açısından önemlidir (Polat, 2015). Peyzajda yapılan görsel kalite analizindeki amaç peyzajların korunması, onarımı ve yenilenmesi için gerekli faktör ve kriterleri belirlemek aynı zamanda peyzajın estetik açıdan uygunluğuna karar vermektir. Bu sayede estetik açıdan değerli olan peyzajlar

korunarak gelecek nesillere aktarılabilmektedir (Golchin vd., 2012). Bununla birlikte mevcut araştırmalar, mekanı tercih etmede görsel kalitenin etkili olduğunu belirtmektedir (Kiper vd., 2017).
Peyzaj, çevresel estetik kalite için değerli bir kaynaktır ve üniversite tanıtımlarında uzun zamandır kullanılmaktadır. Üniversite internet sitelerinde gölgelik ağaç altında oturan, yerleşkede yeşil alanda sosyalleşen öğrenciler tanıtımlarda yer almaktadır (Mt Akhir vd., 2018). Kaliteli yerleşke peyzajı, öğrencilerin üniversiteye kaydolmasını etkilemekte (Groen ve White, 2003; McFarland vd., 2008; Mt Akhir vd., 2018), üniversitelerin kamusal yüzü haline gelmekte (Mt Akhir vd., 2018) ve üniversitenin imajını arttırmaktadır (Gumprecht, 2007). Dünya üzerinde çoğu üniversite yerleşkelerini daha yeşil hale getirmeye çalışmaktadır (Tiyarattanachai ve Hollman, 2016; Mt Akhir vd., 2018). Araştırmacılar, manzara ve yeşil bitkilerin duyguları olumlu etkilediğini ve stresi azalttığını belirtmektedir (Speake vd., 2013; Li ve Sullivan, 2016). Bu yönüyle yerleşke peyzajı yalnızca dış ortamları iyileştirmek değil aynı zamanda üniversite topluluğunun da refah düzeyini arttırabilir. Ayrıca peyzajın öğrencileri yerleşkede zaman geçirmeye teşvik etme, zihinsel yorgunluklarını azaltarak performansını arttırma etkisi bulunmaktadır (Mt Akhir vd., 2018). Dolayısıyla görsel kalitesi yüksek manzaralar, daha fazla tercih edilecektir (Kiper vd., 2017). Bu doğrultuda bu araştırmanın genel amacı, yerleşkelerde gerçekleşen yapılaşma faaliyetlerinin peyzajın görsel kalitesine olan etkisini belirlemektir. Araştırmanın üç hedefi bulunmaktadır. 1) Görsel açıdan kaliteli peyzajları belirlemek. 2) Görsel kaliteye etki eden peyzaj bileşenlerini belirlenmek. 3) İlk iki hedefin çıktılarını kullanarak yerleşke peyzajlarında görsel kaliteyi arttırmaya yönelik öneriler geliştirmektir.

Materyal ve Yöntem

Araştırma Alanı

Araştırma alanını Burdur Mehmet Akif Ersoy Üniversitesi (MAKÜ) İstiklal Yerleşkesi oluşturmaktadır. MAKÜ 2006 yılında kurulmuş olup, bünyesinde 12 fakülte, 5 yüksekokul, 13 meslek yüksekokulu, 1 konservatuar ve 4 enstitü bulundurmaktadır (URL-1, 2022). MAKÜ İstiklal Yerleşkesi, Burdur İlinin Merkez İlçesinde bulunmaktadır. Yerleşke ilçe merkezine 10 km uzaklıkta bulunup, ilçe merkezi nüfusu 117189'dur (Şekil 1) (TÜİK, 2022). MAKÜ gelişmekte olan bir üniversitedir ve halen yerleşke içinde yapılaşma faaliyetleri sürmektedir. Bu faaliyetler sonucunda yerleşke peyzaj yapısı değişime uğramaktadır. Yapılaşmanın görsel kaliteye etkisinin en iyi incelenebileceği yer olarak düşünülen; lavanta tepesi hotel ve eğitim binalarının arasında yer alan vadi araştırma alanı olarak belirlenmiştir.



Şekil 1. Çalışma alanı

Görsel Kalite Analizi Süreci

Tüfekçioğlu (2008) görsel kalite değerlendirmelerinde yöntem olarak "Görsel Kaynak Yönetimi (Visual Resource Management System [VRM])", "Peyzaj Karakter Değerlendirmesi (Landscape Character Assessment [LCA])" ve "Manzara Güzelliği Değerlendirme Yöntemi (Scenic Beauty Estimation Method [SBE])" kullanıldığını belirtmektedir. Bu araştırmada görsel kaynak yönetimine ve uzman görüşüne yönelik bir yöntem izlenmiştir. Uzmanlar tarafından alan ziyaret edilmiş, alanı en uygun tanımlayan 5 noktada (Şekil 2; Tablo 1) gözlemler yapılmıştır. Her noktada yapılan gözlem 5 uzman (alanında en az 5 yıl deneyimli) tarafından Tablo 2 baz alınarak değerlendirilmiştir. Değerlendirme sırasında alandan fotoğraflar çekilmiştir. Yapılan değerlendirmeler sonucunda değerlendirme puanlarının ortalamaları alınarak her noktanın genel görsel kalite puanı belirlenmiştir. Noktalar aldıkları puana göre 4 görsel kalite sınıfına ayrılmıştır. 12 ve üzeri puan alanlar I. Sınıf, 9-11 puan alanlar II. Sınıf, 6-8 puan alanlar III. Sınıf ve 0-5 puan alanlar ise IV. Sınıf olarak değerlendirilmiştir. Görsel kalite sınıflarının planlama kararlarında kullanım amacı şunlardır (BLM, 1986):

I. Sınıf: Bu sınıfa ait peyzajlar mevcut karakterini korumalıdır. Alan kullanımları devamlılığını sağlamalı, peyzaj karakterindeki değişimler dikkat çekici olmamalıdır. Yapılacak tüm değişikler mevcut peyzaja uyumlu olmalıdır.

II. Sınıf: Bu sınıfa ait peyzajlar mevcut karakterini korumalıdır. Peyzaj karakterindeki değişim çok düşük olmalıdır. Değişimler gözlemcinin dikkatini çekmemeli, Herhangi değişiklik peyzajın temel biçim, çizgi, renk ve doku unsurlarına uygun olmalıdır.

III. Sınıf: Bu sınıfın amacı, peyzajın mevcut karakterini kısmen korumaktır. Peyzaj karakterinde orta düzeyde değişiklik yapılabilir, ancak genel peyzaj karakteri baskın olmalıdır. Değişiklikler gözlemcinin görüşüne hükmetmemeli, peyzajın karakteristik yapısında bulunan baskın doğal özelliklerinin devamı niteliğinde olmalıdır.

IV. Sınıf: Bu sınıfa ait peyzajlarda mevcut karakterinde büyük değişiklikler gerektiren yönetim faaliyetleri gerçekleştirilebilir. Peyzajın karakteristik seviyesinde değişim yüksek olabilir. Değişiklikler genel peyzaj karakterinde baskın olabilir.



Şekil 2. Gözlem noktaları

Tablo 1. Gözlem noktaları

1. Nokta	**2. Nokta**
	
37°41'30.78"K-30°20'22.57"D	37°41'7.87"K-30°20'22.19"D
3. Nokta	**4. Nokta**
	
37°40'47.23"K-30°20'6.50"D	37°41'0.31"K-30°20'4.68"D
5. Nokta	
	
37°41'21.06"K-30°19'59.74"D	

İstatiksel Analiz

Veriler tablolar oluşturularak yorumlanmış, veriler arasındaki ilişkiyi bulmak için korelasyon analizi yapılmıştır. Verilerin analizinde SPSS (SPSS Inc., 2002) programı kullanılmıştır.

Bulgular ve Tartışma

Görsel kalite faktörleri incelendiğinde arazi şekli faktörü bakımından en yüksek puanı gözlem noktası 3, en düşük puanı ise gözlem noktası 5 almıştır. Bitki örtüsü faktörü bakımından gözlem noktası 3 ve 4 en yüksek değere sahip iken en düşük değere gözlem noktası 5 sahiptir. Gözlem noktası 1 ve 5 su faktörü bakımından en düşük puanı almıştır. Tüm gözlem noktalarında renk faktörü puanları eşittir. Panoramik görüntü faktörü gözlem noktası 3'te en yüksek, gözlem noktası 2'de ise en düşüktür. Nadirlik faktörü bakımından tüm gözlem noktalarının puanları neredeyse eşittir. Tüm gözlem noktaları kültürel düzenlemeler faktörü açısından düşük puan almıştır. En düşük puanlar gözlem noktası 2 ve 5 aittir. Genel görsel kalite puanları incelendiğinde gözlem noktası 3 en yüksek değere sahipken gözlem noktası 5 en düşük değere sahiptir (Tablo 3).

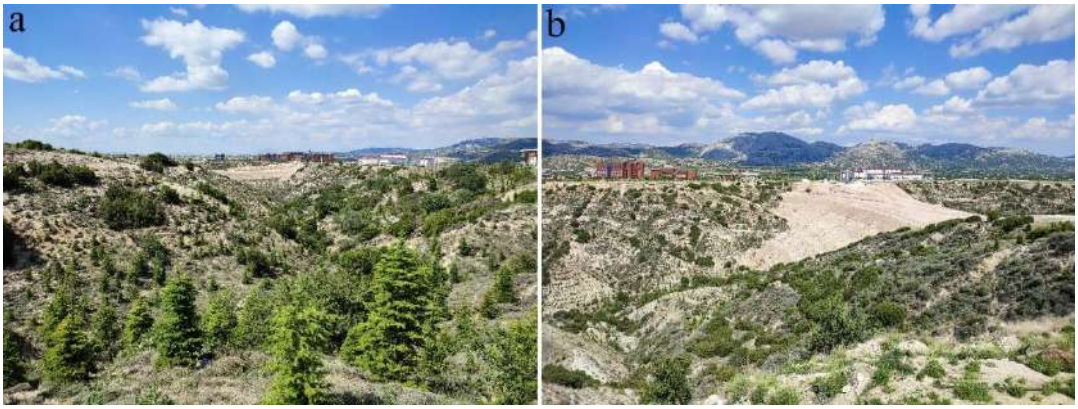
Gözlem noktalarının görsel kalite sınıfları incelendiğinde gözlem noktası 1; III. Sınıf, gözlem noktası 2; II. Sınıf, gözlem noktası 3; I. Sınıf, gözlem noktası 4; II. Sınıf ve gözlem noktası 5 ise III Sınıf olarak ayrılmıştır. I. Sınıf olarak sınıflandırılan gözlem noktası 3'te tüm yapılan düzenlemeler mevcut peyzaj yapısı ile uyumlu ve dikkat çekici olmamalıdır. II. Sınıf olan gözlem noktası 2 ve 4'te değişimler çok küçük olmalı, gözlemcinin dikkatini çekmemeli ve mevcut peyzaja uygun olmalıdır. III. Sınıf olan gözlem noktası 1 ve 5'te ise mevcut peyzaj karakteri kısmen korunmalıdır. Genel peyzaj karakteri baskın olmak şartı ile orta düzeylerde değişiklik yapılabilir.

Tablo 2. Görsel kalite analiz formu (BLM, 1986; Uzun ve Müderrisoğlu, 2011)

Faktörler	**Kriterler**	**Puan**
Arazi şekli	1) Dik yamaçlar, 2) Yoğun kayalık alanlar, 3) Dikkat çeken alanda yaygın yeryüzü şekilleri, 4) Kumullar	5
	1) Dik vadiler, 2) Kanyonlar, 3) Volkanik oluşumlar, 4) Küçük tepe dizileri, 5) Yaylalar, 6) Dikkat çeken alanda yaygın olmayan yeryüzü şekilleri	3
	1) Az dalgalı arazi şekli, 2) Az ya da hiç ilginç peyzaj özellikleri içermeyen alanlar	1
Bitki Örtüsü	1) Çok çeşitli vejetasyon tipine sahip alanlar (renk, form, tekstür)	5
	1) Bir ya da iki çeşit vejetasyon tipine sahip alanlar	3
	1) Çok az bitki örtüsüne sahip alanlar, 2) Genel vejetasyona uyumsuz alanlar	1
Su	1) Temiz ve berrak, durgun ya da hareketli su yüzeyleri genel görünümde baskın	5
	1) Genel peyzajda baskın olmayan hareketli veya durgun su yüzeyleri	3
	1) Peyzajda su yüzeylerinin olmayışı ya da belli belirsiz oluşu	0
Renk	1) Zengin renk kombinasyonları, 2) Canlı ya da çeşitli renkler, 3) Toprak, bitki örtüsü, su ve karlı alanlar arasındaki beğenilen zıtlıkların varlığı	5
	Peyzajda baskın olmasa da; 1) Bir miktar renk yoğunluğu ve çeşitliliğinin olması, 2) Toprak, bitki örtüsü, su ve karlı alanlar arasındaki zıtlıkların varlığı	3
	1) Göze çarpmayan renk çeşitliliği, 2) Genelde yumuşak renk tonlarının olması	1
Panoramik Görüntü	1) Görsel kaliteyi çok yükselten panoramik görüntü	5
	1) Genel görsel kaliteyi kısmen arttıran panoramik görüntü	3
	1) Genel görsel kaliteyi çok az ya da hiç etkilemeyen panoramik görüntü	0
Nadirlik	1) Bölge için çok nadir olan, akılda kalabilen peyzaj elemanları (Olağan üstü yaban hayatı görüntüleri)	5
	1) Diğer bölgelerde de görülebilen belirgin peyzaj özellikleri	3
	1) İlginç yapıya sahip ancak bölgede sıklıkla görülen peyzaj özellikleri	1
Kültürel Düzenlemeler	1) Görsel çeşitliliğe uygun ve bu çeşitlilikle uyum içinde olan düzenlemeler	2
	1) Görsel çeşitliliğe katkıda bulunmayan ya da bu çeşitliliği bozmayan düzenlemeler	0
	1) Görsel çeşitliliği bozan, uyumu ortadan kaldıran düzenlemeler	-4

Tablo 3. Gözlem noktaları görsel kalite faktörleri ve genel görsel kalite puanları

Gözlem Noktası	**Görsel Kalite Faktörleri**							**Genel Görsel Kalite Puanı**
	Arazi Şekli	**Bitki Örtüsü**	**Su**	**Renk**	**Panoramik Görüntü**	**Nadirlik**	**Kültürel Düzenlemeler**	
1	2,20	2,20	00,00	1,40	2,40	2,60	-3,20	7,60
2	3,00	2,60	3,00	1,40	0,60	2,20	-4,00	8,80
3	4,60	3,00	1,80	1,40	3,00	2,60	-3,20	13,20
4	1,80	3,00	1,80	1,40	1,80	2,20	-3,20	9,20
5	2,20	1,80	00,00	1,40	2,80	2,20	-4,00	6,60



Şekil 3. (a) En yüksek (13,20) görsel kalite puanına sahip gözlem noktası 3, (b) en düşük (6,60) görsel kalite puanına sahip gözlem noktası 5

Tüm gözlem noktalarının ortalamaları alınarak MAKÜ İstiklal Yerleşkesi genel görsel kalite puanı belirlenmiştir. MAKÜ en yüksek puanı arazi şekli faktöründen almıştır. En düşük puan ise kültürel düzenlemelere aittir. Aldığı 9,08 puan ile II. Sınıf görsel kalite değerine sahiptir. Buda MAKÜ'nün mevcut peyzaj karakterini koruması gerektiğini, çok düşük değişimler yapılabileceğini ve yapılan bu değişikliklerin peyzajın temel unsurlarına uygun olması gerektiğini belirtmektedir. Genel görsel kalite puanı ile arazi şekli, bitki örtüsü, renk, nadirlik ve kültürel düzenlemeler faktörleri arasında anlamlı bir ilişki bulunmuştur. Görsel kalite faktörleri arasında ise arazi şekli ve bitki örtüsü, panoramik görüntü ile su ve renk, kültürel düzenlemeler ile renk anlamlı bir ilişkiye sahiptir (Tablo 4).

Tablo 4. MAKÜ İstiklal Yerleşkesi görsel kalite faktörleri ile genel görsel kalite puanı açısından puanları ve korelasyon sonuçları

Görsel Kalite Faktörleri		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Puan**
1	Arazi Şekli	-							2,76
2	Bitki Örtüsü	0,564**	-						2,52
3	Su	0,150	0,309	-					1,32
4	Renk	0,366	0,047	-0,242	-				1,40
5	Panoramik Görüntü	0,200	-0,329	-0,445*	0,425*	-			2,12
6	Nadirlik	0,125	-0,185	0,090	0,343	0,283	-		2,36
7	Kültürel Düzenlemeler	0,235	0,208	-0,327	0,739**	0,216	0,253	-	-3,52
MAKÜ Görsel Kalite Puanı		**0,738****	**0,433***	**0,194**	**0,703****	**0,440***	**0,481***	**0,577****	**9,08**
*p<0,05, **p<0,01									

Sonuç

MAKÜ İstiklal Yerleşkesinde yapılan araştırmanın sonuçları yapılaşma faaliyetlerinin görsel açıdan yerleşke peyzajını olumsuz etkilediğini göstermektedir. Araştırmada görsel açıdan en kaliteli manzaranın gözlem noktası 3'e, en kalitesiz manzaranın ise gözlem noktası 5'e ait olduğu belirlenmiştir. Bunun sebebi gözlem noktası 3'te yapıların gözlem noktası 5'e göre dahan az gözükmesidir. Yerleşkenin görsel kalitesini etkileyen en önemli faktörlerin arazi şekli, renk ve kültürel düzenlemeler olduğu belirlenmiştir. Yerleşke içerisinde mevcut peyzaj yapısına uygun olmayan düzenlemeler ve yapılaşma görsel kalitenin düşmesine sebep olmaktadır. Her ne kadar yapılaşma faaliyetlerinden yerleşke olumsuz etkilense de halen II. Sınıf bir görsel kaliteye sahiptir. Görsel kalitenin korunması ve arttırılması için ileride yapılması planlanan düzenlemeler mevcut peyzaj yapısına uygun olmalıdır.

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Effect of Environmental Pollution on Landscape Ecology

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Abstract
In recent years, the main causes of environmental pollution are problems such as unplanned urbanisation, population growth and migration movements in natural areas and habitats. Therefore, many professional groups such as biologists, environmental engineers, agricultural engineers, landscape architects, urban and regional planners are working to solve these problems. The aim of this study is to examine the impact of today's very notable environmental pollution on landscape ecology and to present a guideline for research on this topic. For this purpose, the topic of environmental pollution has been studied under five headings such as air pollution, water pollution, soil pollution, noise pollution and radioactive pollution and the significance of the impact of environmental pollution on landscape ecology has been highlighted through literature review.
Key Words: *Environment, Ecology, Impact, Pollution, Landscape Ecology*

Çevresel Kirliliğin Peyzaj Ekolojisine Etkisi

Özet
Son yıllarda doğal alanlar ile yaşam alanlarında görülen çarpık yapılaşma, plansız kentleşme, nüfus artışı, göç hareketleri gibi sorunlar çevre kirliliğinin başlıca nedenlerinden sayılmaktadır. Dolayısıyla biyologlar, çevre mühendisleri, ziraat mühendisleri, peyzaj mimarları, şehir ve bölge planlamacılar gibi birçok meslek grubu, bu sorunları çözmek için çalışmalar yürütmektedir. Çalışmanın amacı, günümüzde oldukça dikkat çeken bir sorun olan çevresel kirliliğin peyzaj ekolojisine etkisinin incelenerek, konuyla ilgili yapılacak araştırmalarda yol gösterici bir kılavuzun ortaya konulmasıdır. Bu amaç doğrultusunda, çevresel kirlilik konusu, hava kirliliği, su kirliliği, toprak kirliliği, gürültü kirliliği ve radyoaktif kirlilik olmak üzere beş başlıkta incelenmiş ve çevresel kirliliğinin peyzaj ekolojisine etkisinin önemi literatür taraması yapılarak ortaya konulmuştur.
Anahtar Kelimeler: *Çevre, Ekoloji, Etki, Kirlilik, Peyzaj Ekolojisi*

Giriş

Dünya üzerindeki mevcut peyzajlar dinamik bir niteliktedir ve yoğun insan müdahaleleri peyzajların değişimine yol açmaktadır (Hofgaard, 1999; Olgun ve Yılmaz, 2019; Zeller vd., 2020; Wu vd., 2021). 1960'lı yıllardan günümüze kadar insanoğlu çevresinde ortaya çıkan olumsuz değişimlerin etkisiyle, yaşam alışkanlıklarını devam ettirmesi halinde mavi gezegen adı verilen dünyadaki yaşam koşullarının hem kendisi hem de diğer canlı türleri için sürdürülebilirliğini kaybedeceğini fark etmiştir (Erdoğan vd., 2007) ve özellikle atmosfer ve su kirliliği gibi olumsuz koşullar giderek artan toplumsal sorunlar olarak ele alınmaya başlanmıştır (Eren, 1999; Miyawaki, 2006). Akten ve Akten (2005) ile Martin vd. (2016)'e göre de, yaşanan teknoloji ve bilimsel alanlardaki ilerlemeler toplumların yaşam şartlarını iyileştirmiş ancak ekolojik dengenin bozulması sorununun ortaya çıkmasına neden olmuştur.

İnsanlığın sınırsız ve sorumsuz doğal kaynakları kullanması, günümüzde pek çok sorunun ortaya çıkmasına sebep olmuştur. Doğal kaynak olarak kabul edilen suyun, toprağın, havanın ve bitki örtüsünün kirlenip, bozulacağı hatta hayvan varlığının bir gün gelip tükeneceği düşünülmemiştir (İlke vd., 2011). Yaşam kalitesi, insanların ve ekosistemlerin sağlığı doğal kaynakların nasıl yönetildiğine bağlıdır ve hiç şüphesiz ki bunda sürdürülebilirlik ilkesinin benimsenmesi gereklidir (Gavrilescu, 2021). Ormanların zarar görmesi ve erozyon, hızlı nüfus artışı, çarpık yapılaşma ve açık-yeşil alanların yetersizliği, kıyı alanların tahrip edilmesi, kimyasal maddelerin sanayide kullanılması, termik santraller ya da nükleer enerjiye dayalı çevre sorunlarının insan sağlığına etkisi birçok ülke tarafından çözümlenmeye çalışılmaktadır (Kışlalıoğlu ve Berkes, 2001). Bu duruma bağlı olarak, 19. yüzyılın sonundan itibaren çevre koruma bilinci giderek yaygınlaşmıştır (Köseoğlu, 1983; Xu, 2017). Pek tabii, bilinçlilik toplumların kültürel yapılarından gelen bir davranış biçimi olarak, kişilerin inançları, kuralları, değerleri ve varsayımlarıyla biçimlenmektedir (Güzel, 2020).

Fiziksel çevreyi ve insanların o çevreyi algılaması ve beğenmesini ifade eden "Peyzaj" terimi (Anonim, 2022a), değişen ve yaşayan, dinamik, içinde ekolojik süreçlerin, özellikle insan etki ve müdahalelerinin gözlendiği arazi parçası ve etkileşimlerin bütünüdür (Çabuk ve Değerliyurt, 2014). Doğal bilimler (peyzaj ekolojisi) ve sosyal bilimler (kültürel süreçler) olmak üzere iki bilim dalı peyzajı incelemektedir (Şahin vd., 2014). Bu bağlamda, peyzaj ekolojisi bilim dalının temelini ekosistem dağılım desenleri ve peyzaj elemanları, su kaynakları, enerji,

besin ve diğer materyaller ile türler arasındaki dolaşımı, peyzaj mozaiğinin zaman içindeki değişimi oluşturmaktadır. Diğer taraftan peyzajın işlevi, peyzaj yapısı ve peyzajdaki değişimlere bağlı olarak peyzajın karakteristiğini ortaya koymak peyzaj ekolojisinin hedefini oluşturmaktadır (Demir ve Demirel, 2018).
Bu bilgiler ışığında çalışmanın amacı, günümüzde oldukça dikkat çeken bir sorun olan çevresel kirliliğin peyzaj ekolojisine etkisinin detaylı şekilde incelenerek konuyla ilgili yapılacak araştırmalarda yol gösterici bir kılavuzun ortaya konulmasıdır.

Peyzaj Ekolojisi Kavramı

Peyzaj ekolojisi teriminin kökeni, peyzaj ve ekoloji olmak üzere iki kelimeye dayalıdır (Bastian, 2001). Bu nedenle daha iyi açıklanabilmesi için konu sırasıyla "Peyzaj", "Ekoloji" ve "Peyzaj ekolojisi" başlıklarında incelenmiştir.

Peyzaj

Fransızca "paysage" kelimesinden türetilmiş olmakla birlikte, görünüm ve manzara anlamlarına gelen peyzaj (Arı, 2005; Şenöz, 2013), kır ve kıra ait manzara anlamına sahiptir (Baş Bütüner ve Çavdar Sert, 2021).
"Peyzaj", tarihsel sürece bakıldığında özellikle Orta Avrupa'da farklı anlamlara dayandırılmış ve farklı şekillerde tanımlanmıştır. Ortaya çıkan bu tanımlamalar, kullanım hedefi ve çeşitli dönemlerde bilimsel ve sanatsal akımlardan etkilenmiştir (Güngöroğlu, 2008). Peyzaj bilimsel açıdan ilk olarak 1900'lü yılların başında Alman coğrafyacı Alexander von Humboldt tarafından, yeryüzündeki bir alanın bütün karakterleri olarak tanımlanmıştır (Deniz vd., 2006; Kupik, 2010; Förster vd., 2012; Şenöz, 2013; Vural, 2020). Bayer (1977) peyzajı, dünya kabuğu üzerinde bulunan doğal objelerden jeolojik ve morfolojik arazi yapısı ile su yüzeyi, tarım arazisi ve orman arazisi gibi örtülerin kapsadığı görünümler olarak tanımlamaktadır. Odum ve Barrett (2008) ise peyzajı, bir bölgedeki farklı arazi biçimlerinin bütünü olarak tanımlanmaktadır. Hutchinson (2016) farklı şekilde peyzajı, zaman içinde değişim gösteren jeomorfolojik, jeolojik, biyolojik ve kültürel katmanların bütünleşmesinden oluşan ve insanlar tarafından algılandığı, resmedildiği ve değer verildiği bir alanın görünümü olarak tanımlamıştır. Antrop (2013) ve Keshtkaran (2019), peyzaja yaklaşımların çok geniş kapsamlı olması sebebiyle açık bir şekilde tanımının yapılamadığını ifade etmiştir.
Peyzaj, doğal ve kültürel peyzaj olmak üzere iki başlıkta, kültürel peyzaj ise kırsal ve kentsel peyzaj olmak üzere iki başlıkta sınıflandırılmaktadır (Tablo 1) (Çetinkaya ve Uzun, 2014).

Tablo 1. Peyzajın sınıfları (Çetinkaya ve Uzun, 2014)

Kültürel Peyzaj		Doğal Peyzaj
Kırsal Peyzaj	Kentsel Peyzaj	
- Yerleşim alanları - Tarım alanları - Ağaçlandırma alanları - Yeşil koridorlar - Koruluklar	- Ev bahçeleri - Parklar - Kent ormanları - Tarım alanları - Kent/Bölge parkları - Çatı bahçeleri - Düşey Peyzaj (Örn: Yeşil duvar) - Hobi bahçeleri - Yeşil koridorlar - Yol ağaçlandırmaları	- Sulak alanlar (Örn: nehirler, kıyılar, göller, dereler vb.) - Ormanlar - Çayırlar-Meralar

Abiyotik, biyotik ve insan bileşenlerinden oluşan peyzaj (Şenöz, 2013), bir alanın çevresel koşulları ve yeryüzü şekilleriyle tanımlanmış halini ifade etmekle birlikte insanların tarih sürecinde yaptığı etkilerle çeşitlilik ve değişim gösterebilmektedir (Can ve Akay, 2007). Bir başka deyişle, doğal çevre ve kültürel çevrenin etkileşiminden dolayı tüm peyzajların zaman içinde dinamik olduğu ve değişim gösterdiğini ifade etmek mümkündür (Primdahl ve Swaffield, 2011).

Ekoloji

1866'da Alman biyolog Haeckel tarafından önerilen ekoloji terimi, canlıların çevreleriyle olan ilişkilerinin incelenmesini ifade emektedir. Etimolojik olarak, Yunanca "oikos" ve "logos" kelimelerinden oluşmaktadır ve habitat bilimini ifade etmektedir. Aslında ekoloji, sadece canlılar ve onların fizikokimyasal ortamları arasındaki ilişkileri incelemekle kalmaz, aynı zamanda organizmalar arasında gelişen ilişkileri düzenleyen yasaları oluşturmayı da amaçlamaktadır (Burel ve Baudry, 2003). Kısaca açıklamak gerekirse ekoloji, canlıların birbiri ve cansız çevreleriyle olan ilişkilerini ve bu ilişkilerle bağlantılı süreçleri araştıran bilim dalıdır (Plutynski, 2008; Can, 2013; Rajashekara, 2014). 1900'lü yıllarda ayrı bir bilim dalı olarak ortaya çıkan ekoloji sözcüğü yaklaşık son otuz veya kırk yıldan buyana, günlük terminolojinin bir parçası olarak karşımıza çıkmaktadır (Odum ve Barrett, 2008).

Tarihi boyunca ekoloji ile bilim adamları, ekosistemlerin abiyotik ve biyotik bileşenlerinde zaman ve mekân arasında değişkenlik olup olmadığını incelemişlerdir (Clark, 2010). Bu kapsamda Kaya (2011) ekolojinin başlıca konularını aşağıdaki gibi belirtmiştir:

- Canlı organizmalara ait olan bireylerin yaşayıp gelişmesine fırsat sağlayan edafik (toprakla ilişkili), klimatik (iklimsel), fizyografik (yeryüzü şekline bağlı) ve biyotik (diğer canlılarla ilgili) unsurları incelemek, organizmaların bu doğal şartlara karşı davranışlarını ve bu doğrultuda yetişme ortamı isteklerini saptamak,
- Aynı türden meydana gelen canlılar topluluğunun gelişimini, yapısını, topluluk içi ve ayrıca diğer topluluklarla ilişkilerini, enerji temini ve beslenme durumlarını ortaya koymak,
- Çeşitli canlılara ait toplumlar ve bu toplumların içinde yaşadıkları fiziksel mekândan meydana gelen doğal sistemlerin (ekosistemlerin) öğelerini, yapılarını, tiplerini, enerji ilişkileri ve beslenmelerini incelemektir.

Ekoloji, sınırlı bir alanda yaşayan canlılar ile bunları kuşatan cansız çevrelerin karşılıklı ilişkileri ile oluşan ve süreklilik ifade eden bir sistemdir. Bu ekolojik sistem içindeki unsurların işleyişi birbirinden bağımsız şekilde düşünülmemelidir. Alan dinamiklerinin daha uzun süreli ve mekanik yöntemlerle incelendiği araştırmalarda çok net sınırları olan sistemler içinde bile madde ya da organizma alışverişinin olduğu açıkça ortaya konulmaktadır. Dolayısıyla peyzajlar izole ve kapalı sistemler olmanın tersine, sürekli ve açık şekilde birbiri ile etkileşim durumunda olan ekolojik sistemleri ifade etmektedir (Şenöz, 2013) ve peyzajların anlaşılması ekolojinin üzerinde durduğu en önemli unsurlardan birisidir (Antrop, 2013).

Peyzaj Ekolojisi

İlk olarak 1938 tarihinde Alman bir ekolojist olan Carl Troll peyzaj ekolojisi terimini kullanılmıştır. Troll peyzaj ekolojisi terimini, "*Bir peyzaj parçasındaki canlı topluluklar ile çevreleri arasındaki bütün karmaşık ağları inceleyen bir bilim dalıdır*" şeklinde tanımlamıştır. Troll en küçük nitelikteki ekolojik peyzaj biriminin ekotop (ekosistem birimi)'tan oluştuğunu ve peyzaj birimini pek çok elemanın meydana getirdiğini belirtmiştir. Ayrıca, Troll biyoloji ve coğrafya disiplinlerinin peyzaj ekolojisine katkı yaptığını ifade etmiştir. Peyzaj ekolojisine coğrafyanın bütünsel ve fiziksel temel bir yaklaşım hazırladığını ve biyolojinin ise ekosistemin işlevleri ve yapısı ile ilgili kavramları incelediğini belirtmiştir. Jeomorfoloji, toprak ilmi ve bitki bilimlerinin de fiziksel yaklaşıma katkı sağladığını ifade etmiştir (Tozar, 2006; Şenöz, 2013).

Peyzaj ekolojisi, peyzajın bir bölümünde egemen olan çevre şartları ve canlı toplulukları arasındaki karmaşık nitelikteki neden-sonuç ilişkilerini bir bütün halinde ele alan bilim dalı olarak tanımlanmaktadır (Odum ve Barrett, 2008). Peyzaj ekolojisinde doğadaki belirli organizmalar ya da diğer unsurların incelenmesiyle birlikte belirli bir peyzajda mevcuttaki bütün öğe ve sistemlerin karşılıklı olan etkileşim ve etkilerinin incelenmesi söz konusudur (Köseoğlu, 1983). Peyzaj ekolojisi modern ekolojinin bir dalı olarak kabul görmektedir. İnsan, bitki ve hayvanlar ile bunların fiziksel çevreleri ve arasındaki ilişkileri konu alan çeşitli disiplinler arasında bir köprü ve bağ kuran, yani disiplinler arası bir bilim dalıdır (Çepel, 1988). Peyzaj ekolojisinin temel amacı; karmaşık doğal sistemlerin yapı ve işlevlerini detaylı şekilde inceleyerek çevre koruma, doğal potansiyel, mekân planlaması konularına ait problemleri çözecek bulguları saptamaktır (Kaya, 2011).

Peyzaj ekolojisi, çevre biliminde ortaya çıkan sorunları hızlı şekilde çözmek için kullanılan büyük oranda kullanılan bir disiplindir ve dünyada sürdürülebilirlik ve küresel değişimle ilgili sorunlar ele alınırken peyzaj ekolojisine ihtiyaç daha çok artmaktadır (Gergel ve Turner, 2002). Bu bağlamda, peyzaj ekolojistleri, aynı anda ve etkileşimli olarak çalışan insan ve doğal sistemlere odaklanan, peyzaj değişikliğinin doğal ve insan kaynaklı birçok etkenini anlamak için disiplinler arası bir bakış açısı kullanmaktadırlar (Mayer vd., 2016).

Barnes (2000) ise, peyzaj ekolojisinin anlaşılabilmesi için dört temel başlığın olduğunu belirtmiş ve bunları aşağıdaki gibi açıklamıştır:

- Peyzaj kompozisyonu: Popülasyonların genetik yapısı, ekosistemdeki türlerin kimliği, çeşitliliği ve mevcut farklı topluluk türleri.
- Peyzaj yapısı: Habitat yamaları ya da ekosistemlerin çeşitliliği ve bunların desenleri (yamalar, meşcereler veya ekosistemlerin boyutu ve düzeni).
- Peyzaj fonksiyonu: İklimsel, jeolojik, hidrolojik, ekolojik, vb. süreçler.
- Peyzaj değişim: Ekosistemlerde mevcut olan sürekli değişim durumu.

Çevresel Kirlilik ve Peyzaj Ekolojisi İlişkisi

İnsanlar, sürekli üretme ve tüketme faaliyetleri içerisindedir. Hayatını devam ettirebilmek için beslenme ve barınma gibi zorunlu ihtiyaçlarını ve diğer faaliyetleri gerçekleştirilmesi esnasında ve sonrasında oluşan maddeler ile doğanın dengesi bozulmakta ve sonucunda çevre kirliliği oluşmaktadır (Atabek Yiğit, 2009). Çepel (1988), peyzaj ekolojisi kapsamında çevre kirliliği konusunu; hava kirliliği, su kirliliği, toprak kirliliği, gürültü kirliliği ve radyoaktif kirlilik olmak üzere beş başlıkta incelemiştir.

Hava Kirliliği

İnsan sağlığını ya da çevresel dengeleri yıpratacak biçimde bileşiminin değişmesi, kirletici maddelerin havada yer alması hava kirliliği olarak ifade edilmektedir (Zencirci ve Işıklı, 2017). Hava kirliliği sorunu sanayi devrimi sonrasında ve özellikle sanayileşmiş kesimlerde ortaya çıkmıştır. Artış gösteren çevre sorunları ve bu sorunların

neden olduğu ekolojik dengenin bozulması, canlıların karşılaştığı sağlık sorunları ve canlı çeşitliliğin azalması durumu, çevreyle barışık kalkınma modelini sürdürülebilir kalkınma modeli olarak ortaya çıkarmış ve dünyadaki her türlü canlının güvenliğini sağlamakla, ekonomiklik ve kalkınma arasındaki denge ve barışa borçlu olduğu görüşünü beraberinde getirmiştir. Hava kirliği çevre sorunlarından sadece biridir ve küreselleşen dünyada, ülkeleri birbirlerine sorumlu kılan en önemli kirlilik çeşidi olmuştur. Burada ozon tabakasının incelmesi ve küresel ısınma problemleri etkili olmuştur. Son yıllarda uzun mesafeli taşınımlara neden olan, özellikle kalıcı zehirli maddeler için antlaşmaların yapılmasına başlanmıştır (Sofuoğlu, 2022).

Hava kirliliği, kentlerin büyümesi, nüfusun hızla artması, endüstrinin ilerlemesiyle artan oranda ve değişen içerikte etkilerini göstermektedir. Lokal nitelikte bir kaynaktan salınmış olan hava kirleticileri yerel etkilere neden olurken, kent merkezlerinde fosil yakıt yanması, enerji tüketimi, motorlu taşıtların aşırı kullanımı hava kalitesinin niteliğini kaybetmesine sebep olmaktadır. Bölgesel taşınımlar, artış gösteren sera gazları, asit depolanması, troposferik ozon üretimi bugün hava kirliliğinin küresel ölçeğe ulaşan etkilerini ortaya koymaktadır. Antropojenik kaynaklı trafik, endüstri, ulaşım ve ısınmadan kaynaklı olan kirleticiler hava kirliliğinin en önemlileri iken; topografik yapı, meteoroloji, dispersiyon ve kimyasal dönüşüm süreçlerinin iklim ve hava kirliliği üzerindeki etkileri daha iyi bilinmektedir (Anonim, 2022b). Hava kirliliği hayvan, bitki ve inşaların sağlığı ve yaşamını olumsuz biçimde etkilemekle birlikte yapıları da (metal, ahşap ve taş kısımları) tahrip etmektedir. Ayrıca hava kirliliği iklim koşullarının değişmesine de (sıcaklık, nem, rüzgar hızı, ışın enerjisi, yağış) sebep olmaktadır (Çepel, 1988). Şekil 1'de hava kirliliğine ait bir görünüm sunulmuştur.



Şekil 1. Hava kirliliği (URL-1, 2022)

Su Kirliliği

Su kirliliği, istenilmeyen zararlı maddelerin, suyun niteliğini ölçülebilecek düzeyde bozmalarını sağlayacak yoğunluk ve miktarda suya karışması durumudur (Aydoğdu, 2014). Son dönemde çevre sorunlarından bir diğeri de su kirliliği konusudur. Çevre kirliliğinden en çok şekilde etkilenen ve çevre kirliliği bakımından en savunmasız olan doğal kaynak su olarak kabul edilmektedir. Canlıların yaşamı, çevre ve ekonomik gelişim bakımından gerekli olan su kaynakları sınırlı durumdadır ve dışardan gelen olumsuz etkenlere açık niteliktedir. Dolayısıyla günümüzde insanoğlunun birçok faaliyeti neticesinde su kaynaklarının büyük bir kısmının doğal bileşimi bozulmuş yani kirlenmiş durumdadır. Eğer koşullar böyle sürerse gelecekte tatlı suya erişim sıkıntıya girecek ve ayrıca doğal bileşimi zarar gören su ortamında yaşamakta canlılarda birtakım sorunlarla kaçınılmaz şekilde karşı karşıya kalacaktır (Menteşe, 2017).

Su kirliliğinin başlıca kaynakları, endüstri kuruluşları ve enerji santralleri, yerleşim birimleri, zararlılarla mücadele ve gübreleme yapılan orman ve tarım alanları, hayvansal atık maddeler üretimi yapan çiftlikler, toprak erozyonunun görüldüğü alanlardır (Çepel, 1988). Şekil 2'de su kirliliğine ait bir görünüm sunulmuştur.



Şekil 2. Su kirliliği (URL-2, 2022)

Toprak Kirliliği

Toprak kirliliği kısaca toprağın üstünde ve içine bırakılan zararlı atıkların toprağın özelliğini bozmasıdır. Ancak, toprağın özelliğini bozan sadece madde ya da süreçler değildir. Bu sebeple, toprak kirlenmesi, toprağın verimini düşürecek optimum seviyede toprak karakteristiklerini yıpratacak her türlü teknikleri, ekolojik baskıları ve olayları ifade etmektedir (Çepel, 1988). Günümüzde gelişen teknoloji ile beraber besin ihtiyacının sağlandığı topraklar her geçen gün kirlenmekte ve toprak kirliliğinin artması neticesinde sebze, meyve ve tarımsal ürünlerin yetiştirildiği alanlar azalmaktadır (Kızıloğlu Algan ve Bilen, 2005). Şekil 3'de toprak kirliliğine ait bir görünüm sunulmuştur. Toprak kirliliğine sebep olan unsurlar aşağıda belirtildiği gibidir (Anonim, 2022c):

- Yerleşim alanlarında oluşan ya da çıkan atıklar, egzoz gazları, endüstri atıkları, tarımsal mücadelede kullanılan ilaçlar ve kimyasal gübreler toprak kirliliğine neden olan en önemli unsurlardır.
- Yerleşim alanlarında oluşan ya da çıkan çöplerin rastgele atıldığı alanlar ile kanalizasyon şebekelerinin arıtılmadan, direk olarak toprağa karıştığı alanlarda toprak kirliliği oluşmaktadır.
- Egzoz gazları, kükürtdioksit (SO_2), karbonmonoksit (CO), kadmiyum (Cd), kurşun (Pb), vb. zehirli maddeler havaya yayılarak ve solunum yolu vasıtasıyla büyük bir kısmı canlılar tarafından alınmaktadır. Geriye kalan zehirli maddeler ise rüzgârlar ile uzak mesafelere taşınmakta ve yağışlarla yeryüzüne inerek, suyu ve toprağı kirletebilmektedir.
- Toprak kirliliğine neden olan bir diğer etken de tarımsal mücadele ilaçları ve suni gübrelerden oluşmaktadır. Tarımsal mücadele ilaçlarının aşırı ve bilinçsiz kullanımı neticesinde, toksik maddelerin toprakta birikimi artış göstermekte ve doğal ortamın kirlenmesine neden olmaktadır. Özellikle, sodyum, fosfor, magnezyum, potasyum, kalsiyum, demir, çinko, mangan, bakır, bor gibi besin maddelerini barındıran suni gübrelerin bilinçsiz ve aşırı kullanımı neticesinde, toprağın yapısı bozularak ve toprak kirliliği meydana gelmektedir.
- Endüstri tesislerinde oluşan ve arıtılmadan toprağa, havaya ve suya verilen atıklar çevrenin kirlenmesine sebep olmaktadır.



Şekil 3. Toprak kirliliği (URL-3, 2022)

Gürültü Kirliliği

Gürültü kaynakları nitelik ve nicelik açısından yaşam düzeyinin artışına paralel biçimde yükselmiştir. Bu sebeple insanların sağlığını etkileyen çevre kirletici faktörlerinden birisi olarak kabul görmektedir. Yaşam düzeyinin artışının uçak, tren, otobüs, vapur gibi toplu taşım araçlarının kullanımını artırdığı gibi özel araçların kullanımında da artış olmuş ve halen bu artış devam etmektedir. Diğer taraftan, hem imalathane ve fabrikaların sayısı hem de konfor için mutfak eşyaları, havalandırma araç ve gereçleri de insanlar tarafından yoğun şekilde kullanımı artış göstermektedir (Çepel, 1988).

Gürültü; insanların algılamasını ve işitme sağlığını olumsuz şekilde etkileyen, psikolojik ve fizyolojik açıdan dengelerini bozabilen, iş yapma verimliliğini düşüren, çevrenin sakinliği ve hoşluğunu ortadan kaldırarak niteliğini olumsuz yönde değiştiren çok önemli bir çevre kirliliğidir (Toprak ve Aktürk, 2004) ve bir kirlilik kaynağı olarak mevzuatlarda yer almaktadır (Sert Sütçü ve Şahin, 2021). Şekil 4'de gürültü kirliliğine ait bir görünüm sunulmuştur.



Şekil 4. Gürültü kirliliği (URL-4, 2022)

Radyoaktif Kirlilik

Radyoaktif kirlilik dünyadaki tüm peyzajların yapı elemanlarının hepsini etkileyebilecek nitelikte olması sebebiyle, son derece önemli bir konudur. En etkin kaynağı ise nükleer enerji santralleri olarak ifade edilmektedir. Radyoaktif kirlenme esasen, elektron radyasyonu yani elektron yayılmasına dayalıdır (Çepel, 1988).

İnsanlar, güneşten ve uzaydan gelen kozmik ışınlar, yer kabuğundaki radyoizotoplar sebebiyle yapı malzemeleri ve toprak, su ve gıdalar gibi doğal kaynaklardan ışın almaktadırlar. Bu etkenlere ek olarak insanlar enerji üretimi, endüstri, tıp, araştırma, tarım, hayvancılık gibi pek çok alanda kullanılan yapay kaynaklar sebebiyle de radyasyona maruz kalmaktadırlar. Kısaca radyoaktif kirlilik, çevre sorunlarının bir çeşidi olmakla birlikte, biyolojik sistemlere etki ederek kolaylıkla besin zincirine girmekte ve canlılarda büyük hasarlara sebep olmaktadır (Anonim, 2022ç). Şekil 5'de radyoaktif kirliliğe ait bir görünüm sunulmuştur.



Şekil 5. Radyoaktif kirlilik (URL-5, 2022)

Sonuç

Bu çalışma ile çevresel kirlilik konusunun peyzaj ekolojisi üzerinde etkisi ortaya konulması amaçlanmıştır. Belirtilen amaç doğrultusunda çevresel kirlilik konusu, hava kirliliği, su kirliliği, toprak kirliliği, gürültü kirliliği ve radyoaktif kirlilik olmak üzere beş başlıkta incelenmiş ve çevresel kirliliğinin peyzaj ekolojisine etkisi ortaya konulmuştur;

- Hava kirliliği hem doğal alanlar hem de kentsel alanlarda zararlı etkiler yapmaktadır. Ancak hava hareketleri sebebiyle kirli hava başka bölgelere taşınabilmektedir. Dolayısıyla hava kirliliği sorununun çözümü sadece küçük bir bölge olarak değil daha büyük ölçekli bir konu olarak ele alınmalıdır. Bu kapsamda başta sanayi bölgeleri, kentsel alanlar olmak üzere hava kirliliğine neden olan alanlarda planlama ve tasarım çalışmalarında disiplinlerarası yaklaşımların ortaya konulması gerekmektedir.
- Günümüzde susuzluk sorunu sebebiyle mevcut su kaynaklarının korunması gerekmektedir. Dolayısıyla su kirliliği gibi olumsuz bir durum mevcut kullanılabilir su kaynaklarını olumsuz şekilde etkilemektedir. Bu durumun önüne geçecek şekilde su kaynaklarının korunması ve atık suların kullanımı gibi konularda yönetimsel kararların alınması ayrıca su kullanımına yönelik bilinçlendirme ve farkındalık çalışmalarının yürütülmesi faydalı olacaktır.
- Yapılaşma, sanayi ve artan nüfus artışı gibi sorunlar özellikle toprak üzerinde kirliliğe sebep olmaktadır. Ancak tarımsal üretimin temel unsuru olan topraktaki kirlilik durumu insanların besin ihtiyaçlarının karşılanmasını engellememelidir. Bu kapsamda kırsal ve kentsel alanlarda yaşayanların toprak kirliliğine yönelik bilinçlenmesi için ulusal ya da uluslararası projeler dahil olmak üzere birçok çalışma yürütülmelidir. Ayrıca, toprak kirliliğini önleyici çalışmaların yapılması ile yeraltı sularının da korunmasını sağlamak mümkün olacaktır.

- Artan nüfus neticesinde özellikle yoğun yapılaşma alanlarında gürültü kirliliği önemli sorunlardan birisi olarak kabul edilmektedir. Gürültü kirliliği sorunu konut alanlarının yaşanabilirliğini olumsuz şekilde etkilemekle birlikte insanlar başta olmak üzere tüm canlılarda sağlık sorunlarını beraberinde getirebilmektedir. Bunun için planlama ve tasarım kararlarında gürültü kirliliğini azaltıcı ve önleyici disiplinlerarası çalışmalar yürüterek yaşanabilir mekânlar oluşturulması etkili çözümlerden biri olacaktır.
- Günümüzde insanlar radyoaktif kirliliğe bir şekilde maruz kalmakta ve bunun etkileri süreç içinde kendini gösterebilmektedir. Bunun önüne geçebilmek için radyoaktif kirliliği önleyici yönetimsel çalışmalar yapılmalı, sebep ve sonuçlarını tanıtan bilinçlendirme ve farkındalık çalışmaları yürütülmelidir.

Sonuç olarak, çevre kirliliğinin olumsuz etkilerinin hem doğal çevre hem de insanların yaşam alanlarında her geçen gün artış gösterdiği bir gerçektir. Çevre kirliliği konusunun peyzaj ekolojisine etkisinin bilinmesi ve bu yönde çözümleyici yaklaşımların geliştirilmesi ile doğal kaynak değerlerinin sürdürülebilirliğinin sağlanması yanı sıra yaşanabilir mekânların oluşturulması da mümkün olacaktır.

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Perinatal Nutrition of Broiler Chicks

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Abstract
The developments in poultry industry fields, such as genetic improvement, disease control, nutrition, management, and organization have significantly increased the production efficiency of broiler chickens. It is expected that these positive developments observed in the last 50 years will continue in the future. Early nutrition plays a key role in ensuring the sustainability of this success in broiler chicken production. A good start in life is the most important part of profitable production, especially in terms of farm animal species. In the case of broiler chickens, the perinatal period, referring to a few days pre-hatching and about 7 days post-hatching, represents a large part of the productivity in the broiler chick lifespan. The perinatal nutrition in this period plays an important role in the development of their muscle, skeleton, intestinal microbiota, morphology and immune system in the life cycle of broiler chicks. In fact, achieving maximum performance levels of broiler chickens in the fattening stage depends on the management and nutrition in this period. The perinatal nutrition program for broiler chicks can be divided into two basic parts. The first of these is the in-ovo feeding period done within the first few days before hatching, during which the embryo shows rapid growth and development, and the chick prepares for hatching and life outside the egg. The second is the neonatal feeding period, which includes feeding in the incubator during the first 48 hours from when the first chick hatches until the last chick hatches, feeding during their transfer to farms, and feeding programs in the first few days on the farm. Chicks access to feed being delayed during this period after hatching may have negative effects on the yield performance of the chicks throughout the production stage. For this reason, chicks need to be able to have access to feed as soon as possible, immediately after hatching. Therefore, the purpose of this review was to provide information about feeding strategies in the perinatal period and to examine the postnatal effects of such strategies on broilers through the present studies.
Key Words: *Perinatal, In-Ovo, Neonatal, Nutrition, Broilers*

1. Introduction

With the genetic selection, care, and feeding programs carried out in commercial broiler farming, one-day old broiler chicks that weigh 35-45 g can increase their body weight 65-70 times until 42 days old. However, this intense selection pressure for rapid growth has resulted in a number of adverse complications on the immune function and bone development of broilers (Rawlinson et al., 2009; Van der Most et al., 2011). In addition, this rapid growth and development has also increased the susceptibility of broilers to infectious diseases (Havenstein et al., 2003). On the other hand, egg nutrient reserves are insufficient for chick embryos whose metabolic rate increases with the genetic progress achieved today and can be rapidly depleted after hatching (Yair et al., 2013). Therefore, nutrition of chicks during perinatal periods is critical for both embryonic development and the development of postnatal muscle, skeleton, gut, healthy microbiota, and immune systems. The perinatal period in broiler chicks includes a few days before hatching and about 7 days after hatching. The feeding strategies to be applied in this period can be divided into 2 parts as in ovo and neonatal feeding. The purpose of feeding in both periods is to activate the development of the immune and gastrointestinal systems as soon as possible to prepare chicks for hatching and post-hatching life. As a matter of fact, at the end of the incubation period, visceral organs begin to grow and develop rapidly, and in the last 6 days of incubation, the absorption surface of the small intestine increases, goblet cells are formed, and the chicks' ability to digest and absorb develops (Uni et al., 2003; Gilbert et al., 2007). After hatching, gastrointestinal tract grows four times faster than the rest of the body during the first two weeks of a broiler's life (Nitsan et al., 1991). Therefore, a correct and appropriate feeding in the perinatal period affects the future fattening performance of broilers. It has been reported that probiotics provide resistance against pathogens post-hatching (De Oliveira et al., 2014), prebiotics promote early colonization of beneficial bacteria (Tako et al., 2014), carbohydrates (maltose, sucrose and dextrin) increase glycogen stores (Uni et al., 2005), amino acids (threonine, mixture of arginine, glutamine, glycine and proline) improve growth (Kadam et al., 2008; Shafey et al., 2014), vitamins C and E strengthen antioxidant defense and immunity (Zhu et al., 2019; Araújo et al., 2019) and creatine pyruvate supports muscle growth (Zhao et al., 2017) in the early period feeding of chicks. However, there is still insufficient information about the early feeding of broiler chickens. The aim of this review was to provide information about early nutrition programming (in ovo and neonatal feeding) strategies and to reveal the postnatal effects of these feeding strategies on broiler chickens over studies.

2. In Ovo Feeding of Chicks

Feeding in the early period or feeding young animals is an important part of successful animal breeding. In particular, in ovo injection technology is widely used by approximately 95% of the world's industrial hatcheries for embryo vaccination processes (Maiorano et al., 2012). Besides that, the use of this technology in in ovo nutrition of developing embryos with external nutrients can provide a practical way. With this technique, chicks can be fed with amino acids, minerals, vitamins, carbohydrates, fatty acids, and essential oils during hatching (Araújo et al., 2019; El-Kholy et al., 2021; Lu et al., 2022; Sogunle et al., 2022; Tavaniello et al., 2022). Thus, in ovo feeding of broiler chicks during hatching can have a positive effect on their performance during the fattening period (Hassan, 2018; Araújo et al., 2019; Wang et al., 2020). The results of the study on the effects of in ovo feeding on performance in broilers are presented in Table 2.1. Furthermore, broilers getting a good start in life has many advantages. It has been reported in the studies that in ovo feeding in broilers improves hatchability (Naeem Asa et al., 2022), increases chick initial body weights (Zhao et al., 2017; Hassan, 2018), promotes intestinal development (Tako et al., 2004), supports the immune system (Sogunle et al., 2022), enhances antioxidant defense (Lu et al., 2022), improves meat quality (Tavaniello et al., 2019), alteres mRNA expression levels of genes (Zhu et al., 2019), and consequently increases final body weights of broilers (Zhao et al., 2017; Hassan, 2018). Moreover, the epigenome is dynamic during embryogenesis and in ovo feeding of chicks can cause changes in cell and gene functions that influence animal growth and development through epigenetic modification such as DNA and histone modifications (Métayer-Coustard et al., 2019). In addition to the advantages mentioned, in ovo injection technology has various difficulties in terms of its applicability and sustainability in practice. For this reason, it is necessary to pay attention to issues such as the additive to be used before in ovo injection and the developmental stage of the embryo for the additive to be used in, the location where the injection will be made, and the dose of the injection.

3. Neonatal Feeding of Chicks

The neonatal period, which covers the period from hatching to reaching feed and the first few days, is a critical period for chicks. As a matter of fact, chicks have to wait about 48 hours in the hatching machine from the first chick's hatching to the hatching of the other eggs (Careghi et al., 2005). Then, in practice, time is also spent with post-hatching vaccination, sex determination, and boxing and transfer of chicks to farms. Therefore, within a period of approximately 72 hours, the chicks use yolk, which is left in hatching towards the end of the incubation period and withdrawn into the abdominal cavity, as the sole energy source. The residual yolk may be sufficient to keep the chicks alive for the first 3-4 days without feed but does not support the development of the gastrointestinal tract and immune system and does not help increase body weight (Panda et al., 2006; Arulnathan et al., 2019). On the other hand, the digestive system of newly hatched chicks has a limited ability to digest and absorb nutrients (Jin et al., 1998). Therefore, the development of the gastrointestinal and immune system is essential for growth to begin, which can be improved by early feeding. As a matter of fact, Li et al. (2022) has determined that access to the feed immediately after hatching of broilers within a 2-hour period increases daily live weight gain and feed intake, improves feed conversion ratio, increases villus height (VH), decreases crypt depth (CD) and increases the VH/CD ratio in the 1-21st days, compared to 48-hour delay time.

In the neonatal period, there are feeding strategies such as feeding in the hatching machine until all chicks hatch, feeding during transportation, bringing embryonated eggs to the broiler chicken farm facilities on the 18th day of incubation to ensure that the chicks hatching on the farms (NestBorn system), thus providing reaching feed and water immediately. Hesabi Nameghi et al. (2022) reported that the hydrated nutritious gel supplement applied to the chicks in the first 24 hours after hatching did not change the body weight, feed intake, feed conversion ratio at the 35th day, as well as VH, CD, VH/CD ratio, and lamina propria thickness. Similarly, it was determined that the hydration nutritious supplementation, which is a commercial product, did not affect chick live weight at 0-7th days (Özlü et al., 2022). On the other hand, Lingens et al. (2021) compared the common practice of transferring chicks to henhouses without feed or water within the first 72 hours after hatching with the new practice in which the embryonated eggs on the 18th day of incubation are transported to henhouses by a special vehicle and chicks hatching on henhouses, and have immediate access to feed and water for 6-7 days. According to the results, they found that the new system significantly increased the final body weights of broilers compared to the traditional system. In addition, the first 3-4 days after hatching, the chicks can be fed with special pre-starter diets with high digestibility and specific nutritional needs. In the study by Franco-Rossello et al. (2022), it was determined that the daily live weight gain and feed intake increased, and feed conversion rate improved significantly at the end of the fattening period (42nd day) in broiler chickens fed with pre-starter feed at 0-4th days after hatching compared to those fed with standard starter feed. Another feeding method observed in the neonatal period is the first 7-day feeding program in which chicks are provided with immediate access to feed and water in henhouse. Brief information on previous studies conducted within the scope of this feeding program is presented in Table 3.1.

Table 2.1 The effects of in ovo feeding on performance in broiler chicks

			Treatment effect (% difference from untreated control)				
Materials	**Inoculants**	**In Ovo Inoculation Rate/Incu-bation Day (d)**	**Initial BW**	**Final BW**	**FI**	**FCR**	**References**
Fertilized eggs (Arbor Acres)	Creatine pyruvate (CrPyr)	0.6 ml physiological saline (0.75%) containing 12 mg CrPyr per egg/ on 17.5 d.	↑ 2.26	↑ 7.36	↑ 4.71	→	Zhao et al., 2017
Fertilized eggs (Cobb500)	Nano-selenium	15 ppm per egg/on 18 d.	↑ 4.56	↑ 26.06	↓ 9.89	↓ 28.87	Hassan, 2018
Fertilized eggs (Cobb500)	Vitamin E (VE)	27.5, 38.5, 49.5, 60.4 IU/ on 17.5 d.	↑ 4.36 (in the highest level)	→	→	↓12.01 (in the highest level)	Araújo et al., 2019
Fertilized eggs (Ross 708)	L-ascorbic acid (AA)	100 µL of sterile saline (0.85%) containing 3, 6, 12, or 36 mg AA/ on 17 d.	→	→	→	→	Zhang et al., 2019
Fertilized eggs (Arbor Acres)	Vitamin C (VC)	3 mg VC dissolved in 0.1 ml of normal saline/ on 15 d.	→	→	→	→	Zhu et al., 2019
Fertilized eggs (Arbor Acres)	Folic acid (FA), glucose (Glu) or their mixture	0.2 mg FA, 125 mg Glu per egg/ on 17 d.	→	→	→	→	Abdel-Halim et al., 2020
Fertilized eggs (Ross 308)	N-acetyl-L-glutamate (NAG)	1.5 mg NAG per egg/ on 17.5 d.	→	→	↓ 13.11	↓ 5.75	Wang et al., 2020
Fertilized eggs (Arbor Acres)	Manganese (Mn)	12.5, 25.0 mg Mn per egg/ on 9 d.	→	→	→	→	Geng et al., 2022
Fertilized eggs (Slow-growing Korat chicken)	L-arginine (Arg)	5 mg of Arg per egg/ on 18 d.	→	→	→	→	Lu et al., 2022
Fertilized eggs (Arbor Acres)	Organic salts of zinc, copper and their combinations	80, 16 or 80+16 µg per egg, respectively/ on 18 d.	→	→	→	→	Sogunle et al., 2022
Fertilized eggs (Cobb500)	Organic salts of zinc, copper and their combinations	80, 16 or 80+16 µg per egg, respectively/ on 18 d.	→	→	→	→	Sogunle et al., 2022
Fertilized eggs (Hubbard JA57)	Galactooligosaccharides (GOS)	3.5 mg GOS per egg/on 12 d.	↓ 2.21	→	→	→	Tavaniello et al., 2022

BW, body weight; FI, feed intake; FCR, feed conversion ratio; ↑, increase; ↓ decrease, → no significant differences.

Table 3.1 The neonatal feeding studies and effects on broiler chicks.

Animals	Dietary information and experimental design	Major results	References
Hybro broiler chickens	The 5 treatments were: immediate feeding (3 hour (h)), delayed access to feed for 12h, 24h, 36h and 48h	↓ BW at 7 d in all delayed access time to feed groups compared with immediate feeding (3 h) group. At 35 d → BW in all groups. Acording to delayed access time to feeding ↓ FI and →FCR.	Kang et al., 2018
Ross 708 broiler chickens	Chicks were divided into 2 treatment groups as follows: birds receiving ad libitum access to feed and water immediately after hatch (FED) and birds without access to feed for the first 48 h post-hatch (NOTFED).	↑ BWG and FI in FED group compared with NOTFED group. Among Ca transporter genes, only ↑ mRNA expression level of Calbidin D28k in jejunum and ↑ Ca sensing receptor (CaSR) in ileum, and for P transporter genes' expression, only P transporter type III (PIT1) mRNA expression level was significantly ↑ in in FED group compared with NOTFED group.	Proszkowiec -Weglarz et al., 2019
Ross 708 broiler chickens	Chicks were divided into 2 treatment groups as follows: birds receiving ad libitum access to feed and water immediately after hatch (FED) and birds without access to feed for the first 48 h post-hatch (NOTFED).	Compared with group NOTFED, broilers in group FED among tight junction and gut-barrier related genes ↑ mRNA expression levels of occludins (OCLN), occludens-1 (ZO-1), junctional adhesion molecule (JAM) 2 in jejunum and OCLN, ZO-1, JAM2, JAM3, claudins (CLDN) 1, immunoglobulin A (IgA) in ileum.	Proszkowiec -Weglarz et al., 2020
Ross 308 broiler chickens	Chicks were allotted to 36 rearing pens in a 2 x 3 factorial design with two hatching treatments (directly provided access to feed and water (Early); deprived of feed and water for 38 h (Late)) and three starter dietary (control, diet with low (0.057%) and high (0.114%) inclusion of algal extract) treatments until 6 d.	↑ BW, FI, and → FCR in early group compared with group late. Late chicks also had longer relative intestine, ↑ relative (g/kg BW) weight of gizzard and proventriculus, but ↓ relative bursa weight on day 6. → Gut microbiota, gut development or vaccine-induced antibody responses in all dietary treatments group.	Ivarsson et al., 2022
Lingnan Yellow broiler chickens	The 3 treatments were: immediate feeding (Group 2 h), delayed access to feed for 24 h (Group 24 h), and delayed access to feed for 48 h (Group 48 h).	During the starter period (1-21 d) ↑ ADG, ↑ ADFI and ↓ FCR in group 2 h compared to the group 48 h. Compared with group 48 h, broilers in group 2 h exhibited ↑ VH, ↓ CD, ↑ VH/CD in the duodenum, ↑ occludin, and claudin-1 mRNA expression level in the jejunum at 50 d. Broilers in group 2 h ↓ Escherichia spp. at 21 d and ↓ Bacteroides spp. at 50 d compared with group 48 h.	Li et al., 2022

BW, body weight; FI, feed intake; FCR, feed conversion ratio; BWG, body weight gain; mRNA, messenger ribonucleic acid; Ca, calcium; P, phosphorus; ADG, average daily gain; ADFI, average daily feed intake; VH, villus height; CD, crypt depth; ↑, increase; ↓ decrease, → no significant differences.

4. Conclusion

In conclusion, perinatal feeding improves the development of the gastrointestinal and immune system necessary for growth induction in broilers. Thus, by providing flock uniformity, it leads the way for successful and profitable industrial broiler breeding. However, more studies are needed to determine the most appropriate early feeding time and the most beneficial feed additive levels for the sustainability of productivity increase in broiler farming.

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Investigation of the Expectations and Satisfaction of the Partners from Agricultural Credit Cooperatives in Trabzon

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Abstract

Agricultural Credit Cooperatives (ACC) were organized throughout Turkey with 1,001,418 partners in 36,407 affiliated settlements. The main purpose of Agricultural Credit Cooperatives is to meet the credit needs of their partners. In addition to this purpose, meeting the input needs of the partners and marketing the various products grown by the partners are among the objectives. The ability of these cooperatives to perform the expected functions more effectively, the participation of their members in their activities, is directly related to the determination of the opinions, expectations and suggestions of the members about the activities of the cooperatives. For this reason, in this study, it is aimed to determine and evaluate the expectations and satisfaction of its members regarding the functions and activities of Agricultural Credit Cooperatives.

The main population of the research consists of the partners of 3 cooperatives in Trabzon, which is within the body of the Trabzon Regional Union of Agricultural Credit Cooperatives. Care was taken to select the cooperatives established in the settlements where tea, hazelnut and animal husbandry facilities are made. In the study, the data obtained from the survey conducted with 93 randomly selected partners were used. The Wilcoxon Signed Ranks Test was used to test the extent to which the expectations of the partners were met, since the samples were not independent and the variables were measured with a Likert scale.

Most of the surveyed partners find significant about the attitudes and behavior of the ACC towards their partners, their following the innovations, their activities on issues such as agricultural input supply, input quality, price policy and education. Although the rates are lower than the expectations, it has been concluded that a significant part of the partners find the Agricultural Credit Cooperatives successful in their activities.

Key Words: Agricultural Credit Cooperatives, *Farmers Expectations, Partners satisfactions, Tarbzon*

Trabzon'da Tarım Kredi Kooperatiflerinden Ortak Beklenti ve Memnuniyetinin Araştırılması

Özet

Tarım Kredi Kooperatifleri (TKK), 16 Bölge Birliği ve 1625 birim kooperatifi ile 36.407 yerleşim biriminde 1.001.418 ortak ile Türkiye genelinde örgütlenmiştir. Tarım Kredi Kooperatiflerinin temel amacı ortaklarının kredi ihtiyaçlarını karşılamaktır. Bu amaca ilave olarak, ortaklarının girdi gereksinimlerini karşılamak ve ortaklarının yetiştirdikleri çeşitli ürünlerinin değerlendirilmesi de amaçlar arasında yeralmaktadır. Bu kooperatiflerin beklenen işlevleri daha etkin bir şekilde gerçekleştirebilmeleri, ortaklarının faaliyetlerine katılımı, kooperatiflerin faaliyetleri hakkında ortakların düşünceleri, beklenti ve önerilerinin belirlenmesi ile doğrudan ilişkilidir. Bu nedenle çalışmada, ortaklarının Tarım Kredi Kooperatiflerinin işlev ve faaliyetlerine yönelik beklenti ve memnuniyetlerinin tespit edilmesi ve değerlendirilmesi amaçlanmıştır.

Araştırmanın ana kitlesini Tarım Kredi Kooperatifleri Trabzon Bölge Birliği bünyesinde bulunan Trabzon ilindeki 3 birim kooperatifin ortakları oluşturmaktadır. Çay, fındık ve hayvancılık tesislerinin yapıldığı yerleşim yerlerinde kurulan kooperatiflerin seçimine özen gösterilmiştir. Çalışmada tesadüfi olarak seçilen 93 ortak ile yapılan anket çalışmasından elde edilen veriler kullanılmıştır. Ortakların beklentilerinin ne derece karşılandığının istatistiksel olarak test edilmesinde, örneklemler bağımsız olmadığı ve değişkenler Likert ölçeği ile ölçüldüğü için işaret testi (Wilcoxon Signed Ranks Test) kullanılmıştır.

Araştırma yapılan ortakların büyük bölümü TKK'lerinin ortaklarına karşı tutum ve davranışını, yenilikleri takip etmelerini, tarımsal girdi tedariki, girdi kalitesi, fiyat politikası ve eğitim gibi konulardaki faaliyetlerini önemsemektedirler. Oranlar beklentilerden daha düşük olmakla birlikte, ortakların önemli bir kısmının Tarım Kredi Kooperatiflerini bahse konu faaliyetlerinde başarılı buldukları sonucuna ulaşılmıştır.

Anahtar Kelimeler: *Tarım Kredi Kooperatifleri, Çiftçi Beklentileri, Ortak Memnuniyeti, Trabzon*

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Alkali Extraction Of Phenolic Compounds From Tomato Peel: Optimization Of Extraction Conditions And Investigation Of Phenolic Profile By Lc-Ms/Ms

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Abstract

With the increasing world population, the food need of humanity is increasing proportionally. Agricultural wastes constitute an important potential for the global economy as they contain components that are less preferred to be consumed as food due to their low bioavailability due to their indigestion in the human body or due to their sensory properties, but that may be beneficial to human health such as antioxidant substances and antimicrobial agents. The benefits of using these wastes in terms of economy and reducing environmental pollution are obvious. Tomato, which is one of the most used agricultural products in our country and in the world, is processed by removing its skins in the processing of many products. Tomato skins cause serious environmental problems and economic losses unless they are valorized. In this regard, this study aims to optimize the extraction efficiency, the antioxidant capacity and total phenolic content of the tomato peel extract according to the independent variables of temperature and time, while the alkaline extraction process applied to tomato skins is cheap and industrially applicable. Using response surface methodology, highest extraction yield (28.77 g/100 g dry extract), total phenolic content (3819,32 mg GAE/100 g dry extract), and total antioxidant capacity (2737.82 µmol Trolox/100 g dry extract) were obtained under extraction conditions at 100°C for 5.26 hours. According to LC-MS/MS results, tomato skins treated with alkali contain various phenolic acids and some flavonoids. The phenolic component found in the highest amount in the tomato peel extract was determined as p-coumaric acid (429.99 ± 38,53 mg/100 g dry extract). Other important phenolic components are ferulic acid (12.44 ± 2.06); 4-hydroxy benzoic acid (7.13 ± 1.01) and vanillin (2.47 ± 0.22) mg/100 g dry extract.

Key Words: *Tomato Peel, Antioxidant Capacity, Optimization, Alkaline Extraction, Phenolic Profile*

Domates Kabuğunun Alkali Ekstraksiyon Yöntemiyle Fenolik Bileşiklerinin Ortaya Çikarilmasi: Ekstraksiyon Koşullarinin Optimizasyonu Ve Fenolik Profilin Lc-Ms/Ms İle İncelenmesi

Özet

Artan dünya nüfusu ile birlikte insanlığın gıda ihtiyacı da orantılı olarak artmaktadır. Tarımsal atıklar küresel ekonomi için önemli bir potansiyel oluşturmaktadır çünkü bu atıklar antioksidan maddeler ve antimikrobiyal maddeler gibi insan sağlığına faydalı olabilecek bileşenleri içermektedir. Ancak bu bileşenlerin insan vücudunda sindirilebilirliklerinin düşük olması veya duyusal özellikleri, tarımsal atıkların gıda olarak tüketimini daha az tercih edilir kılmaktadır. Bu atıkların ekonomiye kazandırılması ve çevre kirliliğinin azaltılması açısından faydaları ortadadır. Ülkemizde ve dünyada en çok kullanılan tarım ürünlerinden biri olan domates, birçok ürünün işlenmesinde kabuğu çıkarılarak işlenmektedir. Domates kabukları değerlendirilmediği takdirde ciddi çevre sorunlarına ve ekonomik kayıplara neden olmaktadır. Bu bağlamda, bu çalışma, domates kabuklarından ucuz ve endüstriyel olarak uygulanabilir bir teknik olan alkali ekstraksiyon işlemi ile elde edilen ekstraktın ekstraksiyon verimini, antioksidan kapasitesini ve toplam fenolik madde miktarını sıcaklık ve zaman bağımsız değişkenlerine göre optimize etmeyi amaçlamaktadır. Yanıt yüzey metodolojisi kullanılarak en yüksek ekstraksiyon verimi (28.77 g/100 g kuru ekstrakt), toplam fenolik madde (3819,32 mg GAE/100g kuru ekstrakt) ve toplam antioksidan kapasite (2737.82 µmol Trolox/100 g kuru ekstrakt) elde edilmiştir. 5.26 saat boyunca 100°C'de ekstraksiyon koşulları altında LC-MS/MS fenolik profil sonuçlarına göre alkali ile muamele edilen domates kabukları çeşitli fenolik asitler ve bazı flavonoidler içermektedir. Domates kabuğu ekstraktında en yüksek miktarda bulunan fenolik bileşen p-kumarik asit (429,99 ± 38,53 mg/100 g kuru ekstrakt) olarak belirlenmiştir. Diğer önemli fenolik bileşenler ise ferulik asit (12.44 ± 2.06); 4-hidroksi benzoik asit (7.13 ± 1.01) ve vanilin (2.47 ± 0.22) mg/100 g kuru ekstrakt.olarak tespit edilmiştir.

Anahtar Kelimeler: *Domates Kabuğu, Antioksidan Kapasite, Optimizasyon, Alkali Ekstraksiyon, Fenolik Profil*

ID: 774

Evaluation of Chemical Use in Beekeeping Activities in the Şile Region of Istanbul Province

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Abstract
The province of Istanbul, Şile District has a very advantageous position for beekeeping in terms of its geographical structure and vegetation. The main purpose of this research is to reveal some general characteristics of the beekeeping producers in the Şile District of Istanbul, to evaluate the use of chemicals, and to determine the problems in the production and marketing stages. In this evaluation, beekeeping activities, data obtained through a questionnaire applied to a total of 69 beekeepers in 36 villages in Şile Region were used. With the questions asked in this survey study, detailed data were obtained on many subjects such as the reasons for starting beekeeping, educational status, honey yields, produced bee products, and fight against diseases and pests. The deficiencies in beekeeping activities are discussed as education, product marketing, queen bee production or supply, and fight against diseases and pests.
Key Words: *Beekeeping, Chemical Use, Şile, Istanbul*

İstanbul İli Şile Bölgesinde Arıcılık Faaliyetlerinde Kimyasal Kullanımının Değerlendirilmesi

Özet
İstanbul ili, Şile İlçesi coğrafik yapısı, bitki örtüsü bakımından, arıcılık için oldukça avantajlı bir konuma sahiptir. Bu araştırmanın temel amacı, İstanbul İli Şile İlçesindeki arıcılık yapan üreticilerin genel bazı özelliklerini ortaya koymak ve kimyasal kullanımını değerlendirmek, üretim ve pazarlama aşamasındaki sorunlarını saptamaktır. Bu değerlendirmede arıcılık faaliyetleri, Şile Bölgesinde 36 köyde toplam 69 arı yetiştiricisine uygulanan anketle elde edilen veriler kullanılmıştır. Bu anket çalışmasında sorulan sorular ile arıcılığa başlama nedenleri, öğrenim durumları, bal verimleri, üretilen arı ürünleri, hastalık ve zararlılar ile mücadele gibi birçok konu hakkında ayrıntılı veri elde edilmiştir. Arıcılık faaliyetlerindeki eksiklikler eğitim, ürün pazarlama, ana arı üretimi veya temini, hastalık ve zararlılar ile mücadele olarak ele alınmıştır.
Anahtar Kelimeler: *Arı Yetiştiriciliği, Kimyasal Kullanımı, Arıcılık, Şile, Istanbul*

ID: 775

Sensory Quality Properties of Fermented Foods

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Abstract
Fermentation is one of the most economical food production and traditional food preservation methods that has been applied for centuries. Fermented foods carry the cultural history of ethnic communities around the world. Milk, cereals, meat, fish, soy, vegetables and fruits based fermented products are produced in both around the world and our country. Fermented foods have biological functions such as source of probiotic microorganisms, food preservation, enrichment of nutritional value, antioxidant effect, therapeutic factors and immunological effects. Due to their functional properties, interest in the consumption of fermented foods has increased in recent years, with this increasing interest, the sensory properties of fermented foods have come to the fore. In this study, it was aimed to examine the sensory properties such as taste, aroma, smell, color, texture, appearance and shape of foods obtained by using various starter cultures, especially lactic acid bacteria. When the literature studies on fermented foods are examined, it is seen that the prominent sensory properties of fermented milk products such as yogurt, kefir, kumiss, kurut are taste, viscosity, color, aroma and smell. It has been determined that the prominent sensory properties of fermented cereal products such as boza, mahewu, tarhana, bread, idli, dosa are taste, texture, and odor resulting from microorganism activities. It was determined that the prominent sensory properties of sausage, soy sauce and fermented fish sauce were taste, aroma and texture. Finally, it has been emphasized in the literature that the prominent sensory properties of fermented fruits and vegetables such as kimchi, sauerkraut, gundruk, sunki, pickles are taste, aroma, color, texture and appearance. As a result, it has been determined that sensory properties have a significant contribution to product quality and consumer taste.
Key Words: *Fermentation, quality, sensory feature.*

Fermente Gıdaların Duyusal Kalite Özellikleri

Özet
Fermentasyon, yüzyıllardan beri uygulanmakta olan en ekonomik gıda üretim ve geleneksel gıda muhafaza yöntemlerinden birisidir. Fermentasyonla üretilen gıdalar, dünyadaki etnik toplulukların kültürel tarihini taşımaktadır. Hem dünya genelinde hem de ülkemizde süt, tahıl, et, balık, soya, sebze ve meyve bazlı olmak üzere çok çeşitli fermente ürünler üretilmektedir. Fermente gıdalar probiyotik mikroorganizma kaynağı, gıdaları koruma, besin değerini zenginleştirme, antioksidan etki, terapötik faktörler ve immünolojik etkiler gibi biyolojik işlevlere sahiptir. Fonksiyonel özelliklerinden dolayı son yıllarda fermente gıdaların tüketimine olan ilgi artmış, artan bu ilgiyle birlikte fermente gıdaların duyusal özellikleri de ön plana çıkmıştır. Bu çalışmada, laktik asit bakterileri başta olmak üzere çeşitli starter kültürler kullanılarak elde edilen gıdaların tat, aroma, koku, renk, tekstür, görünüş, şekil gibi duyusal özelliklerinin incelenmesi amaçlanmıştır. Fermente gıdalar üzerindeki literatür çalışmaları incelendiğinde, fermente süt ürünlerinden yoğurt, kefir, kımız, kurut gibi gıdaların öne çıkan duyusal özelliklerinin tat, viskozite, renk, aroma, koku olduğu anlaşılmıştır. Boza, mahewu, tarhana, ekmek, idli, dosa gibi fermente tahıl ürünlerinde öne çıkan duyusal özelliklerin tat, tekstür, mikroorganizma faaliyetleri sonucu oluşan koku olduğu belirlenmiştir. Sucukta, soya sosu ve fermente balık sosunda öne çıkan duyusal özelliklerin tat, aroma, tekstür olduğu belirlenmiştir. Son olarak kimchi, sauerkraut, gundruk, sunki, turşu gibi fermente meyve ve sebze ürünlerinde öne çıkan duyusal özelliklerin tat, aroma, renk, tekstür, görünüş olduğu literatürde vurgulanmıştır. Sonuç olarak duyusal özelliklerin ürün kalitesine ve tüketici beğenisine önemli derecede katkısının olduğu tespit edilmiştir.
Anahtar Kelimeler: *Fermentasyon, kalite, duyusal özellik.*

Giriş
Fermente gıdalar, bitkisel ve hayvansal kaynaklardan ortamdaki mikroorganizmalarla doğal olarak ya da starter kültürlerin ortama eklenmesiyle üretilen gıdalardır (Tamang ve ark., 2016). Fermentasyon ile farklı duyusal özelliklere sahip yeni bir gıda maddesi üretilmekte, ayrıca gıdanın raf ömrü uzamaktadır. Fermente yiyecek ve içecekler bakteri, maya ve küf mantarları gibi mikroorganizmaların enzimleri aracılığıyla üretilmektedir. Biyokimyasal olarak fermentasyon, karbonhidratların ve proteinlerin herhangi bir elektron alıcısının yokluğunda kısmen okside edilerek enerjinin serbest bırakıldığı metabolik bir süreçtir (Kabak ve Dobson, 2011). Sütün yoğurt ve peynire dönüşmesi, hamurun mayalanması, etil alkol, asetik asit, laktik asit, propiyonik asit, bütirik asit gibi

farklı maddelerin oluşması fermentasyon ile gerçekleşir. Bakteri fermentasyonları etken mikroorganizmaların çeşidine göre gruplandırılmakta, bu biyokimyasal değişimlerle üründe arzu edilen aromatik ve tekstürel yapıya ulaşılmaktadır.

Genel Bilgiler

Starter kültürler, fermentasyonda kullanılan GRAS nitelikteki mikroorganizmalardır. Fermentasyonda rol oynayan mikroorganizmaların doğal olarak hammaddede yeterli düzeyde bulunduğu gıdalarda fermentasyon, starter kültür ilave edilmeden gerçekleştirilebilmesine rağmen, starter kültür kullanılarak gerçekleştirilen fermentasyonlar standart ve daha yüksek kalitede ürünlerin üretilebilmesine olanak sağlamaktadır. Starter kültürler kullanılacakları hammaddeye uygun olarak seçilmektedir. Dolayısıyla süt, et, hububat ve sebze ürünleri için seçilen starterler genel olarak farklı mikroorganizmaları farklı miktarlarda içermekte, bu durum farklı duyusal özelliklerin oluşumunu desteklemektedir (Holzapfel, 1997). Gıda endüstrisinde patojen olmayan, starter kültür olarak kullanılan mikroorganizmalar laktik asit bakterileri, bazı maya ve küflerdir. Lactococcus, Lactobacillus, Leuconostoc, Pediococcus, Oenococcus ve Streptococcus cinsi bakteriler ile Saccharomyces cinsi mayalar ve Penicillium cinsi küfler gıda işlemede kullanılan başlıca starter kültürlerdir (Foulquie vd., 2006; Holzapfel, 2003). Belirli fermente ürünlerin eldesinde uygun starterlerin seçilebilmesi için, öncelikle bu starterlerden üretmeleri istenilen lezzet ve koku bileşiklerinin belirlenmiş olması gerekmektedir (Marshall, 1987). Örneğin peynir üretiminde kullanılan kültürlerde çoğalma direnci olması istenirken, fermente sucuk ve hububat ürünlerinde bu özellik istenmemekte veya hububat ürünlerinde kullanılan starter kültürün asetat ve diasetil üretmesi uygun iken peynir ve fermente sucuklarda bu özellik istenmemektedir (Ganzle, 2009). Fermente et, süt, meyve, sebze ve hububat ürünleri için kullanılan starter kültürlerin gıdaların duyusal kalite özelliklerine ve tüketici tarafından genel beğenisine ne derece önemli etkide bulunacağı aşikârdır.

Fermente Süt Ürünleri ve Duyusal Kalite

Fermente gıdalar üzerindeki literatür çalışmaları incelendiğinde, fermente süt ürünlerinden yoğurt, kefir, kımız, kurut gibi gıdaların öne çıkan duyusal özelliklerinin tat, viskozite, renk, aroma olduğu bilinmektedir. Fermente süt ürünleri içerisinde yaygın olarak tüketilenler arasında yoğurt, peynir, tereyağı ve krema yer almaktadır (De Vuyst, 2000). Özellikle Lactococcus, Leuconostoc, Lactobacillus, Streptococcus ve Pediococcus cinslerine ait laktik asit bakterileri, bu ürünlerin üretiminde rol almakta, diasetil gibi önemli aromatik bileşenler üretmektedir (Daly vd., 1998). Ayrıca starter kültürler, peynirde arzu edilen tekstürel yapının oluşumuna, yoğurt ve kremada viskoz yapının gelişimine yardımcı olmaktadır. Sağlığa oldukça faydalı süt ürünlerinden biri olan yoğurdun üretiminde *Str. thermophilus* ve *Lb. bulgaricus* türlerini içeren starter kültür karışımları kullanılmaktadır (Caplice ve Fitzgerald, 1999). Fermente süt ürünlerinden kefirin kimyasal özelliklerinin ve mikroflorasının ürünün duyusal özelliklerine direkt etki ettiği, bu etkiden sorumlu bileşiklerin de laktik asit, etanol, CO_2, diasetil, asetaldehit ve aminoasitler olduğu bilinmektedir (Rattray ve O' Connel, 2011).

Fermente Et Ürünleri ve Duyusal Kalite

Fermente et ürünlerinden fermente sucukta, soya sosu ve fermente balık sosunda öne çıkan duyusal özelliklerin tat, aroma, tekstür olduğu bilinmektedir. Etin fermente edilerek muhafazası çok eski tarihlerden beri uygulanan işleme yöntemlerindendir. Etin kürleme tuzu ile karıştırılarak fermente edilmesi ve kurutulması mikrobiyolojik açıdan daha dayanıklı bir ürün oluşturmaktadır. Özellikle Avrupa' nın merkezi ve Güney Avrupa'da, ayrıca birçok Asya ülkesinde fermente et ürünleri yaygın olarak tüketilmektedir (Caplice ve Fitzgerald, 1999). Etin fermentasyonu sırasında starter kültürler duyusal kaliteyi geliştirirken aynı zamanda biyokoruyucu ajanlar olarak da davranmaktadır (Fadda vd., 2010). Et ürünlerinden izole edilip daha sonra fermente et üretiminde starter kültür olarak kullanılan laktik asit bakterileri, fermentasyon sırasında spontan mikroflorayı engelleyerek, fermentasyon ve olgunlaşma aşamalarını kontrol etmektedirler (Hugas ve Monfort, 1997).

Fermente Sebze Ürünleri ve Duyusal Kalite

Kimchi, sauerkraut, gundruk, sunki, turşu gibi fermente meyve ve sebze ürünlerinde öne çıkan duyusal özelliklerin tat, aroma, renk, tekstür, görünüş olduğu literatürde vurgulanmıştır. Sebze ürünlerinden salatalık, lahana ve zeytin gibi hammaddelerin fermente edilmesi endüstriyel açıdan önem kazanmıştır. Havuç, fasulye, enginar, kapari ve patlıcan gibi diğer bazı sebze çeşitlerinin de standart şartlar altında laktik asit fermentasyonu sağlanarak güvenliği, besin içeriği, raf ömrü, tat, aroma, renk, tekstür, görünüş gibi duyusal özellikleri iyileştirilmektedir. Ayrıca fermentasyonda oluşan laktik asit antimikrobiyal etki sunmaktadır. İstenen kalitede fermente bir sebze ürünü elde edebilmek için laktik asit bakterilerinin hammaddenin özelliklerine adapte olması gerekmektedir (Rodríguez vd., 2009). Günümüzde birçok sebze fermentasyonu, ortama sadece tuz eklenmesi yoluyla gerçekleştirilmektedir. Taze sebzelerde bulunan laktik asit bakterileri, doğal floranın sadece %0,15–1,5' ini oluşturmaktadır (Buckenhüskes, 1997). Spontan fermentasyon, ortamdaki doğal flora ile kontamine mikroorganizmalar arasındaki rekabet sonucu gerçekleşmekte, zamanla bu süreç uzamakta, işlem başarısız olabilmektedir. Bozucu ve patojen mikroorganizmaların gelişiminin engellenerek yüksek kalite ve güvenliğe sahip ürün elde edilebilmesi için sebze

fermentasyonunda starter kültür kullanılması önerilmektedir. *Lb. plantarum*, salatalık, lahana ve zeytin fermentasyonunda en sık kullanılan ticari starter kültürdür (Rodríguez vd., 2009). Fermente zeytin üretiminde, son ürün için duyusal özeliklerin korunması ve geliştirilmesi büyük önem taşımaktadır. Fermentasyonun etkinliğini belirlemede en önemli faktör laktik asit konsantrasyonudur. Ayrıca mikrobiyal metabolizma sonucu oluşan ürünler de aroma ve lezzet özelliklerini etkilemektedir. Renk, ürün tercihinde tüketicinin dikkatini çeken öncelikli kriterlerden birisidir. Ürünün tat, tekstür, raf ömrü gibi birçok önemli özelliği hakkında tüketiciye bilgi sunmakla birlikte ürün albenisine de katkıda bulunmaktadır (Erbay vd., 2010).

Fermente Tahıl Ürünleri ve Duyusal Kalite

Boza, mahewu, tarhana, ekmek, idli, dosa gibi fermente tahıl ürünlerinde öne çıkan duyusal özelliklerin tat, tekstür, mikroorganizma faaliyetleri sonucu oluşan koku olduğu belirlenmiştir. Tahıl ürünleri, günlük protein, karbonhidrat, vitamin, mineral ve diyet lifi ihtiyacını karşılama açısından önemli kaynaklar olup bu ürünlerin fermente edilmesi ile ürünün hem besin değerinde hem de duyusal özelliklerinde önemli artışlar sağlanmaktadır. Fermentasyonda tahıl ürünlerindeki fitatların optimum pH' da enzimatik yıkımları sonucunda çözünebilir demir, çinko, kalsiyum gibi minerallerin miktarlarında artış olması besinsel kaliteyi iyileştirirken; protein miktarı ve kalitesinde artış arzu edilen tekstürel yapıyı desteklemektedir. Bazı aminoasitlerin sentezi ve B vitamini içeriğindeki artış aromayı etkilemekte, ayrıca güvenli ürünler üretilmektedir (Blandino vd., 2003). Fermente tahıl ürünlerinden tarhana üzerinde yapılan bir çalışmada tarhananın serbest aminoasitlerinden valine, methionin, triptofan ve alanine miktarlarındaki artışın fermentasyon süresince proteolitik aktiviteden kaynaklandığı saptanmıştır (Erbaş vd., 2005). Gerçekleşen bu biyokimyasal ve mikrobiyolojik değişimler ürünün duyusal özelliklerini yakından etkilemektedir. Ayrıca reaksiyonlarda etken faktör pH da önem arz etmekte, ürünün duyusal özelliklerini etkilemektedir. Boza üzerinde yapılan bir çalışmada 24 saat fermentasyon süresince kimyasal özelliklerdeki değişim izlenmiş, fermentasyon sonunda toplam asitliğin %0,02' den %0,27' e, alkol içeriğinin %0,02' den %0,79' a yükseldiği; pH değerinin ise 6,13' den 3,48' e düştüğü, tüm bu oluşumların ürün özelliklerini etkilediği belirlenmiştir (Hancıoğlu ve Karapınar, 1998).

Sonuç

Çalışmada, fermente gıdaların duyusal kalite özelliklerinin ürün için öneminin incelenmesi amaçlanmıştır. Elde edilen literatür bulguları ile kimyasal ve mikrobiyolojik özelliklerin fermente gıdaların duyusal özelliklerini de etkilediği anlaşılmıştır. Fermente et, tahıl, süt ve meyve sebze ürünlerinin renk, aroma, tekstür, görünüş gibi özellikleri başta olmak üzere duyusal özelliklerinin gıdalar için kalite standartlarının belirlenmesinde önemli rol oynadığı vurgulanmıştır.

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ID: 776

Enhanced immunosuppressive effects of 3,5-bis[4 (diethoxymethyl)benzylidene]-1-methyl-piperidin- 4-one, an α, β-unsaturated carbonyl-based compound as PLGA-b-PEG nanoparticles

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3,5-Bis[4-(diethoxymethyl)benzylidene]-1-methyl-piperidin-4-one (BBP), a novel synthetic curcumin analogue has been revealed to possess strong *in vitro* and *in vivo* immunosuppressive effects. The aim of present study was to prepare and characterize BBP-encapsulated polylactic-co-glycolic acid-block-polyethylene glycol (PLGA-b-PEG) nanoparticles and to evaluate its *in vivo* efficacy against innate and adaptive immune responses. Male BALB/c mice were orally administered with BBP alone and BBP- encapsulated nanoparticles equivalent to 5, 10 and 20 mg/kg of BBP in distilled water for a period of 14 days. The immunomodulatory potential was appraised by determining its effects of non-specific and specific immune parameters. The results showed that BBP was successfully encapsulated in PLGA-b-PEG polymer with 154.3 nm size and high encapsulation efficiency (79%) while providing a sustained release for 48 hours. BBP nanoparticles showed significant enhanced dose-dependent reduction on the migration of neutrophils, Mac-1 expression, phagocytic activity, reactive oxygen species (ROS) production, serum levels of ceruloplasmin and lysozyme, immunoglobulins and myeloperoxidase (MPO) plasma levels when compared to unencapsulated BBP. Enhanced dose-dependent inhibition was also observed on lymphocyte proliferation along with the downregulation of effector cells expression and release of cytokines, and reduction in rat paw oedema in BBP nanoparticles treated mice. At higher doses the suppressive effects of the BBP nanoparticles on various cellular and humoral parameters of immune responses were comparable to that of cyclosporine-A at 20 mg/kg. These findings suggest that the immunosuppressive effects of BBP were enhanced as PLGA-b-PEG nanoparticles.

Keywords: Immunosuppressive, PLGA-PEG polymer, Immunomodulatory

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Determination of resistance levels of *Hordeum vulgare L.* lines grown in Türkiye against *F. culmorum*

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Abstract

Barley (*Hordeum vulgare* L.) is one of the important cereals widely cultivated in Turkey. The yield and product quality of barley cultivation is decreasing due to infections caused by plant pathogens such as *Fusarium culmorum*. In the scope of the research, 23 barley lines were infected with *F. culmorum* (FcUK99) and incubated for 7 days at 28°C±2. At the end of the period, changes in barley following infection were examined morphologically, and the severity of the disease was evaluated. According to the pathogenicity test, sensitive (*H. vulgare L.* cv. Akhisar 98) and resistant (*H. vulgare L.* cv. Avcı 2002) lines were determined. Changes in epigenetic and genomic stability were investigated by coupled restriction enzyme digestion-random amplification (CRED-RA) analysis. In CRED-RA assays for Akhisar 98, genomic template stability (GTS) and % polymorphism for *Hap*II/*Msp*I values were 83% and 22.3/37.8% while, values for Avcı 2002 were 90% and 0%/5,8%, respectively. Total RNA isolation and cDNA synthesis were performed in control and experimental groups. The effects of pathogenicity on gene expression levels in 7 *WRKY* genes were analyzed. The highest gene expression level for Avcı 2002 and Akhisar 98 barley lines was determined in *WRKY 6* gene. Fold changes in *WRKY 6* of Avcı 2002 and Akhisar 98 cultivars were calculated as 4.95 ± 1.28 and 1.72 ± 0.28, respectively. The lowest gene expression levels for Avcı 2002 and Akhisar 98 were determined in *WRKY 9* (0,042±0,009) *and WRKY 33* (1,073±0,20) genes, respectively. This study is important in terms of knowing the resistance levels of barley against phytopathogens and developing effective strategies against this species in the agricultural field.

Key Words: *CRED-RA, Fusarium culmorum, Hordeum vulgare L., Gene Expression, WRKY,*

Türkiye'de yetiştirilen *Hordeum vulgare L.* hatlarının *F. culmorum'*a karşı direnç seviyesinin belirlenmesi

Özet

Arpa (*Hordeum vulgare L.)*, ülkemizde yaygın bir şekilde ekimi yapılan önemli hububat çeşitlerinden biridir. Ancak, *Fusarium culmorum* gibi bitki patojenlerinin geliştirdiği enfeksiyonlar nedeniyle elde edilen ürün kalitesinde düşüş yaşanmaktadır. Proje kapsamında 23 arpa çeşidi *F. culmorum* (FcUK99*)* fitopatojeni ile enfekte edilmiş, 28°C±2 sıcaklık altında 7 gün boyunca inkübe edilmiştir. Süre sonunda arpalarda enfeksiyon sonucu oluşan değişimler morfolojik olarak incelenmiş, hastalık şiddeti hesaplanmıştır. Patojenite testine göre hassas (*H.vulgare L. cv.* Akhisar 98) ve dirençli hatlar (*H.vulgare L. cv.* Avcı 2002) tespit edilmiştir. Patojenite uygulaması sonucu gelişen epigenetik ve genomik stabilitedeki değişimler çift restriksiyon enzimi kesimi ve rastgele çoğaltımı (CRED-RA) analizi ile gerçekleştirilmiştir. Yapılan CRED-RA analizlerinde *H.vulgare L. cv.* Akhisar 98 ve *H.vulgare L. cv.* Avcı 2002 hatlarının genomik kalıp stabilitesi (GKS) ve *Hap*II/*Msp*I % polimorfizm değerleri sırasıyla, %83, %90 ve %22,3/37,8, %0,0/%5.8 olarak belirlenmiştir. Kontrol ve deney gruplarından total RNA izolasyonu ve cDNA sentezi gerçekleştirilmiştir. 7 *WRKY* geninde patojeniteye karşı gelişen gen anlatım düzeyindeki değişimler incelenmiştir. Avcı 2002 ve Akhisar 98 arpa hatları için en yüksek ekspresyon seviyesine sahip gen *WRKY 6* geni olarak belirlenmiştir. Bu gen için Avcı 2002 ve Akhisar 98 hatlarının gen anlatım oransal değişimleri sırasıyla 4,954 ± 1,286 ve 1,722 ± 0,2884 olarak elde edilmiştir. En düşük gen anlatım seviyesi Akhisar 98 hattında *WRKY 33* (1,073±0,20) geninde belirlenirken, Avcı 2002 hattı için *WRKY 9* (0,042±0,009) genidir. Bu çalışma, arpaların fitopatojenlere karşı direnç seviyelerinin bilinmesi, zirai alanda bu türe karşı etkin stratejiler geliştirilmesi açısından önem arz etmektedir.

Anahtar Kelimeler: *CRED-RA, Gen Anlatımı, Fusarium culmorum, Hordeum vulgare L. WRKY,*

ID: 778

Biodegradation of Some Pesticides by *Enterobacter cloacae*; *in vitro*

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Abstract
In this study, the degradation of some pesticides (acetamiprid, boscalid, deltamethrin, kresoxim-methyl, pyraclastrobin and pyridaben) by *Enterobacter cloacae* (plant growth promoting bacteria) was investigated in vitro. The bacterial isolate used in the study was isolated from the rhizosphere region of the plants in the pepper production areas of Tokat province and diagnosed by MALDI-TOF MS (Matrix-Assisted Laser Desorption Ionization-Time of Flight Mass Spectrometry) technique. It was determined that the effective substances used initially did not have a negative effect on *E. cloacae*, and the bacteria showed the same growth as the control group in the nutrient agar medium. Secondly, application doses of pesticides were added to erlenmeyers with nutrient broth, and 1 ml of $1x10^9$ cells/ml of *E. cloacae* solution was inoculated and incubated in a shaker at room temperature (24 °C) for 7 days. After the nutrient broth medium were extracted, pesticide amounts were measured by Liquid Chromatography Tandem Mass Spectrometry (LC-MS/MS). When the results were compared with the control group, there was no degradation in acetamiprid, but 98.9% in pyraclastrobin, 98.6% in boscalid, 94.1% in kresoxim-methyl, 73.5% in pyridaben and 57.3% in deltamethrin. The results of this work may provide useful information for the biodegradation of boscalid, deltamethrin, kresoxim-methyl, pyraclastrobin and pyridaben in wastewater, soil, groundwater and plant.
Key Words: *Bacteria, Pesticide, Biodegradation, Bioremediation, PGPR, LC-MS/MS,*

Özet
Bu çalışmada seçilen bazı pestisitlerin (acetamiprid, boscalid, deltamethrin, kresoxim-methyl, pyraclastrobin ve pyridaben) laboratuvar ortamında *Enterobacter cloacae* (bitki gelişimini teşvik eden bakteri) tarafından bozunması araştırılmıştır. Çalışmada kullanılan bakteri izolatı, Tokat ili biber üretim alanlarındaki bitkilerin rizosfer bölgesinden izole edilmiş, MALDI-TOF MS (Matrix-Assisted Laser Desorption Ionization-Time of Flight Mass Spectrometry) tekniği ile tanısı konulmuştur. İlk olarak kullanılan pestisitlerin *E. cloacae* üzerinde olumsuz bir etki yapmadığı, nutrient agar besi yerinde bakterinin kontrol grubu ile aynı gelişimi gösterdiği tespit edilmiştir. İkinci olarak nutrient broth sıvı besi yeri bulunan erlenmayerlere pestisitlerin uygulama dozları eklenmiş ve 1'er ml $1x10^9$ hücre/ml yoğunluğunda *E. cloacae* solüsyonu inokule edilerek 7 gün boyunca oda sıcaklığında (24 °C'de) inkübasyona bırakılmıştır. Süre bitiminde alınan nutrient broth besi yerleri ekstrakte edildikten sonra Sıvı Kromatografi-Tandem Kütle Spektrometre (LC-MS/MS) cihazında pestisit miktarları ölçülmüştür. Sonuçlar kontrol grubu ile kıyaslandığında acetamiprid'de bozunma olmazken pyraclastrobin'de %98.9, boscalid'de %98.6, kresoxim-methyl'de %94.1, pyridaben'de %73.5 ve deltamethrin'de %57.3 oranında bozunma görülmüştür. Bu çalışmanın sonuçları, boscalid, deltamethrin, kresoxim-methyl, pyraclastrobin ve pyridaben etkili maddelerinin atık su, toprak, yeraltı suyu ve bitkide biyolojik olarak parçalanması için faydalı bilgiler sağlayabilir.
Anahtar Kelimeler: *Bakteri, Biyodegredasyon, Biyoremediasyon, PGPR, LC-MS/MS,*

ID: 779

Effects of Cold Stress During Incubation on Hatchability and Sex Ratio in Layers

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Abstract

Temperature is the most important factor in incubation and the developing embryo is very sensitive to environmental temperature. Incubation temperature is effective on hatchability and chick quality as it provides embryonic growth and development. In this context, the effect of cold stress applied during certain periods of hatching on hatchability performance and sex ratio was researched in this study. For this purpose, 800 breeding eggs belonging to Brown Nick and Nick Chick genotypes were used in the study. Eggs were randomly divided into control and cold stress groups and they were incubated in the combined incubators. The study consists of two different experiments. The experiment consisted of 1 control group (CG; 37.8 °C during incubation) and 3 different treatment groups. Group 1 (TRG-1) of the treatment groups was 6 hours on the 3rd day of incubation, group 2 (TRG-2) was 6 hours on the 3rd and 4th days of incubation, and group 3 (TRG-3) was on the 3rd, 4th and 5th days of incubation. They were exposed to cold stress at 10 °C for 6 hours each day. Experiment 2 consists of a control group (CG; 37.8 °C during incubation) and 3 different treatment groups. Treatment groups were incubated at 10 °C for 6 hours on the 15th day (TRG-1), 6 hours on the 15th and 16th days (TRG-2), and 6 hours on the 15th, 16th and 17th days (TRG-3) cold stress was applied. According to the results obtained, it was determined that the application of cold stress did not significantly affect the hatching weight of the chick in both experiments ($P \geq 0.4168$). Nevertheless, no effect of cold application on hatching eggs on hatchability was observed in both experiments ($P=0.9710$; $P=0.5616$). Again, no statistically significant difference was found between the groups in terms of the probability of hatching male chicks ($P \geq 0.5110$). Although it is not statistically significant, considering that the probability of male chick hatching is 49% lower, this numerical difference can be economically important for hatcheries that produce layer chicks. On the other hand, probability means less one-day old male chick culling. In 1, each hour in which the embryos were kept at 10 degrees increased the incubation period by 1.23 hours. Each hour in which the embryos were kept at 10 degrees in Experiment 1 extended the incubation period by 1.25 hours, and in experiment 2 by 1.02 hours. As a result, there was no negative effect of cold stress on hatching weights and hatching eggs on hatchability embryos of different genotypes.

Key Words: *Egg, Incubation, Hatchability, Male chick, Hatching weight*

Yumurtacı Tavuklarda Kuluçka Esnasında Uygulanan Soğuk Stresinin Kuluçka Performansı ve Cinsiyet Oranı Üzerine Etkileri

Özet

Kuluçkada sıcaklık en önemli faktördür ve gelişen embriyo çevre sıcaklığına karşı çok hassastır. Kuluçka sıcaklığı, embriyonik büyüme ve gelişmeyi sağlaması sebebiyle kuluçka performansı ve civciv kalitesi üzerinde etkilidir. Bu bağlamda bu çalışmada kuluçkanın belirli dönemlerinde uygulanan soğuk stresinin kuluçka performansı ve cinsiyet oranına etkisi araştırılmıştır. Bu amaçla çalışmada 800 adet Brown Nick ve Nick Chick genotiplerine ait damızlık yumurtalar kullanılmıştır. Yumurtalar kontrol ve soğuk stresi gruplarına rastgele bölünerek kuluçka makinelerinde inkübe edilmiştir. Çalışma iki farklı denemeden oluşmaktadır. Deneme 1 kontrol grubu (KG; kuluçka sürecince 37,8 °C) , 3 farklı muamele grubundan oluşmuştur. Uygulama gruplarından grup 1 (UYG-1) inkübasyonun 3. gününde 6 saat, grup 2 (UYG-2) 3.ve 4. günlerinde 6'şar saat ve grup 3 (UYG-3) ise kuluçkanın 3., 4. ve 5. günlerinde 6'şar saat boyunca 10 °C'de soğuk stresine maruz bırakılmıştır. Deneme 2 ise yine kontrol grubu (KG; kuluçka sürecince 37,8 °C) ve 3 farklı muamele grubundan oluşmaktadır. Uygulama grupları 10 °C'de inkübasyonun 15. gününde 6 saat (UYG-1) , 15. ve 16. günlerinde 6'şar saat (UYG-2) ve 15., 16. ve 17. günlerinde 6'şar saat (UYG-3) soğuk stresi uygulanmıştır. Elde edilen sonuçlara göre soğuk stres uygulamasının her iki denemede de civciv çıkış ağırlığını önemli düzeyde etkilemediği belirlenmiştir ($P \geq 0,4168$). Yine her iki denemede soğuk uygulamasının çıkış gücü üzerinde bir etkisi görülmemiştir ($P=0,9710$; $P=0,5616$). Erkek civciv çıkma olasılığı bakımından yine her iki denemede gruplar arasında istatistiksel olarak önemli bir farklılık tespit edilmemiştir ($P \geq 0,5110$). İstatistiksel olarak önemli olmasa da erkek civciv çıkma olasılığının %49 daha düşük olduğu düşünüldüğünde rakamsal olarak gözlenen bu farklılık yumurtacı civciv üretimi yapan kuluçkahaneler için ekonomik olarak önem arz edebilmektedir. Diğer taraftan olasılık daha az erkeğin itlafı anlamına gelmektedir. Deneme 1'de embriyoların 10 derecede tutulduğu her bir saat, kuluçka süresini 1,25 saat, Deneme 2'de ise 1,02 saat uzatmıştır. Sonuç olarak soğuk stresinin farklı genotiplerdeki embriyoların çıkış ağırlıkları ve çıkım gücü üzerinde olumsuz etkisi görülmemiştir.

Anahtar Kelimeler: *Yumurta, İnkübasyon, Çıkım gücü, Erkek civciv, Çıkış ağırlığı*

Giriş

Kuluçka işletmeciliğinde kârlılık kuluçkalık yumurtadan elde edilecek civciv sayısı ve kalitesine bağlıdır. Kuluçka performansı ve embriyo kaybı damızlıkların yaşı, beslenmeleri, erkek/dişi oranı, yumurta ağırlığı, yumurtaların depolanması, kuluçka sıcaklığı, nemi ve çevirme işleminden etkilenir. İyi bir embriyo gelişiminin sağlanabilmesi ve kaliteli civciv elde edilmesi için inkübatör sıcaklığı büyük önem taşımaktadır.

Kanatlı hayvanlarda ontogenez esnasında fonksiyonel sistemlerin ve fonksiyonel endokrin eksenlerin kurulması için kritik dönemler vardır. Tavuklarda embriyonik gonadların embriyonik gelişimin 3,5 – 4,5 gününe kadar morfolojik olarak her iki cinsiyette de benzer oldukları, ancak embriyonik gelişimin 6,5 gününden itibaren belirgin bir şekilde farklılaştıkları bildirilmiştir (Ebensperger ve ark., 1988). Hipotalamus-hipofiz-tiroid bezleri ve adrenal eksenlerin oluşma dönemi, embriyo gelişmesini etkileyen kritik periyot olarak önerilmiştir (Halle ve Tzschentke,2011).

En iyi çıkış gücü ve en iyi çıkış sonrası performansın yumurta kabuğu sıcaklığının sürekli 37,8 °C'de tutulduğu embriyolarda olduğu ve özellikle kuluçkanın son haftası boyunca yüksek yumurta kabuk sıcaklığının (38,9 °C) geç dönem embriyonik ölümü artırdığı bildirilmiştir. Optimum civciv kalitesi ve kuluçka performansı elde etmek için inkübasyon koşullarının embriyonik gereksinimleri karşılayacak şekilde ayarlanması gerekir (Meijerhof, 2009).

Bazı türlerde monoseks bireylerin üretimi arzu edilir. Örneğin yumurta üretiminde dişiler ön plana çıkarken et üretiminde erkekler tercih edilir. Yumurtacı tavuklarda erkek civcivler istenmemekte, dolayısıyla milyonlarca 1 günlük erkek civciv imha edilmektedir (Koenig ve ark., 2012). Yumurtacı erkek civcivlerin imha edilmeleri özellikle hayvan hakları savunucularının tepkisine neden olmaktadır. Hayvan hakları savunucularının giderek seslerini yükseltmeleri neticesinde başta Avrupa ülkelerinde olmak üzere, 1 günlük erkek civcivlerin öldürülmelerine yönelik toplumsal bir baskı oluşmuştur. Bu anlamda yumurta tavukçuluğu sektörü sorunun çözümü için yollar aramaktadır. Kanatlılarda, özellikle kuluçka süresince maruz kalınan çevresel faktörler yumurtadan çıkan yavruların cinsiyet oranında rol oynayabilmektedir. Örneğin inkübasyonun ilk 5 günü 38,1 °C sıcaklık uygulaması sonucu %8 ile %10 daha fazla erkek civciv üretilmiştir (Piestun ve ark., 2013). Erkek ve dişi embriyoların gelişimsel koşullara ve çevresel stres faktörlerine farklı tepki verdikleri bildirilmektedir (Sockman ve ark., 2008). Tavuklarda cinsiyet farklılaşması inkübasyonun 5. ve 6. günleri arasında şekillenmektedir. Dişilerde aromataz geninin ekspresyonu inkübasyonun 5-6. günlerinde başlamaktadır. Aromataz proteini, dişi gonadların medullasında eksprese edilir ve ekspresyonu yumurtalık gelişimi sırasında artar. Aromataz çevresel etkilere, özellikle sıcaklığa karşı duyarlıdır (Bruggeman ve ark., 2007).

Bugüne kadar kuluçka sorunlarının irdelendiği çalışmaların çoğunda yüksek kuluçka sıcaklıklarının etkisi araştırılmıştır. Genellikle etlik piliçler üzerinde ve embriyonik gelişimin son döneminde yüksek sıcaklıklar uygulanmıştır. Ancak herhangi bir nedenle oluşabilecek olan sıcaklık düşüşlerinin embriyolar ve çıkım sonuçları etkisine yönelik çalışmalar kısıtlıdır. Bu çalışmada embriyonik gelişimin belirli dönemlerinde soğuk stresi uygulamasının farklı yumurtacı tavuk genotiplerinde kuluçka performansı ve cinsiyet oranına etkileri araştırılmıştır.

Materyal ve Yöntem

Çalışma Çanakkale Onsekiz Mart Üniversitesi Deneysel Araştırmalar Uygulama ve Araştırma Merkezi Kanatlı Ünitesi'nde bulunan kombine kuluçka makineleri kullanılarak gerçekleştirilmiştir. Çalışmada ticari bir firmadan temin edilen 800 adet Brown Nick ve Nick Chick genotiplerine ait damızlık yumurtalar kullanılmıştır. Yumurtalar kontrol ve soğuk stresi gruplarına rastgele bölünerek kuluçka makinelerinde inkübe edilmiştir. Çalışma embriyonik gelişimin erken döneminde soğuk stresi ve inkübasyonun geç döneminde soğuk stresi olmak üzere 2 denemeden oluşmuştur.

Deneme 1'e ait soğuk stres uygulaması Çizelge 1'de görülen sürelerde uygulanmıştır. Söz konusu çizelgeden görüleceği üzere Deneme 1, kontrol grubu ve 3 farklı muamele grubundan oluşmaktadır (Çizelge 1.) Buna göre kontrol grubu yumurtalar çıkım ünitesine alınana kadar 37,8 °C'de inkübe edilmiştir. Uygulama gruplarından Grup-1, kuluçkanın 3. gününde 6 saat boyunca 10 °C'ye konmuş, Grup-2 ise 3. ve 4. günlerde 6'şar saat boyunca 10 °C'ye konmuştur. Grup-3' e ait yumurtalar ise kuluçkanın 3., 4. ve 5. günlerinde 6'şar saat boyunca 10 °C'de muhafaza edilmiştir.

Çizelge 1. Erken Dönemde Uygulanan Soğuk Stresine ilişkin deneme düzeni

Gruplar	**Kuluçka Süreci**	**Sıcaklık**	**Günlük Süre**	**Soğuk Uygulanan Toplam Süre**
Kontrol	18. güne kadar	37,8 °C	Sürekli	0
Grup 1	3. gün	10 °C	6 saat	6 saat
Grup 2	3. ve 4. günler	10 °C	6 saat	12 saat
Grup 3	3., 4. ve 5. günler	10 °C	6 saat	18 saat

Embriyonik dönemin 14. gününden itibaren, hipotalamus-pituiter-adrenal ekseninin fonksiyonel gelişimi başlamaktadır. Hipotalamus-pituiter-adrenal ekseni tamamen işlevsel olduğunda, salgılanan adrenokortikal steroidler, stres toleransı, embriyonun yaşama gücü ve çıkım sonrası performansı gibi birçok faktör üzerinde önemli bir etkiye sahiptir (Jenkins ve Porter, 2004). Bu bağlamda da Deneme 2'deki uygulama grupları 15. gün soğuk uygulaması, 15. ve 16. günler soğuk uygulaması ve 15., 16. ve 17. günler soğuk uygulaması olarak 3 farklı uygulama grubundan oluşmuştur (Çizelge 2).

Çizelge 2. Geç Dönemde Uygulanan Soğuk Stresine ilişkin deneme düzeni

Gruplar	**Kuluçka Süreci**	**Sıcaklık**	**Günlük Süre**	**Soğuk Uygulanan Toplam Süre**
Kontrol	18. güne kadar	37,8 °C	Sürekli	0
Grup 1	15. gün	10 °C	6 saat	6 saat
Grup 2	15. ve 16. günler	10 °C	6 saat	12 saat
Grup 3	15., 16. ve 17. günler	10 °C	6 saat	18 saat

Her bir çalışma gruplarındaki yumurtalar kuluçkaya konmadan önce,± 0,1 g hassasiyette hassas terazi ile tartılarak yumurta ağırlıkları belirlenmiştir. Kuluçkanın 18. günü gelişimini tamamlayan yumurtaların 18. gün tartımı yapılarak 37,5°C sıcaklık, %60 nem içeren çıkım bölümüne aktarılmıştır. Gelişim gerçekleşmeyen yumurtalar kırılarak yapılan gözlemler sonucu çıkış gücü (ÇG) ve çıkım gerçekleşmeyen yumurtalarda ise embriyo ölümleri belirlenmiştir. Yumurtadan çıkımı gerçekleşen her bir civciv tartılarak çıkış ağırlığı belirlenmiştir. Civcivlerin renklerine ve tüylenme hızına bakılarak cinsiyet tayini yapılmıştır. Civcivlerin yumurtadan çıkış saatleri 6 saat aralıklar ile kontrol edilmiş ve kuluçka çıkış saati kayıt altına alınmıştır.
İstatistiksel Analizlerde 0. gün, 18. gün yumurta ağırlıkları ve çıkış ağırlığı, cinsiyet, çıkım gücü ve kuluçka sürelerine ilişkin varyans analizinde grup (Kontrol, Grup 1, Grup 2 ve Grup 3) ve genotip (Brown Nick, Nick Chick) faktörleri ile bunların interaksiyonlarını içeren model kullanılmıştır.

Bulgular ve Tartışma

Deneme 1: Erken Dönem Uygulanan Soğuk Stresine Ait Çalışma Bulguları

Çalışmada çıkış ağırlıkları bakımından grup ve genotiplere göre en küçük kareler ortalamaları ve önem seviyelerine bakıldığında ele alınan özelliklerin gruplar arasındaki farkı istatistiksel olarak önemli değil iken Grup*Genotip etkileşimleri istatistiksel olarak önemli bulunmuştur (*P*=0,0025). Muhtemelen grup genotip etkileşiminin önemli bulunması genotipler arası 0. gün yumurta ağırlık farkından kaynaklanmaktadır (veriler sunulmamıştır).

Çizelge 3. Grup ve genotiplere göre 0. ve 18. gün yumurta ağırlıkları ve çıkış ağırlıklarına ilişkin en küçük kareler ortalamaları ($\bar{x}$), standart hataları (SH) ve önem seviyeleri (P)

Faktör	***Seviye***	**18. gün Yumurta Ağırlıkları**				**Çıkış Ağırlığı**			
		$\bar{x}$	**SH**	***P***	**Grup*Genotip**	$\bar{x}$	**SH**	***P***	**Grup*Genotip**
Grup	**Kontrol**	49,57	0,34	0,1398	<0,0001	38,89	0,34	0,4168	0,0025
	Grup 1	50,35	0,35			39,20	0,33		
	Grup 2	49,76	0,35			38,71	0,32		
	Grup 3	49,22	0,35			38,44	0,33		
Genotip	**Brown Nick**	48,23	0,25	<0,0001		37,81	0,24	<0,0001	
	Nick Chick	51,22	0,25			39,81	0,22		

Soğuk stresi uygulamasının civciv çıkma olasılığı üzerinde olumsuz bir etkisi görülmemektedir (Çizelge 4; *P*=0,9710). Kanatlı hayvanlarda embriyonik ortam - özellikle sıcaklık - bir bireyin metabolik hızını yöneterek yavrunun hayatta kalmasını etkileyebilir. Muhtemelen embriyonik gelişimin erken döneminde uygulanan soğuk stresi embriyonik aşamada hücrelerin gelişimini korumuş olabilir. Kanatlı hayvanlarda kronik veya akut stres altında sıcaklık şoku protein genlerinin (HSP) ekspresyonu artmaktadır (Gol ve ark., 2022). Hipotermi gen ekspresyonunu yeniden şekillendirerek antioksidan sistemi indüklemektedir (Eskla ve ark., 2018). Dolayısı ile oksidatif strese karşı güçlü bir savunma mekanizması oluşmaktadır. Soğuk stresinin embriyoların yaşama gücünü etkilemediği söylenebilir.

Çizelge 4. Çıkım gücü bakımından ele alınan faktörlere ilişkin regresyon katsayıları (b), standart hata (SH), odds oranları (Ψ) ve *P* değerleri

Faktör	***Seviye***	***b***	**SH**	***Ψ***	***P***	**Grup*Genotip**
Grup	Kontrol	0,00	0,00	1,00	0,9710	0,7998
	Grup 1	0,27	0,64	1,31		
	Grup 2	0,23	0,64	1,25		
	Grup 3	0,56	0,61	1,75		
Genotip	Brown Nick	1,03	0,58	2,81	0,0104	
	Nick Chick	0,00	0,00	1,00		

Brown Nick genotipinde civciv çıkma olasılığı Nick Chick'lere göre 2,81 kat daha yüksek bulunmuştur (*P*=0,0104). 11 farklı beyaz yumurtacı genotip ile 11 farklı kahverengi yumurtacı genotiplerin mevsime göre çıkım güçlerinin değerlendirildiği bir çalışmada tüm aylar boyunca kahverengilerin çıkım güçlerinin beyazlara göre daha yüksek olduğu bildirilmiştir (Bouba ve ark., 2021).

Yapılan incelemeler sonucunda embriyonik ölüm oranları bakımından gruplar arasında istatistiksel olarak önemli fark bulunmamıştır (veriler sunulmamıştır). Kanatlılarda, doğal kuluçka koşullarında cinsiyet oranlarının manipülasyonu, koşullar bir cinsiyet için diğerine göre daha uygun olduğunda daha fazla erkek veya dişi üretilebilmektedir. Örneğin kuluçka sıcaklığı, cinsiyetler arasındaki farklı embriyonik ölüm oranı yoluyla kuşların cinsiyet oranlarını etkilediği bildirilmiştir (Eiby ve ark., 2008).

Soğuk uygulamasının cinsiyete olan etkisinin istatistiksel olarak önemsiz olduğu tespit edilmiştir (Çizelge 5; *P*=0,5110).

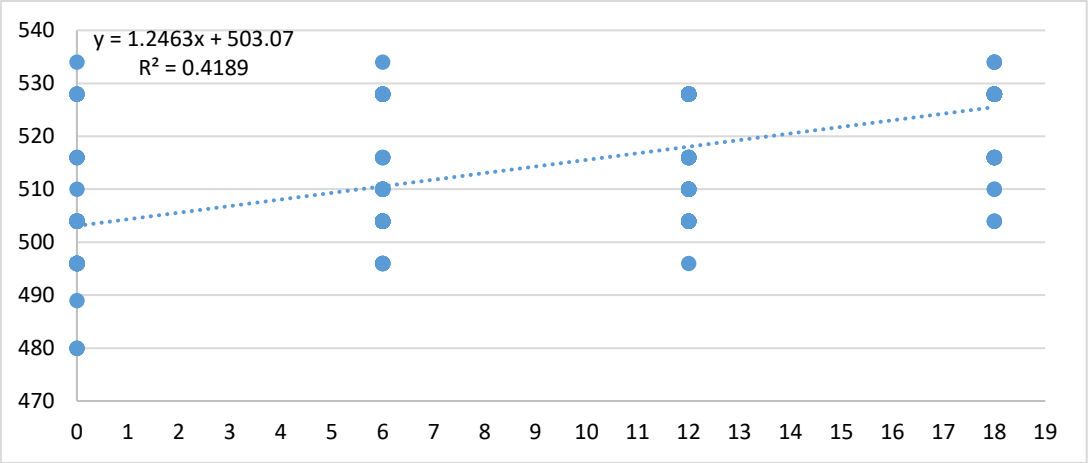
Çizelge 5. Cinsiyet bakımından ele alınan faktörlere ilişkin regresyon katsayıları (b), standart hata (SH), odds oranları (Ψ) ve P değerleri

Faktör	**Seviye**	***b***	**SH**	***Ψ***	***P***	**Grup*Genotip**
Grup	Kontrol	0,00	0,00	1,00	0,5110	0,5169
	Grup 1	0,07	0,44	1,07		
	Grup 2	-0,55	0,43	0,58		
	Grup 3	-0,68	0,44	0,51		
Genotip	Brown Nick	-0,21	0,47	0,81	0,8732	
	Nick Chick	0,00	0,00	1,00		

Soğuk stresi uygulamasının kuluçka süresine etkisi Çizelge 6'da verilmiştir. Söz konusu çizelgeden görüleceği üzere gruplar arasındaki fark istatistiksel olarak önemlidir (*P*=<0,0001). En geç çıkımın 524,88 saat ile en uzun süre soğuk stresi uygulanan grup olan Grup 3'te gerçekleştiği görülmektedir. Beklendiği üzere soğuk uygulama süresi arttıkça kuluçkadan çıkım süresi artmıştır. Bu artış ise embriyoların 10 °C'de tutulduğu her bir saat, kuluçka süresini 1,25 saat uzatmıştır (Şekil 1.). Düşük kuluçka sıcaklıklarında kuluçka süresi uzamaktadır (Martin, 2008). Düşük inkübasyon sıcaklığı, muhtemelen embriyonun hücresel bölünmesi ve organsal gelişimini yavaşlatarak belki de durdurarak inkübasyon süresini uzatmıştır.

Çizelge 6. Kuluçka süresi bakımından ele alınan faktörlere ilişkin en küçük kareler ortalamaları ($\bar{x}$), standart hataları (SH) ve önem seviyeleri (*P*)

Faktör	**Seviye**	$\bar{x}$	**SH**	***P***	**Grup*Genotip**
Grup	Kontrol	502,64	1,14	<0,0001	**0,1799**
	Grup 1	511,01	1,13		
	Grup 2	518,01	1,10		
	Grup 3	524,88	1,11		
Genotip	Brown Nick	514,02	0,83	0,6261	
	Nick Chick	**514,57**	**0,76**		



Şekil 1. Gruplara göre kuluçka süresinin değişimi

Deneme 2: Geç Dönem Uygulanan Soğuk Stresine Ait Çalışma Bulguları

Çıkış ağırlığı bakımından gruplar arasındaki fark istatistiksel olarak önemli değildir (*P*=0,4820). İnkübasyonun geç döneminde uygulanan soğuk stresi sarı kesesi emilimini olumsuz etkilememiş gibi gözükmektedir. Çıkım ağırlığının soğuk stresinden etkilenmemesinin nedeninin geç gelişim döneminden önce yapılmış olmasından kaynaklandığı söylenebilir. Zira embriyonik enerji tüketimi geç gelişim döneminde daha hızlı olmaktadır. Ördeklerde *(Aix Sponsa)* yapılan bir çalışmada düşük kuluçka sıcaklığında inkübe edilen embriyoların yumurtadan çıkış ağırlıklarının kontrole göre daha düşük olduğunu bildirmişlerdir (DuRant ve ark., 2012). Embriyonik gelişimin geç döneminde 20 °C gibi bir sıcaklıkta inkübe edilen embriyoların % 20-37 daha fazla enerji harcadığı bilinmektedir (Olson ve ark., 2006).

Çizelge 7. Grup ve genotiplere göre 0. ve 18. gün yumurta ağırlıkları ve çıkış ağırlıklarına ilişkin en küçük kareler ortalamaları ($\bar{x}$), standart hataları (SH) ve önem seviyeleri (*P*)

Faktör	*Seviye*	18. gün yumurta ağırlıkları				Çıkış Ağırlığı			
		$\bar{x}$	SH	*P*	Grup*Genotip	$\bar{x}$	SH	*P*	Grup*Genotip
Grup	**Kontrol**	49,95	0,32	0,8595	0,4848	38,66	0,29	0,4820	0,5321
	Grup 1	49,82	0,33			38,46	0,30		
	Grup 2	50,17	0,33			38,20	0,30		
	Grup 3	49,95	0,33			38,07	0,30		
Genotip	**Brown Nick**	47,44	0,23	<,0001		36,38	0,22	<,0001	
	Nick Chick	52,44	0,23			40,31	0,20		

Çıkım gücü bakımından ele alınan faktörlere ilişkin regresyon katsayıları ve odds oranları Çizelge 8'de sunulmuştur. Çıkım gücü bakımından gruplar arasında istatistiksel olarak önemli bir fark bulunmamıştır (*P*=0,5616). Brown Nick genotipinde civciv çıkma olasılığı Nick Chick'e göre önemli derecede düşük bulunmuştur (*P*=0,0070). Deneme 1' de Nick Chick'lere göre 2,81 kat daha yüksek çıkım gücü gösteren Brown Nick embriyolarının geç dönemde uygulanan soğuk stresinden olumsuz etkilendikleri belirlenmiştir. Buna göre genotipin embriyonik gelişim dönemleri arasında embriyonun soğuk stresine duyarlılığı değişmektedir.

Çizelge 8. Çıkım gücü bakımından ele alınan faktörlere ilişkin regresyon katsayıları (b), standart hata (SE), odds oranları (Ψ) ve P değerleri

Faktör	*Seviye*	*b*	SH	*Ψ*	*P*	Grup*Genotip
Grup	Kontrol	0,00	0,00	1,00	0,5616	0,5573
	Grup 1	-1,09	0,71	0,34		
	Grup 2	-0,60	0,76	0,55		
	Grup 3	-0,78	0,74	0,46		
Genotip	Brown Nick	-1,34	0,70	0,26	0,0070	
	Nick Chick	0,00	0,00	1,00		

Cinsiyete ilişkin regresyon katsayıları ve odds oranları Çizelge 9'da verilmiştir. Gruplar bazında erkek civciv çıkma olasılığı istatistiksel olarak önemsizdir (*P*=0,5345).

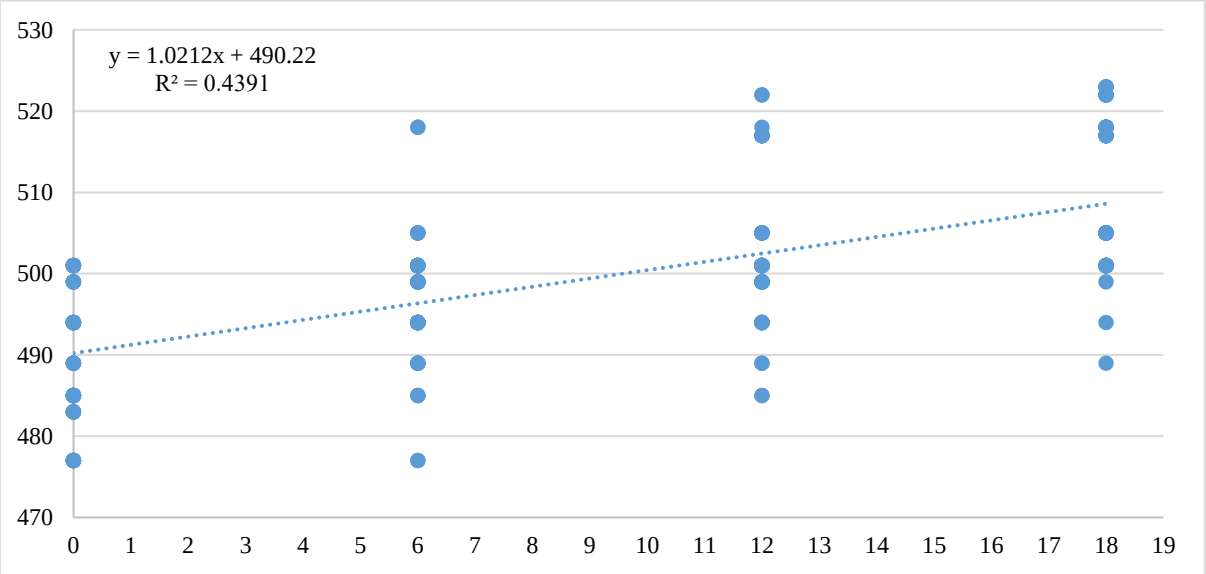
Çizelge 9. Cinsiyet bakımından ele alınan faktörlere ilişkin regresyon katsayıları (b), standart hata (SH), odds oranları (Ψ) ve P değerleri

Faktör	***Seviye***	***b***	**SH**	***Ψ***	***P***	**Grup*Genotip**
Grup	Kontrol	0,00	0,00	1,00	0,5345	0,5935
	Grup 1	0,17	0,43	1,19		
	Grup 2	-0,45	0,42	0,64		
	Grup 3	-0,54	0,43	0,58		
Genotip	Brown Nick	0,17	0,45	1,18	0,3492	
	Nick Chick	0,00	0,00	0,00		

Çizelge 10'da kuluçka süresi bakımından ele alınan faktörlere ilişkin en küçük kareler ortalamaları ve önem seviyeleri verilmiştir. Soğuk stresi uygulama süresi ile kuluçkadan çıkış süresi arasında doğrusal bir ilişki olduğu görülmektedir. Brown Nick genotipi daha erken çıkış sağlamıştır. Genotipler arasında kuluçka süresi bakımından görülen farklılığın (*P*=0,0008) embriyoların fizyolojik farklılıklarından kaynaklandığı düşünülmektedir. Embriyoların 10 °C'de tutulduğu her bir saat, kuluçka süresini 1,02 saat uzatmıştır (Şekil 2.).

Çizelge 10. Kuluçka süresi bakımından ele alınan faktörlere ilişkin en küçük kareler ortalamaları ($\bar{x}$), standart hataları (SH) ve önem seviyeleri (*P*)

Faktör	***Seviye***	$\bar{x}$	**SH**	***P***	**Grup*Genotip**
Grup	Kontrol	489,78	0,85	<,0001	**0,0173**
	Grup 1	497,23	0,86		
	Grup 2	501,51	0,87		
	Grup 3	508,81	0,85		
Genotip	Brown Nick	497,88	0,63	0,0008	
	Nick Chick	**500,79**	**0,58**		



Şekil 2. Gruplara göre kuluçka süresinin değişimi

Çıkım gücü kuluçkahaneler için önemli bir ekonomik göstergedir. Çıkım gücündeki %1'lik bir artışın bile yüksek kapasiteli kuluçkahanelere ekonomik getirisinin yüksek olacağı öngörülmektedir. Aynı zamanda günlük civciv kalitesinin de büyüme ve performans üzerindeki etkileri nedeniyle kuluçkacılık acısından büyük bir önemi bulunmaktadır. Kuluçka koşullarının, kuluçkahanelerin performans göstergesi olan bu özellikler üzerine etkili olduğu bilinmektedir.

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Contact effects of *Mentha piperita* L. (Lamiaceae) essential oil on two important stored product pests [*Tribolium castaneum* (Herbst, 1797) (Coleoptera: Tenebrionidae) and *Sitophilus granarius* (Linnaeus, 1758) (Coleoptera: Dryophthoridae)]

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Abstract

In this study, the contact activity of the essential oil obtained from the *Mentha piperita* L. (Lamiaceae) against two important stored product pests *Tribolium castaneum* (Herbst, 1797) (Coleoptera:Tenebrionidae) ve *Sitophilus granarius* (Linnaeus, 1758) (Coleoptera: Dryophthoridae) was tested under laboratory conditions. For this purpose, 5% (v/v), 10% (v/v) and 15% (v/v) doses of plant essential oil were applied to stored product pests with the help of a microapplicator at a dose of 1 µl to each pest. In the control group, pure acetone was applied. Dead insects were recorded at 24, 48, 72 and 96 hours after aplications. As a result of the study, the essential oil showed contact activity at varying rates depending on the insects and doses. For *T. castaneum*, the highest activity at the end of 24 hours was determined at the 15% (v/v) application dose with a mortality rate of 23.6%, while this rate was determined as 33.4% at the end of 96 hours. For *S. granarius*, the contact activity of this oil was higher and a mortality rate of 93.4% was determined at the 15% (v/v) application dose after 24 hours. For *S. granarius*, the mortality rate was 98.2% after 96 hours. The results of the study reveal that *M. piperita* essential oil has the potential to be used in the control of *S. granarius*.
Key Words: *Essential oil, Insecticidal activity, Stored product pest, Contact activity*

Mentha piperita L. (Lamiaceae) uçucu yağının iki önemli depolanmış ürün zararlısı [*Tribolium castaneum* (Herbst, 1797) (Coleoptera: Tenebrionidae) ve *Sitophilus granarius* (Linnaeus, 1758) (Coleoptera: Dryophthoridae)] üzerine kontakt etkileri

Özet

Bu çalışmada *Mentha piperita* L. (Lamiaceae) bitkisinde elde edilen uçucu yağın iki önemli depo zararlısı *Tribolium castaneum* (Herbst, 1797) (Coleoptera:Tenebrionidae) ve *Sitophilus granarius* (Linnaeus, 1758) (Coleoptera: Dryophthoridae)'a karşı kontakt aktivitesi laboratuvar koşullarında test edilmiştir. Bu amaçla bitki uçucu yağı %5 (v/v), %10 (v/v) ve %15 (v/v)'lik dozlarda depolanmış ürün zararlılarına her zararlıya 1 µl dozunda mikroaplikatör yardımı ile uygulanmıştır. Kontrol grubunda ise saf aseton uygulaması yapılmıştır. Uygulamadan 24, 48, 72 ve 96 saat sonra ölü bireyler kaydedilmiştir. Çalışma sonucunda uçucu yağ uygulama yapılan zararlı ve doza bağlı olarak değişen oranlarda kontakt aktivite göstermiştir. *T. castaneum* için 24 saat sonunda en yüksek aktivite %23.6 ölüm oranı ile %15 (v/v) uygulama dozunda belirlenirken bu oran 96 saat sonunda en yüksek %33.4 olarak belirlenmiştir. *S. granarius* için ise bu yağın kontakt aktivitesi daha yüksek olmuş ve 24 saat sonunda %15 (v/v)'lik uygulama dozunda %93.4 ölüm oranı belirlenmiştir. 96 saat sonunda ise ölüm oranının %98.2 olduğu saptanmıştır. Çalışma sonuçları *M. piperita* uçucu yağının *S. granarius* mücadelesinde kullanılma potansiyelinin olduğunu ortaya koymaktadır.

Anahtar Kelimeler: *Uçucu yağ, Insektisidal aktivite, Depolanmış ürün zararlısı, Kontakt aktivite*

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Effect of Organic and Industrial Fertilizers on Reducing Sugar, Specific Gravity, Dry Matter and Starch Composition of Fresh Harvested Irish Potato Varieties in Musanze District Rwanda

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Abstract
To avoid browning of the finished product, potatoes destined for industrial processing must have a low reducing sugar concentration. Genotype and a range of pre- and post-harvest factors, all affect potato sugar content. The primary pre-harvest variables that affect sugar concentration are crop maturity, temperature throughout development, mineral nutrition, and irrigation, whereas the key post-harvest variables are mechanical stressors and storage conditions. Each genotype needs the proper pre- and post-harvest care to maintain low sugar levels; stress of any form leads to sugar accumulation. The goal of this study was to look at the processing quality of five different potato cultivars growing in Rwanda, as well as their potential use in food products. On season 2021B and 2022A, potatoes were cultivated in the Busogo model farm. The reducing sugars in potatoes tubers were investigated. Although there are many different Irish potato varieties, their nutritional value and viability for domestic and industrial usage have not been thoroughly investigated. This research was done at Busogo Farm in the Musanze District of Rwanda to determine how organic and synthetic fertilizers affected the composition of newly harvested Irish potato cultivars' reducing sugar, specific gravity, dry matter, and starch (Kinigi, Gikungu, Gisubizo, Kirundo and Twihaze). In seasons 2021 B and 2022 A, the experiment was set up using a randomized complete block design. In seasons B and A, tubers were harvested 120 and 90 days after sowing, respectively. The results of the analysis of variance showed that the effects of season and treatment on the amount of reducing sugar (glucose) in fresh irish potatoes are highly significant. The findings demonstrated that in season B (2021), Twihaze and Kirundo varieties recorded high glucose (0.09%), while Gisubizo variety in control, recorded low glucose (0.01%). Additionally, the data for season 2022 A showed that Twihaze variety had high glucose content of 0.80% while Kinigi variety had low glucose content of 0.10%. Additionally, the analysis of variance showed that Irish potato varieties with low to moderate and moderate to high glucose contents, respectively, experienced extremely significant (p 0.001) effects of farmyard manure and NPK on glucose content for the seasons 2021 B and 2022 A. The application of inorganic and organic fertilizers had a significant impact (p 0.05) on dry matter in seasons B and A, according to the analysis of variance. Additionally, the results demonstrated extremely significant (p0.01) differences in specific gravity and starch in both seasons, with Kinigi variety having higher values of dry matter, specific gravity, and starch content in season B and A, respectively, of 24.58, 1.10, and 18.59%. Season 2022 A's high decreasing sugar levels were caused by meteorological conditions brought on by the soil's high moisture content as well as the maturity of the tubers. Due to its low level of reducing sugar, Gikungu, Kirundo, and Kinigi are excellent for chips whereas Twihaze variety is advised for boiling cooking methods.
Key Words: Reducing sugars, Potato cultivars, Mineral fertilizers, genotype, industrial processing

Introduction

A type of sugar known as reducing sugar acts as a reducing agent and is capable of giving electrons to another molecule by oxidizing it. In other words, any sugar that has an aldehyde group (-CHO) or ketone group (-CO-) and may act as a reducing agent in basic solution is known as a reducing sugar (Kunz et al., 2011) and is referred to as a carbohydrate or natural sugar. If the oxygen on the anomeric carbon is unconnected to anything else, a sugar can operate as a reducing agent and is referred to as a reducing sugar. Sugars are part of the family of substances known as carbohydrates. Examples include glucose, fructose, and sucrose. A few sugars with an aldehyde functional group have the ability to act as reducing agents. The composition of reducing sugars can be established using this property as a starting point. For instance, Fehling's solution has copper (II) ions that specific sugars can change to copper (I) ions. Reducing sugars can be processed in a quantitative manner. When the oxygen on its anomeric carbon is unconnected to anything else, a sugar can function as a reducing agent; this sugar is referred to as a reducing sugar (Subrizi, et al., 2019). Irish quality, one of the most crucial features of the potato, is influenced by the amount of reducing sugar and is based on both the exterior and interior tuber's properties (Abebe et al., 2013). The crucial elements and things to take into consideration were amount of sugars, dry matter content, variety, stage of ripeness, storage, and reconditioning procedures

The amount of sugar in potato tubers affects the final product's color after frying, making it crucial. The most significant group of sugars is the reducing sugars, which include fructose, glucose, and sucrose and are responsible for browning. Irish potatoes have a high yield potential, good nutrition, a short growing season, and a wide range of adaptation, making them a crop with a great promise for ensuring food security in sub-Saharan countries (Tewodros et al., 2014).

Materials and Methods

Potatoes were planted in Busogo sector on the model farm campus of the University of Rwanda in Musanze District, Rwanda's Northern Province. It is located at 1°33'26" south latitude and It may be found at 29°32'39" east latitude and 1°33'26" south latitude. The area is well-known for its Andosol because of the volcanic soil. A Randomized Complete Block Design (RCBD) was employed to set up the experiment, with three replications and twenty treatments reflecting the cultivars that were used as factors. Five cultivars from the Musanze RAB Station were used in the study: Kinigi, Kirundo, Gisubizo, Gikungu, and Twihaze. Blocks were divided by 1 m, and guard rows of 0.5 m, with a spacing of 80 cm between rows and 30 cm within rows, separated adjacent plots. They were raised during the 2021–2022 growing season under traditional cultural conditions. Farmyard manure is applied at a rate of 10T/ha, and mineral fertilizer NPK 17.17.17 is applied at a rate of 300kg/ha, either in combination, alone, or not at all, over a period of two seasons.

Table 1: Characterization of study site

Parameter	Units	Season I	Season II	Parameter	Unit	Season I	Season II
pH(H_2O)	-	5.8	5.4	Ca^{2+}	$cmol_c/kg$	5.27	4.71
Available P	ppm	135	180	Mg^{2+}	$cmol_c/kg$	3.03	2.76
Total N	%	0.32	0.45	sand	%	48.4	46.4
OM	%	7.84	9.46	Clay	%	21.6	21.6
OC	%	4.55	5.49	Silt	%	30	32
CEC	$cmol_c/kg$	20.67	20.00	Textural class		Loam	Loam
K^+	$cmol_c/kg$	0.66	0.60	TEA	$cmol_c/kg$	0.19	0.13

Key: TEA: Total exchangeable acidity, N: Nitrogen, OM: Organic matter, OC: Organic carbon, CEC: Cation exchange capacity

Sampling

a) Reducing sugars

Healthy potatoes of processing size were chosen for the biochemical investigation. Each plot's center rows were randomly selected for twenty fresh potato tubers, and three blocks were used for each cultivar (three replications). They underwent laboratory food analysis using Martin Lishman's flow procedure after being rinsed in portable water, shredded into small pieces, and subjected to flow:. The sample of 20 potato tubers from the test plot to serve as a representative sample was taken. These were washed and dried Separately. Each tuber was cut in lengthwise into eight parts. Cut each wedge into 1-cm pieces. All pieces were inserting in the press's basin. Over the bowl, place the press. by tightening the screws potato bits were compressed, the top reservoir is completely filled with juice. With the micro-pipette, removal of 1ml of juice from the reservoir were made and avoiding any impurities. Caution for each fresh sample, fresh tip were used. Juice sample were added to one of the tubes containing the dilution solution (distilled water). Homogenization of the fluid is made by turning the tube upside down. A tiny bit of the solution were filled to the yellow cap. Insert a single paper strip into the monitor. **Caution:** Avoid putting your fingers near the reactive (yellow) tip of the strip. Verification code on the strip. Dip the front edge of the yellow tip into the solution in the cap in case the symbol of flashing displayed in screen. The reading is already in progress. The glucose readings in mg/dl were appearing in 5 seconds. Take a note of the quantity (G). For each sample, the exercise were repeated Repeat 3 times (G1, G2, G3). Result of average measurement (mg/dl) = (G1, G2, G3)/3 . This 3 means count of stripes. Utilize the correction table to look up the juice's glucose content in g/l. Percentage Juice glucose content was calculated following the formula: g/l glucose/10. Percentage fresh weight glucose content was calculated following the formula: Juice glucose (%) x (100-DM*)/100*DM: Dry matter content (%) of the tubers

b) Specific gravity

Around 5 kg of potatoes were cleaned, dried, and weighed in the air and in tap water.

c) Dry matter

Nine processing-sized potatoes were cut and thoroughly combined with dry materials. Following that, 10 g of material were weighed in a crucible with three replications and cooked in a forced-air oven at 80 ºC for 72 hours, or until a constant weight was achieved dry matter was calculated following this formula: $\frac{\text{Dry weight}}{\text{Fresh weight}} X100$.

Samples weighing around 3 g were placed in a 250 ml volumetric flask. Following the addition of 20 ml of concentrated HCl and 3 glass beads, 200 ml of purified water was added. Until a clear solution was achieved, the solution was refluxed. After adding 50% NaOH and 3 drops of phenolphthalein as an indicator, the solution was

neutralized. Whatman no 541 filter paper with 20–25 mm pore size was then used to filter the mixture into a 250 volumetric flask, where it was diluted to the proper strength with distilled water.
Starch, g per 100g, equals % total sugar times 0.9...

Statistical analysis

The 15th version of Genstat statistical software were used to perform an ANOVA on the acquired data, and the Least Significant Difference test between treatments were used to examine means separation. Additionally, linear relationships between the variables were computed using Pearson correlation analysis.

Results and Discussion

The investigation of variation in the reducing sugar content of various Irish potato varieties revealed impacts of variation where season and treatment affect fresh Irish potato's highly substantial glucose content.

Effects of farmyard manure on reducing sugar of Irish potato varieties

The results showed that Twihaze and Kirundo varieties treated with 10 tons of farmyard manure recorded high glucose (0.09%) in season B (2021), while Gisubizo variety under control recorded low glucose (0.01%). However, the prior farming methods are to blame for the high glucose levels for the Kirundo and Twihaze cultivars grown in control plots. Twihaze treated with farmyard manure had a high glucose value of 0.65% in season A 2022, while Kinigi planted as a control had a low glucose value of 0.10%. Gikungu, Gisubizo, and Kinigi's recorded glucose values are all categorized as low by ARVALIS-Institut du végétal's (2004) standards of interpretation since they are all less than 0.4%, whereas Kirundo and Twihaze's values are categorized as moderate because they range from 045 to 6%. Additionally, the analysis of variance showed that farmyard manure had a highly significant (p 0.001) impact on Irish potato cultivars with low to moderate glucose content (Table 2).

Table 2: Effect of farmyard manure on glucose content of Irish potato varieties in Musanze,

Treatment description	Glucose in fresh potato (%)	
	Season B 2021	Season A 2022
Gikungu (Control)	0.04b	0.14ac
Gikungu +FYM	0.03ab	0.22ab
Gisubizo (Control)	0.01c	0.15ac
Gisubizo+FYM	0.02c	0.23ab
Kinigi (Control)	0.03ab	0.10d
Kinigi+FYM	0.03ab	0.11d
Kirundo (Control)	0.09a	0.43c
Kirundo+ FYM	0.09a	0.51b
Twihaze (Control)	0.08a	0.58b
Twihaze+FYM	0.09a	0.65a
Lsd	0.05	0.05
Cv	18.4	3.0
P value	<0.001	<.001

Means with same letter are not significantly different

Effect of chemical fertilizers on reducing sugar content of irish potato varieties

Results showed that Twihaze variety (0.11%) treated with 300 kg of NPK had the highest glucose content in season B 2021, while Gisubizo variety had the lowest glucose content (0.01%). (Table3). Additionally, Twihaze types that got 300 kg of NPK had a high glucose content of 0.78% in season A, but Kinigi varieties had a low glucose content of 0.10%. The recorded glucose values for Gikungu, Gisubizo, and Kinigi are all categorized as low by ARVALIS-Institut du végétal (2004) because they are all less than 0.45%, while Kirundo's glucose content is categorized as moderate and Twihaze's glucose value is categorized as high because it is greater than 0.7%. Additionally, the analysis of variance showed that chemical fertilizers (NPK) had a highly significant (p 0.001) impact on the glucose content of various Irish potato cultivars (Table 3)

Table 3: Effect of chemical fertilizers on reducing sugar content of irish potato varieties

Treatment description	Glucose in irish potato (%)	
	Season B 2021	Season A 2022
Gikungu (Control)	0.04b	0.14ab
Gikungu+ NPK	0.03ab	0.23d
Gisubizo (Control)	0.01c	0.15ab
Gisubizo+ NPK	0.05b	0.25d
Kinigi (Control)	0.03ab	0.10ab
Kinigi+NPK	0.03ab	0.12ab
Kirundo (Control)	0.09a	0.43c
Kirundo +NPK	0.09a	0.52b
Twihaze (Control)	0.08a	0.58b
Twihaze +NPK	0.11a	0.78a
LSD	0.05	0.05
CV	18.4	3.0
P value	<0.001	<0.001

Means with same letter are not significantly different

Effect of mixture of FYM manure and chemical fertilizers on reducing sugar content of irish potato's varieties

The combination of farmyard manure and NPK 17 17 17 has an impact on the glucose content of Irish potato types in the Musanze District, as shown in Table 5. Results showed that in season B 2021, Twihaze variety had a high glucose content of 0.15 percent and Gisubizo variety had a low glucose content of 0.01%. Additionally, season A 2022 results showed that Twihaze variety had high glucose content of 0.80% while Kinigi variety had low glucose content of 0.10%. All recorded glucose values for Gikungu, Gisubizo, and Kinigi are categorized as low because they are all less than 0.45%, in accordance with ARVALIS-Institut du végétal's (2004) standards of interpretation. Similar to how the glucose concentration found in Kirundo is categorized as moderate since it is between 0.45 and 0.6%, whereas Twihaze is categorized as high because it is greater than 0.7%. Additionally, the analysis of variance showed that farmyard manure and chemical fertilizers (NPK) had a highly significant (p 0.001) impact on the glucose content of several Irish potato cultivars (Table 4)

Table 4: Effect of mixture of FYM manure and chemical fertilizers on reducing sugar content of irish potato's varieties

Treatment description	Glucose's irish potato (%)	
	Season B 2021	Season A 2022
Gikungu (Control)	0.04c	0.14ac
Gikungu+NPK+FYM	0.02ab	0.24ab
Gisubizo (Control)	0.01ab	0.15ac
Gisubizo+NPK+FYM	0.08b	0.29ab
Kinigi (Control)	0.03c	0.10d
Kinigi+FYM +NPK	0.05c	0.15ac
Kirundo (Control)	0.09b	0.43c
Kirundo+FYM+NPK	0.07b	0.55b
Twihaze (Control)	0.08b	0.58b
Twihaze+FYM+NPK	0.15a	0.80a
Lsd	0.05	0.05
Cv	18.4	3.0
P value	<0.001	<0.001

Means with same letter are not significantly different

Discussion

The greater glucose in season 2022 A than in season 2021 B is an indication of the effects of seasons on lowering sugar (glucose), which is explained by weather conditions by the higher soil moisture content in season A than B. During the growth of Irish potatoes, moisture content permits both translocation and the flow of plant nutrients. The findings are consistent with those of Kumar et al. (2004) who found that potato tubers grown during a drought are less water stressed and had lower decreasing sugar levels. Additionally, water challenged tubers showed a substantial correlation between invertase activity and hexose formation, according to Kumar et al. (2004). Low precipitation during the growth stage led to low reducing sugar content. The findings are consistent with Belachew

(2016), who found a significant correlation between the tuber's access to water before harvest and the levels of sucrose found after harvest. Twihaze's high glucose content can be attributed to genetic characteristics, and these characteristics have a significant impact on a mature tuber's early decreasing sugar levels. A heritable characteristic is the propensity to have a high or low concentration of total sugar or a specific sugar.

Table 5: Effect of farmyard manure and NPK $_{17\ 17\ 17}$ on Specific gravity, Dry matter and Starch of irish potato

Treatment description	Season B 2021 for 120 DAP			Season A 2022 for 90 DAP		
	DM (%)	SP_Gravity	Starch (%)	DM (%)	SP_Gravity	Starch %)
T0 +Gikungu	20.43c	1.08c	16.04b	20.96ab	1.08c	15.80b
T0 +Gisubizo	21.70b	1.08c	15.79c	19.93ab	**1.07ab**	14.04c
T0 +Kinigi	18.63ac	1.07ab	12.77d	19.22ac	**1.07ab**	13.34d
T0 +Kirundo	23.80b	1.08c	16.31b	22.08b	1.08c	15.39b
T0 +Twihaze	18.78ac	1.07ab	12.94d	20.09ab	**1.07ab**	14.21c
FYM +Gikungu	18.57ac	1.07ab	12.59d	20.26ab	1.08c	14.35c
FYM +Gisubizo	20.50c	1.08c	14.67ab	19.62ac	**1.07ab**	13.75c
FYM +Kinigi	21.58b	1.08c	15.49c	21.60c	1.08c	15.58b
FYM +Twihaze	20.95c	1.08c	15.04c	21.57c	1.08c	15.04b
FYM+Kirundo	18.55ac	1.07ab	11.07e	21.43c	1.08c	15.49b
NPK +Gikungu	19.30ab	1.07ab	13.26d	20.23ab	1.08c	14.24c
NPK +Gisubizo	20.78c	1.08c	14.90ab	19.50ab	1.07ab	13.63c
NPK +Kinigi	**24.58a**	**1.10a**	**18.59a**	**24.58a**	**1.10a**	**18.59a**
NPK +Kirundo	20.43c	1.08c	14.58ab	20.43ab	1.08c	14.58c
NPK +Twihaze	18.13ac	1.07ab	12.29ac	19.48ac	1.07ab	13.60c
NPK+FYM +Gikungu	21.10b	1.08c	14.82ab	21.10c	1.08c	14.82c
NPK+FYM +Kinigi	21.55b	1.08c	15.63c	21.26c	1.08c	15.34b
NPK+FYM +Kirundo	18.80ac	1.07ab	14.06ab	19.37ac	**1.07ab**	14.55c
NPK+FYM +Twihaze	**17.63d**	**1.06ac**	10.18f	**18.82d**	**1.07ab**	**12.12e**
NPK+FYM +Gisubizo	24.17a	1.09b	18.16a	24.17a	1.09b	12.72ab
Lsd	4	0.014	2.72	3.5	0.014	3
CV	1.1	0.1	1.6	1.0	0.1	1.4
P value	0.014	<.001	<.001	0.024	0.002	<.001

Means with the same letter are not significantly different

Effects of FYM manure on irish potato glucose content

Because FYM releases plant nutrients (nitrogen, phosphorus, potassium, calcium, etc.) that promote plant growth, it has the effect of lowering sugar (glucose concentration). The availability of plant nutrients that alter Irish potato biomass accounts for the high significance (p 0.001) effect of farmyard manure on glucose content across Irish potato cultivars. For the Kirundo variety, the application of FYM boosted the glucose level from low to moderate, and for Twihaze, the glucose content was high. Zewide et al. (2018), claimed that increasing N application increased or decreased reducing sugars in the apical and stem ends, respectively, are in conflict with the findings of this study. Furthermore, Najm (2012) discovered that potatoes' decreasing sugar content has been observed to decrease in response to greater nitrogen treatment.

Effect of chemical fertilizers on glucose content of Irish potato varieties

Chemical fertilizers, in particular NPK, help reducing sugar by making mineral nitrogen, potassium, and phosphorus readily available. A significant amount of nitrogen also retards crop maturation, resulting in a tuber with a relatively high nitrate content and low dry matter concentration. In order to estimate the amounts of nitrogen, phosphate, and potassium fertilizer to be applied to the potato crop, mineral testing of the soil was done to determine the actual soil fertility prior to planting. However, the prior farming methods are to blame for the high glucose levels for the Kirundo and Twihaze cultivars grown in control plots.

Similar findings were made by Ababulgu (2018), who noted a notable impact of the application of blended NPS fertilizer and animal dung.

Effect of mixture of FYM manure and chemical fertilizers on reducing sugar content of irish potato's varieties

By supplying additional amino acids and so increasing the starch and sugar levels in the tubers, the application of both chemical and organic substances has a detrimental influence on the quality of the tubers. In addition to the use of mineral fertilizers on potatoes, the value of bovine manure is now understood due to the periodic gradual release of plant nutrients and their long-term impacts on the chemical characteristics of soil. The results support

Sun et al(2018)'s findings that fertilizations increase reducing sugar content, which has an impact on the quality and nutritional value of derived products (chips) by causing Acrylamide to develop. The increased levels of free amino acids brought on by higher nitrogen fertilization have been connected to this departure from the predicted level of reducing sugar (glucose), although not all free amino acids are affected to the same extent. Studies on the effect of nitrogen on sugar accumulation during storage demonstrated that high nitrogen fertilizer rates decreased the amount of glucose and fructose in the crop at harvest, but that sugar accumulation increased and sucrose accumulation decreased throughout storage when compared to no or low fertilization (Kolbe et al., 1995). According to Mohammed et al. (2018), varying rates of inorganic fertilizer (N and P) combined with different amounts of farmyard manure (FYM) resulted in noticeably distinct reductions in sugar and tuber dry matter yield.

Effect of farmyard manure and NPK 17 17 17 on Specific gravity, Dry matter and Starch of Irish potato

Results showed that dry matter, specific gravity, and starch content are affected by maturity and season, with the highest values reported in season 2022 B, where harvesting was carried out 90 days after planting. Environmental factors like weather and genetic producer of types are responsible for the differences.

The use of inorganic and organic fertilizers had a significant impact (p 0.05) on dry matter in seasons A and B, according to the analysis of variance. Additionally, data indicated that specific gravity and starch in both seasons were extremely significant (p 0.01), and that the Kinigi variety had higher values of dry matter, specific gravity, and starch in both seasons (A and B) of 24.58%, 1.10, and 18.59%, respectively. Overall findings showed that Twihaze cultivar had low dry matter, specific gravity, and starch contents of 17.63%, 1.06, and 12.12%, respectively. Because it impacts chip crispiness and oil uptake during processing, Kinigi's high specific gravity justifies its suitability for chips as well as the fact that tubers with a high specific gravity are chosen for dehydrated and fried items. This changes product production (Mohammed, 2016). A product's flavor is enhanced by having a high specific gravity while using less energy in production. Potatoes with a low specific gravity, however, have been shown to be better for canning since they are less likely to disintegrate throughout the process (Ndungutse et al., 2019).

These findings are in line with those from Mohammed (2016) and Abebe et al. (2013), which found that 25 varieties were produced, with results ranging from 1.050 to 1.119 for 17 types and two cropping seasons. According to Soboka et al. (2017), six types of potatoes cultivated in two distinct locales have specific gravities ranging from 1.086 to 1.107.

The outcomes, however, outperformed those of Ekin (2011), who recorded specific gravities ranging from 1.065 to 1.077 on eight kinds.

According to one study, both genetic and environmental variables can affect specific gravity (Abebe et al., 2013). According to Fitzpatrick et al. (1964), potatoes fall into one of three categories: high if the specific gravity is above 1.086, intermediate if it is between 1.077 and 1.086, and low if it is less than 1.07

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Using of *Landoltia punctata* to remove chromium from leather wastewater

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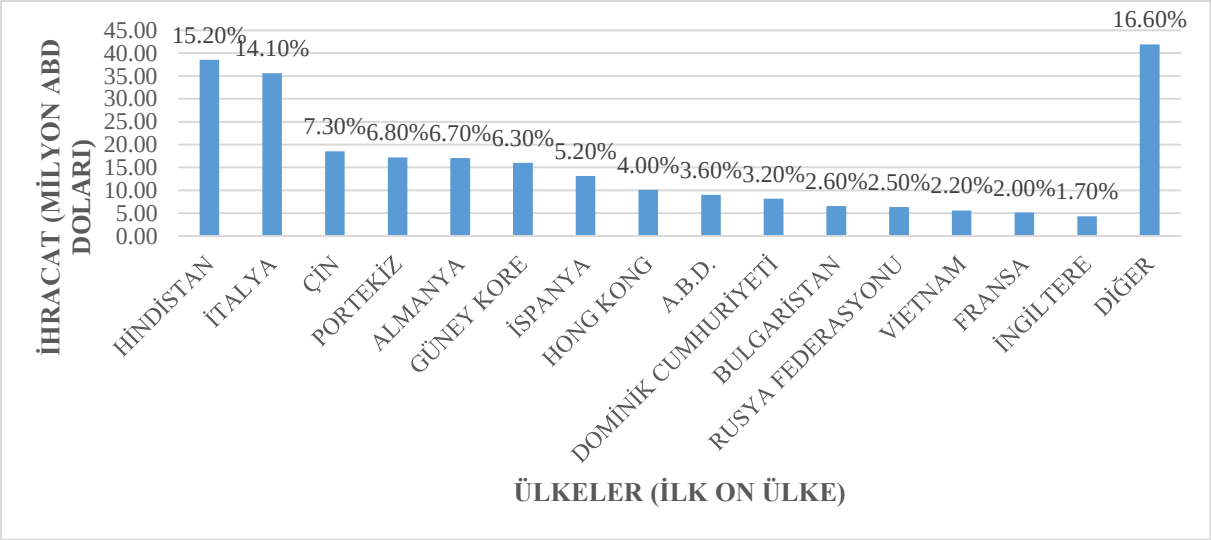
Abstract
Several industrial wastes such as power generation plants, leather tanning, timber treatment, pulp production, and municipal sludge release heavy metals including chromium (Cr). Chromium is also used for metal decoration, in the textile industry for dyeing, silk treating, and printing, in the leather industry for tanning, inks, and paints, and in the manufacture of green varnishes such as catalysts for halogenations, alkylation, and catalytic cracking of hydrocarbons, in the ceramic industry and finally as fuel and a propellant additive. The leading regions of the leather industry in Turkey are mainly the Marmara and Aegean Regions. Due to the increase in leather tanning activities in the Aegean region, chromium and its derivatives are being used in enormous amounts in this industry. Chromium and its derivatives are used in the leather tanning process. This process has increased the Cr-treated waste and is accumulating in enormous amounts, especially in Cr-contaminated waters and sludge. These industrial activities have disturbed the aquatic ecosystems leading to significant assimilation of heavy metals and the rise of chromium and its derivatives to dangerous levels, which has become a critical concern in the world. In this study, the use of Lemnaceae's *Landoltia punctata* in the removal of trivalent and hexavalent forms of chromium in leather wastewater will be investigated.
Key Words: *Landoltia punctata, Lemnaceae, Leather wastewater, Heavy metals, Leather tanning*

Deri atık suyundaki kromun gideriminde *Landoltia punctata*'nın kullanılması

Özet
Enerji üretim tesisleri, deri tabaklama, kereste işleme, kâğıt hamuru üretimi ve belediye çamuru gibi çeşitli endüstriyel atıklar, krom (Cr) dahil olmak üzere ağır metalleri serbest bırakır. Krom ayrıca metal dekorasyon için, tekstil endüstrisinde boyama, ipek işleme ve baskı için, deri endüstrisinde tabaklama, mürekkepler ve boyalar için ve halojenasyonlar, alkilasyon ve hidrokarbonların katalitik çatlaması için katalizörler gibi yeşil verniklerin üretiminde, seramik endüstrisinde ve son olarak yakıt ve itici katkı maddesi olarak kullanılır. Türkiye'de deri sektörünün önde gelen başlıca bölgeleri Marmara ve Ege Bölgeleridir. Ege Bölgesi'nde deri tabaklama faaliyetlerinin artması nedeniyle krom ve türevleri bu sektörde büyük miktarlarda kullanılmaktadır. Krom ve türevleri deri tabaklama işleminde kullanılır. Bu işlem, Cr ile işlenmiş atıkları arttırmıştır ve özellikle Cr ile kirlenmiş sularda ve çamurda büyük miktarlarda birikmektedir. Bu endüstriyel faaliyetler, ağır metallerin önemli ölçüde asimilasyonuna ve krom ve türevlerinin tehlikeli seviyelere yükselmesine yol açan sucul ekosistemleri rahatsız etmiştir ve bu da dünyada ciddi bir endişe kaynağı haline gelmiştir. Bu çalışmada, deri atık sularında +3 ve +6 krom formlarının giderilmesinde Lemnaceae'deki *Landoltia punctata*'nın kullanımı araştırılacaktır.
Anahtar Kelimeler: *Landoltia punctata, Lemnaceae, Deri atık suyu, Ağır metaller, Deri tabaklama*

Giriş

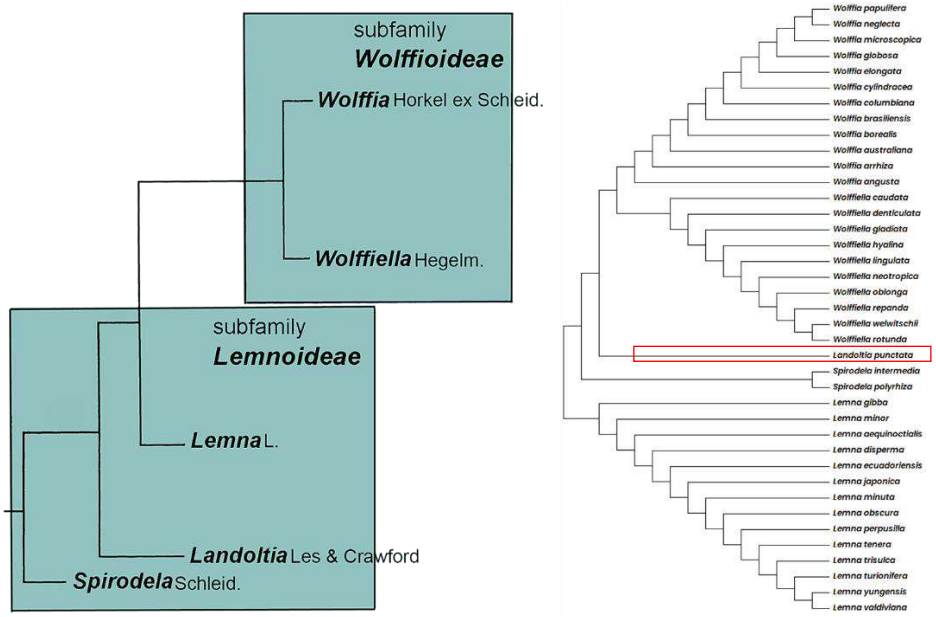
Çevre kirliliği ilk defa kentsel yasamın başlaması sonucu ortaya çıkmış ve endüstriyel ve beşerî gelişme ile orantılı olarak bir artış meydana gelmiştir. Özellikle yirminci yüzyılın ikinci yarısında, nüfus artısındaki hızlanmaya bağlı olarak artan çevre kirliliği (su, toprak ve hava), yaşam kaynaklarının daha fazla kirlenmesine neden olmuş ve sonuçta biyosferin bozulmasıyla giderek çok daha tehlikeli bir hal almıştır. Biyosferin bir bölümünü oluşturan su ortamı, kullanılmış sular ve diğer atıklar için alıcı ve uzaklaştırıcı bölge olarak kullanıldığında, ekosistem içinde hava ve toprağa oranla en yoğun kirlenmeye uğrayan biyosfer türü haline gelmiştir (Ojuederie ve Babalola, 2017). Deri sanayisi Türkiye'de suyun en yaygın şekilde kullanıldığı sanayi kollarından birisini teşkil etmektedir. Türkiye'nin en çok deri ihracatı yaptığı ilk üç ülke sırasıyla Hindistan, İtalya ve Çin'dir (Şekil 1). Türkiye'de büyükbaş hayvan derisinin işlendiği bölgeler, İstanbul-Tuzla, İzmir-Menemen, Niğde-Bor, Bolu-Gerede ve Çorlu iken; küçük baş hayvan derisinin işlendiği bölgeler ise Isparta-Yalvaç, Uşak ve İzmir-Menemen yöresidir (Öztürk, 2014). Özellikle deri tabaklama işlemi sırasında 1 kg ham derinin işlenmesi sonucunda ortalama 30 ila 50 litre arasında atık su meydana gelmektedir. Bu miktar deri sanayinde üretilen toplam atık suyun yaklaşık %8 ila 10'una tekabül etmektedir. Tabaklama ünitesinden çıkan atık suyun pH, yaklaşık olarak 3 ila 4,5 aralığında ve krom konsantrasyonu 3000–6000 $mg \cdot L^{-1}$ arasında değişmektedir (Öztürk, 2014). Deri endüstrisi, diğer endüstriler ile karşılaştırıldığında en fazla kirlilik oluşturan ve işlenme sırasında oldukça yüksek miktarlarda atık su oluşturan endüstrilerden biri olma özelliğine sahiptir. Bu kirlilikten dolayı, Türkiye gibi gelişmekte olan ülkelerde sanayi, sulama, içme suyu temini gibi faaliyetlerde kullanım alanına sahip yüzeysel su kaynakları (baraj, göl, gölet vb.) hızlı sanayileşme, tarımsal faaliyetler, nüfus artışı gibi antropojenik etmenlerin deşarj alanı olarak kullanılan sucul ekosistemleri olumsuz etkilerler (Canpolat ve Çalta, 2020).



Şekil 1. Türkiye'nin 2021 yılında ham ve işlenmiş deri ihracatı yaptığı ilk on ülke (Ticaret Bakanlığı, 2022)

Bu gibi antropojenik etmenlerden dolayı sucul ekosistemlerde kirliliğe yol açan başlıca etkenler, yoğunluğu 4g·cm^{-3}'ten büyük olan, uzun süreli çevresel kirliliğin bulunduğu ortamlardan fiziki olarak uzaklaştırılması zor olan ve arsenik (As), bakır (Cu), kadmiyum (Cd), kurşun (Pb), krom (Cr) gibi ağır metaller olarak bilinen metal ve metaloidlerdir. Bunlar, bitkilerde fotosentetik aktivitelerin azalması, bitki mineral beslenmesi ve esansiyel enzimlerin aktivitesinin azalması gibi olumsuz etkilere sebep olur (Ojuederie ve Babalola, 2017).

Ağır metallerin/metaloidlerin kirlenmiş ortamdan uzaklaştırılmasında, fizikokimyasal metotların yanında günümüzde yeni ve modern bir yaklaşım olarak bitki ve mikroorganizmalar gibi biyolojik metotlar ön plana çıkmaktadır. Fitoremediasyon yöntemi daha uygun ve çevre dostu bir biyolojik yaklaşımdır. Filogenetik adları Lemnaceae olan su mercimekleri, monokot, Lemnoidea (*Lemna*, *Spirodela* ve *Landoltia*) ve Wolffioideae (*Wolffia* ve *Wolffiella*) olmak üzere iki altfamilyanın altında beş cins ve otuz sekiz türe ayrılan, 1 ila 15 mm arasında boyuta sahip, kendine özgü bileşik yaprak yapıları, hızlı bir şekilde büyüyebilmeleri, oldukça yaygın bulunabilen ve kolayca hasat edilebilen ve aynı zamanda kendi bünyelerinde yüksek oranda kirletici biriktirebilen ve kısacık yaşam sürelerinde en az iki yavru yaprak ile nesillerini devam ettirebilme gibi karakteristik ve morfolojik özelliklere sahip yüzer sucul bitkilerdir (Şekil 2; Bog, Appenroth ve Sree, 2019, Liv vd., 2020). Su mercimekleri aynı zamanda birçok ağır metale karşı dirençli olduğundan ötürü fitoremediasyon için uygun türlerdir (Baek, Saeed ve Choi, 2021). Bu gibi avantajlarından ötürü *Landoltia punctata* bitkisi tercih edilmiştir.



Şekil 2. Su mercimeklerinin altfamilyaları ve türleri (Bog, Appenroth ve Sree (2019)'den modifiye edilmiştir).

Materyal ve Yöntem

Numunenin Temini ve Kültür Koşulları
Landoltia punctata su mercimeği türü, İstanbul Üniversitesi Fen Fakültesi Biyoloji Bölümü Öğretim Üyesi Doç. Dr. Taylan KÖSESAKAL'dan, denemede kullanılacak deri endüstrisi atık suyu, Uşak ve İzmir-Menemen yöresindeki bir atıksu fabrikasından (K38.62, D29.48) temin edilmiştir.

Bitkinin Yetiştirilme Koşulları
Su bitki türleri, 16 saat gündüz ve 8 saat gece periyodu, 22 ila 25°C aralığındaki hava sıcaklığı, %70 ila 85 aralığındaki bağıl nem oranı ve 10.000 lüx ışık yoğunluğu olacak şekilde ayarlanan uygun koşullar altında doğal ışıklandırma ve düzenli 1x Hoagland solüsyonu takviyesiyle yetiştirilmiştir.

Krom Uygulamaları
Su bitkinin birer gram tartılarak sırasıyla, 0, 50, 100, 500, 1000 mM konsantrasyonlarında Cr^{3+} ve Cr^{6+} içeren Hoagland çözeltisinde 24-–28°C ortam sıcaklığında çalışılmıştır. Deney kabı içerisindeki krom konsantrasyonu sabit olana dek deneye devam edilecek, toplanılan su örnekleri nitrik asit ile pH'ı 2'nin altına getirilerek analizleri için buzdolabında bekletilmiştir.

Krom Miktarının Tayini
Farklı krom konsantrasyonları uygulanan *Landoltia punctata* bitkisinin krom tayini için örneklerin hasat edilmesinin ardından asit ile yaş yakma yöntemi, AAS (Atomik Absorbsiyon Spektroskopisi) analiz okuması için 82°C'de kurutulan bitki numunelerine Memon'un (1980) yöntemi uygulanmaktadır.

Bulgular ve Tartışma
Landoltia punctata bitkisinin de içinde bulunduğu su mercimekleri çöl ve kutup bölgeleri haricinde değişik ortamlarda ve bölgelerde yetişebilme kapasitesine sahiptir. Bu özelliklerinden ötürü, diğer bitki türlerine nazaran değişen parametrelerde (CO_2, ışık, sıcaklık, besiyeri, pH vb.) ağır metal kirleticilerinin fitoremediasyonunda kullanılmasına dair önemli bir avantaja sahiptir Su mercimekleri aynı zamanda 5 ila 35°C gibi sıcaklık spektrumunda gelişme gösterebilmekte, uygun olmayan koşullarda dormansi halinde kalabilmektedir (Baek, Saeed ve Choi, 2021). Ekonomik ve endüstriyel olarak değerlendirilmeleri açısından araştırma konularında çalışma materyali olarak kullanılmaları önem arz etmektedir (Tablo).

Tablo. Su mercimeği türlerinin ağır metal/metaloid giderimleri (Sharma ve Lenaghan (2022)'dan modifiye edilmiştir.)

Su mercimeği türleri	Metal/metalloid	Akümülasyon seviyesi/verimi	Kaynaklar
Spirodela polyrhiza	Cd	~5,8 $mg \cdot g^{-1}$ kuru ağırlık	Chaudhuri vd. 2014
	As	< %80 uzaklaştırma verimliliği	Rahman ve Hasegawa, 2011
Lemna minor	Fe	~19 $mg \cdot g^{-1}$ kuru ağırlık	Teixeira vd. 2014
	Zn	Maksimum 10 $mg \cdot L^{-1}$ akümüle ~%70–80 uzaklaştırma verimliliği	Jayasri ve Suthindhiran, 2017
	Pb	Maksimum 4 $mg \cdot L^{-1}$ akümüle ~%50 uzaklaştırma verimliliği	Jayasri ve Suthindhiran, 2017
	Cd, Cr, Ni, Pb	Uzaklaştırma verimliliği: Cd = %44,93 Cr = %32,26 Ni = %74,48 Pb = %79,1	Al-Khafaji vd. 2018
	As	0.5 $mg \cdot L^{-1}$ konsantrasyonda >%70	Goswami vd. 2014
	Se	~19,5 $mg \cdot g^{-1}$ kuru ağırlık	Mechora vd. 2015
Lemna gibba	Zn, Cu ve Cd	~800 $\mu g \cdot g^{-1}$ kuru ağırlık	Shi vd. 2011
Wolffia australiana	As	~20 $\mu g \cdot g^{-1}$ kuru ağırlık (0,4 $mg \cdot L^{-1}$ solüsyon içinde)	Xie vd. 2014
Landoltia punctata	Co ve Ni	Azaltılmış frond büyümesi ve fotosentetik pigment içeriği Yüksek nişasta ve flavonoid içeriği	Guo et al. 2017
	Se	Azalmış büyüme hızı ve doku ağırlığı Daha yüksek MDA, fenoller ve flavonoidler Daha yüksek CAT ve daha düşük POD etkinlikleri	Mechora vd. 2015
Wolffia globosa	Ag	Fotosentetik pigmentte minör azalma Düşük Hill reaksiyonu ve floresan söndürme	Zou vd. 2017
Wolffia arrhiza	As	Fotosentez ve fotosentetik verimlilikte ciddi azalma	Ritchie ve Mekjinda, 2016

Tabloda sunulan araştırmalar ışığında Ege Bölgesi için ciddi bir tehdit olarak öne sürülebilecek krom ve türevlerinin fitoremediasyonunda *Landoltia punctata* türünün potansiyelinin araştırılmasına yönelik çalışmalarımız devam etmektedir.

Teşekkür
Çalışmada kullanılan *Landoltia punctata* su mercimeği türünün temininde İstanbul Üniversitesi Fen Fakültesi Biyoloji Bölümü Öğretim Üyesi sayın Doç. Dr. Taylan KÖSESAKAL'a teşekkür ederiz.

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Effect of Cr-stress on the glutathione reductase (GR) gene expression in *B. juncea* L. var. S-9

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Abstract
Reactive oxygen species (ROS) are a major factor in heavy metal (HM) stresses; excess ROS is harmful to plants. Glutathione reductase (GR) acts a significant role in plant redox homeostasis. Chromium (Cr), which has no biological function for the plant, is a toxic pollutant that causes the deterioration of homeostatic balance by producing oxidative stress. In this study, different levels of chromium (Cr) metal will be applied for two weeks to trigger oxidative stress in *B. juncea* L. var. S-9 plant during the germination process. Accordingly, the physiological and antioxidant system response of *B. juncea* L. var. S-9 will be observed and the role of the glutathione reductase (GR) gene in the plant under Cr stress and its expression profile will be investigated.
Key Words: *ROS, Glutathione reductase, Cr, Brassica juncea L. var. S-9, Gene expression*

B. juncea L. var. S-9'da Cr-stresinin glutatyon redüktaz (GR) gen anlatımı üzerine etkisi

Özet
Reaktif oksijen türleri (ROS), abiyotik streslerde önemli bir faktördür; aşırı ROS bitkiler için zararlıdır. Glutatyon redüktaz (GR), bitkide redoks homeostazisinde önemli bir rol oynar. Bitki için biyolojik bir fonksiyonu olmayan krom (Cr) oksidatif strese yol açarak homeostatik dengenin bozulmasına neden olan toksik bir kirleticidir. Bu çalışmada, çimlenme sürecinde *B. juncea* L. var. S-9 bitkisinde oksidatif stresi tetiklemek için farklı seviyelerde Cr metali iki hafta boyunca uygulanacaktır. Bu doğrultuda, *B. juncea* L. var. S-9'un fizyolojik ve antioksidan sistem yanıtı gözlenecek ve Cr stresi altında bitkide GR'in rolü ve ekspresyon profili araştırılacaktır.
Anahtar Kelimeler: *ROS, Glutatyon redüktaz, Cr, Brassica juncea L. var. S-9, Gen anlatımı*

Giriş

Modern dünyanın hızlı sanayileşmesi ve sınırsız antropojenik faaliyetler nedeniyle, çevreye salınan toksik metaller/metalloidlerin yol açtığı stresler bitki büyümesi ve gelişimi için büyük bir sorun haline gelmektedir (Banerjee vd., 2016; Memon, 2016; Ghori vd., 2019). Ağır metal stresi bitki büyümesi ve gelişimi için ciddi bir tehdittir; sonuç olarak, bitkilere alınarak besin zincirine dahil olduktan sonra hayvan/insan sağlığını yanı sıra ürün verimini etkilemektedir (Khan vd., 2015). Bu toksik kirleticiler, bitki metabolizmasına ve gelişimine müdahale ederek fitotoksisiteye neden olmaktadır. Bu anormal ortamlarda yetişen bitkide, nekroz, kloroz ve düşük verim gibi stresle ilişkili ciddi semptomlara yol açmaktadır (Banerjee ve Roychoudhury, 2018a). Bitki, uyarıcı algısına, hücre içi sinyalleşmeye ve enzimatik/enzimatik olmayan tepkilere dayanan olumsuz bir çevreye yanıt vermek için karmaşık mekanizmalar geliştirmiştir. Bu sabit organizmalar, karmaşık bir dizi biyolojik aktivite (antioksidan mekanizmalar, şelasyon ve HM iyonlarının bölgeselleşmesi gibi) yoluyla çevredeki aşırı boyuttaki ağır metaller ile başa çıkmaktadır.

Ağır metal stresi, hücreyi oksidatif hasardan korumak için en aza indirgenmesi gereken, oldukça reaktif ve toksik olan reaktif oksijen türlerinin (ROS) aşırı üretimini indüklemektedir. Hücre organelleri, özellikle kloroplast ve mitokondri, aşırı elektron akışının gerçekleştiği bitkide ROS üretiminin başlıca bölgeleridir. Bitki hücreleri, son derece önemli enzimatik ve enzimatik olmayan antioksidan bileşenlerden oluşan antioksidan mekanizmaların koordineli ve uyumlu iş birliği ile ROS'u ve reaksiyon ürünlerini verimli bir şekilde temizlemektedir. Hem enzimatik hem de enzimatik olmayan farklı antioksidan türlerine dayalı ikili bir hücresel sistem, bitkide üretilen ROS'u temizlemektedir (Gill ve Tuteja, 2010). İlk mekanizma, süperoksit dismutaz (SOD), askorbat/guaiakol peroksidaz (APX/GPX), glutatyon-S-transferazlar (GST), katalaz (CAT), glutatyon redüktaz (GR) enzimlerine dayanmaktadır. İkinci mekanizma, poliaminlerin yanı sıra indirgenmiş glutatyon (GSH), askorbik asit ve α-tokoferol gibi vitaminler, prolin gibi ozmolitler ve ikincil metabolitler, özellikle flavonoidler, fenolikler, karotenoidler gibi düşük moleküler ağırlıklı bileşiklerin üretimini düzenleyen enzimatik olmayan yanıttır (Ashraf, 2009; Akram vd., 2017).

Glutatyon redüktaz (GR), bitki hücrelerini ROS'a ve ROS'un reaksiyon ürünlerinde oluşan potansiyel anormalliklere karşı korumada önemli rol oynayan askorbat-glutatyon (AsA-GSH) yolunun ana bileşenlerinden biridir. GR, GSH ile fizyolojik olarak birlikte hareket eden ve NAD(P)H-bağımlı enzimatik bir antioksidan olup, hücresel bir tiyol olan indirgenmiş GSH havuzunu etkin bir şekilde korumakla görevlidir.

Bu süreç, GR, NAD(P)H ile glutatyon disülfidin (GSSG, yükseltgenmiş glutatyon) glutatyona (GSH, indirgenmiş glutatyon) rejenerasyonunu katalize etmektedir (Asada, 1999; Mittler, 2002). Bu antioksidan enzim, hücre içi glutatyon havuzunu esas olarak indirgenmiş durumda; yani, H_2O_2 ve O_2•- gibi ROS'u temizleyebilen bir antioksidan olarak işlev gören GSH'yi koruyarak oksidatif strese karşı bitkinin metal stresine karşı tepkisinde önemli bir rol oynamaktadır (Yousuf vd., 2012).

Bu çalışmada, krom stresine maruz kalan (0, 25, 50, 100, 200, 500 µM) *B. juncea* L. var. S-9 bitkisinde oksidatif stresin etkisi ve bu olumsuz etkinin üstesinden gelmek için tetiklenen antioksidan savunma mekanizmasında rol oynayan glutatyon redüktaz (GR) ile ilgili araştırma yapılmaktadır.

Materyal ve Yöntem

Bitki Materyali

B. juncea L. S-9, Tarım Araştırma Enstitüsü, Tandojam, Sind Eyaleti, Pakistan' dan temin edilmiştir. Bu çalışma, Uşak Üniversitesi, Bilimsel Analiz ve Uygulama ve Araştırma Merkezi' nde (UBATAM) Moleküler Biyoloji Bölümü' ne ait bitki odasında uygun koşullarda 3' er tekerrürlü olarak yürütülmektedir. Bitkilere uygulanan Cr(III) kimyasalı Sigma firmasından temin edilmiştir.

Bitkilerin Yetiştirilmesi ve Cr muamele

B. juncea L. S-9 türünden 100 adet tohum ayrı ayrı 50 ml' lik falkon tüplerde Tween-20 içeren %5' lik sodyum hipoklorit çözeltisi ile 15 dakika boyunca yüzey sterilizasyonuna tabi tutulmuş ve ardından deiyonize suyla iyice yıkanmıştır. Akabinde imbibisyonu sağlamak için petri kaplarında 1 saat boyunca deiyonize suda bekletilerek tohumlar, çimlenme ve fide gelişimi için ekilmiştir. Çimlenme aşamasında tohumların karanlıkta bekletilmesi ve büyüme fazında nemini korunması amacıyla her bir kapın üzeri 3 gün boyunca alüminyum folyo ile kaplanmıştır. Bu aşamadan sonra, 3. gün çimlenen fideler; 16 saat gündüz/ 8 saat gece periyodu, 22-25 ^{O}C hava sıcaklığı, %70/85 bağıl nem oranı ve 10.000 lüx ışık yoğunluğu olarak ayarlanan uygun koşullar altında iklim odasında ışıklandırma ve düzenli olarak temel besin ihtiyacının karşılanması için 1/4 oranında seyreltilen Hoagland besi çözeltisi ile yetiştirilmiştir (Hoagland ve Arnon, 1938). Çimlenen fidelere 50 ml' lik konsantrasyonları içeren solüsyon gün aşırı 10 gün boyunca uygulanmıştır. Cr uygulanmayan kontrol gruplarına ise sadece 1/4 Hoagland besi çözeltisi uygulanacaktır. Cr muamelesinden sonra, bitkiler gövde ve kök kısımları ayrı ayrı olacak şekilde hasat edilmiştir. Hasat işlemi sırasında, her bir deney grubu kontrol grubu dâhil olmak üzere 3' er tekerrürlü (R1, R2, R3) olacak şekilde ayrılmıştır.

RNA İzolasyonu ve Jel Elektroforezi

Total RNA, Thermo Scientific™' in GeneJet Bitki RNA saflaştırma kiti kullanılarak izole edilecektir. İzole edilen RNA konsantrasyonu, Thermo Scientific Nanodrop 2000 cihazı kullanılarak RNA miktarı tayin edilecektir (Memon vd., 2014; Demirel vd., 2014). İzole edilecek RNA' nın kontrolü denatüre jel elektroforezi ile Memon vd., (1995) metoduna uygun bir şekilde gerçekleştirilecektir.

Ters Transkripsiyon-Tamamlayıcı DNA (cDNA) Sentezi ve Kontrolü

RNA izolasyonundan sonra, saf hale getirilmiş olan total RNA' lar Thermo Scientific™ markasının RT-PCR kiti olan Maxima First Strand cDNA sentez kiti kullanılarak DNA komplementerleri sentezlenecektir (Cevher-Keskin vd., 2019). cDNA sentezi, Maxima First Strand cDNA sentez kiti içerisinde mevcut olan tampon ve enzimler dâhil edilerek gerçekleştirilecektir. Tüm cDNA' lardan pozitif sonuç elde edildikten sonra, örnekler bir sonraki aşama olan kantitatif qRT-PCR' da kullanılmak üzere -20 ^{o}C' de saklanacaktır.

Primer Tasarımı ve qReal-Time PCR

Hasat işleminden sonra, kontrol ve Cr-muameleli bitki gövde ve kökleri qRT-PCR kullanılarak transkripsiyon seviyelerini belirlemek için öncellikle *B. juncea* L. S-9 bitkisine ait GR enzimi için primer dizayn edilecektir. Daha sonra, primerler Primer3 programı kullanılarak tasarlanacaktır. Total hacim 25 µl olacak şekilde hazırlanan cDNA örnekleri (4 µl), hazırlanan master mix (13 µl), polimeraz enzimi, dNTP' ler, primerler (Glutathione reductase forward primer (GR-forward), GR-reverse primer ve referans gen olarak Glyceraldehyde 3-phosphate dehydrogenase (GAPDH) forward primer, GAPDH reverse primer), SYBR Green gibi floresan boyalardan oluşan karışım 96 kuyucuklu platelere yüklenerek BioRad CFX96 sisteminde gerçekleştirilecektir. Her bir örnek için reaksiyon 3 kez tekrar edilecektir.

İstatiksel Analizi

$2^{\Delta\Delta Ct}$ hesaplaması kullanılarak her bir örnek için değerler hesaplanacaktır. Veriler, ortalamalar arasında anlamlı farklılıkların olup olmadığını belirlemek için Tek yönlü ANOVA, IBM SPSS 25.0 paketi (SPSS, ABD) kullanılarak analiz edilecektir.

Bulgular ve Tartışma

Bitkiler toksik metaller/metaloidler stresini antioksidan savunma sistemlerini kullanarak bir dereceye kadar hayatta kalmaya çalışmaktadırlar. Ancak savunma sisteminin aktivitesi ve performansı stres konsantrasyonu, stres süresi, bitki tipi ve bitkinin yaşına göre farklılık göstermektedir. Dengeli metabolizma, biyotik ve abiyotik stresler nedeniyle her zaman bozulan bitkilerde daha iyi üretkenlik için ön koşuldur. Bu nedenle, redoks dengesi, daha fazla oksitlenme ve enerji temini için oksitlenmiş ürünlerin indirgendiği yaşamın temel özelliklerinden biridir.

İndirgenmiş durumdaki glutatyon havuzu, dehidro-askorbatı askorbat-glutatyon döngüsü yoluyla askorbata indirgeyen GR tarafından düzenlenmektedir (Arora vd., 2012). Sonuç olarak, çeşitli streslerle karşı karşıya kalan bitkilerde GR'in rolü son derece önemli hale gelmektedir. Örneğin, farklı Cr (0.0, 0.1, 0.3 ve 0.5 mM) konsantrasyonlarda maruz kalan 30 ve 60 günlük *B. juncea* L. bitkilerinde total proteinler, antioksidatif enzimler (SOD, CAT, POD, APX, GR, MDHAR ve DHAR) ve MDA içeriği gibi morfolojik ve biyokimyasal stres belirteçleri üzerindeki etkiler değerlendirilmiştir (Kanwar vd., 2015). Diğer bir yandan, AsA-GSH yolunun enzimleri arasında, GR'in farklı toksik metaller/metaloidler (Cd, Hg, Cr, Cu vs.) stresine karşı bazı bitki türlerinin tepkileri gösterilmiştir (Tablo 1).

Brassicaceae familyasının üyelerinin HM'lere karşı toleranslı oldukları bildirilmiştir (Kanwar vd., 2012). *B. juncea* bir yağlı tohum bitkisi olarak yetiştirilen ve soya ve palmiyeden sonra yemeklik yağ üretiminden kullanılan endüstriyel bitkidir (Sinha vd., 2010). Hızlı büyüme, yüksek biyokütle, daha az su gereksinimi ve yüksek konsantrasyonda HM'leri absorbe kabiliyeti nedeniyle (Memon vd., 2001; Meng vd., 2009; Gill vd., 2015), HM'lerin fitoremediasyonu için potansiyel bir bitki olarak kabul edilmektedir.

Bu çalışmada, krom stresine (0, 25, 50, 100, 200, 500 µM) maruz kalan *B. juncea* L. var. S-9 bitkisinde oksidatif stresin etkisi ve bu olumsuz etkinin üstesinden gelmek için tetiklenen antioksidan savunma mekanizmasında rol oynayan glutatyon redüktaz (GR) üzerine araştırmalar devam etmektedir.

Tablo 1. Metal stresi altındaki bitki türlerinde glutatyon redüktazın (GR) antioksidan aktivitesi

Bitki türleri	Metal türü	Uygulanan konsantrasyon	Referans
Brassica napus	Cd (10 µM kadar)	GR aktivitesi artış göstermiş	Nouairi vd., 2009
Brassica juncea L.	Cr (VI) (0.0, 0.1, 0.3 ve 0.5mM)	GR aktivitesi artış göstermiş	Kanwar vd., 2015
Ceratophyllum demersum	Cd (10 µM)	GR aktivitesi azalma göstermiş	Aravind ve Prasad, 2005
Arabidopsis thaliana	Cd (1 ve 10 µM)	GR aktivitesi artış göstermiş	Semane vd., 2007
Mung bean Cd-tolerant (Pusa 9531) ve sensitive (PS 16) varyeteleri	Cd (1 mM)	GR aktivitesi artış göstermiş	Hossain vd., 2012
Mung bean tolerant (TPM-1) and sensitive cultivar (TM4)	As (As(V) ve As(III))	GR aktivitesi artış göstermiş	Hossain vd., 2012
Hydrilla verticillata	Cu (5 µM)	GR aktivitesi artış göstermiş	Srivastava vd., 2006
Hydrilla verticillata	Cu (25 µM)	GR aktivitesi azalma göstermiş	Srivastava vd., 2006
Sesbania drummondii	Hg (50 µM)	GR aktivitesi azalma göstermiş	Israr ve Sahi, 2006
Medicago sativa	Hg (10 µM)	GR aktivitesi azalma göstermiş	Zhou vd., 2008
Brassica napus	Cu (100 µM)	GR aktivitesi artış göstermiş	Russo vd., 2008
Rice	Pb (1000 µM)	GR aktivitesi artış göstermiş	Verma ve Dubey, 2003
P. sativum	Cr	GR aktivitesi azalma göstermiş	Gangwar vd., 2011
Barley plants	Cr	GR aktivitesi artış göstermiş	Ali vd., 2013
Brassica juncea cv. pusa jaikisan	Cr(VI) (0.2, 2 ve 20 µM)	GR aktivitesi artış göstermiş	Pandey vd., 2005

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Determination of The Yield and Yield Parameters of Demre Sivrisi, Dogal Sarı Sivri and Dogal Carliston (*Capsicum Annuumm* L.) Pepper Varieties Growed By Fertigation Method in Greenhouse Conditions

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Abstract

In the research, it was aimed to cultivate three different pepper varieties during two years in greenhouse conditions, to investigate their adaptation abilities to Sivas ecological conditions and to determine the most suitable pepper variety to be grown in greenhouse conditions.

Demre Sivri, Dogal Sarı Sivri and Dogal Carliston pepper (Capsicum Annuum L.) species were used as test plants in the study. The research was carried out in a total of 9 plots with 3 replications according to the randomized blocks experimental design. Seeds were made into seedlings by regularly watering for about 60 days in the prepared peat and perlite mixture (1:1 V/V) in viols and planting was carried out in the greenhouse environment when they had 3-4 leaves. Irrigation processes in the research were carried out by drip irrigation method, and irrigation was carried out every 3 days during the 20-day period from planting to 7 leaves of pepper plants. In other processes, irrigation was done every 2 days until the plants were harvested. Considering the results of soil analysis in the research, fertilization was done by fertigation method (fertilization with drip irrigation) for pepper purely at 20 kg N da^{-1}, 6 kg P_2O_5 da^{-1}, 20 kg K_2O da^{-1}. In the study, nitrogen (N) ammonium sulfate $(NH_4)_2SO_4$, phosphorus (P) MKP (monopotassiumphosphate) and potassium (K) potassium nitrate (KNO_3) forms were applied. Nitrogen, phosphorus, potassium, calcium, magnesium, iron, zinc, manganese and copper analyzes were made in the leaf samples taken when the pepper plant reached half of the fruit size and yield were determined. According to the results of the research, Dogal Carliston stood out in the first year in terms of yield (2987 kg da^{-1}), while Demre Sivri (2788 kg da^{-1}) gave the highest yield in the second year.

Key Words: *Fertigation, Pepper, Yield, Nutrient Uptake, Drip Irrigation*

Fertigasyon Yöntemiyle Yetiştirilen Demre Sivrisi, Doğal Sarı Sivri Ve Doğal Çarliston (*Capsicum Annuumm* L.) Biber Çeşitlerinin Sera Koşullarında Verim Ve Verim Parametrelerinin Belirlenmesi

Özet

Araştırmada sera koşullarında iki yıl süreyle üç farklı biber çeşidinin yetiştiriciliği yapılıp, Sivas ekolojik koşullarına adaptasyon yeteneklerinin araştırılması ve sera ortamında yetiştirilmesi en uygun olan biber çeşidinin belirlenmesi amaçlanmıştır.

Araştırmada test bitkisi olarak Demre Sivrisi, Doğal Sarı Sivri ve Doğal Çarliston biber (Capsicum Annuum L.) türleri kullanılmıştır. Araştırma tesadüf blokları deneme desenine göre 3 tekerrürlü olarak toplam 9 parselde yürütülmüştür. Tohumlar hazırlanan torf ve perlit karışımında (1:1 V/V) viyoller içerisinde yaklaşık 60 gün süreyle düzenli olarak sulanarak fide haline getirilmiş ve 3-4 yapraklı olduğunda sera ortamında toprağa dikim işlemi gerçekleştirilmiştir. Araştırmada sulama işlemleri damla sulama yöntemiyle yapılmış olup biber bitkileri dikimden 7 yapraklı oluncaya kadar olan 20 günlük süreçte 3 günde bir sulama işlemi yapılmıştır. Diğer süreçlerde bitkiler hasat edilinceye kadar 2 günde bir sulama işlemi yapılmıştır. Araştırmada toprak analiz sonuçları dikkate alınarak biber için saf olarak 20 kg N/da, 6 kg P_2O_5/da, 20 kg K_2O/da olacak şekilde fertigasyon yöntemiyle (damla sulama ile birlikte gübreleme) gübreleme yapılmıştır. Araştırmada azot (N) amonyum sülfat $(NH_4)_2SO_4$, fosfor (P) MKP (monopotasyumfosfat) ve potasyum (K) potasyum nitrat (KNO_3) formlarında uygulanmıştır. Biber bitkisinin verim ile meyve büyüklüğünün yarısına ulaştığında alınan yaprak örneklerinde azot, fosfor, potasyum, kalsiyum, magnezyum, demir, çinko, mangan ve bakır analizleri yapılmıştır. Araştırma sonuçlarına göre, verim bakımından birinci yıl Doğal Çarliston öne çıkarken (2987 kg/da), ikinci yıl Demre Sivrisi (2788 kg/da) en yüksek verimi vermiştir.

Anahtar Kelimeler: *Fertigasyon, Biber, Verim, Besin Elementi Alımı, Damla Sulama*

ID: 785

Utilization of Postbiotics in Foods

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Abstract
There is a continuous discussion about addition of probiotics to food product leading to technological problems and health risks. For this reason, studies about the use of postbiotics in foods instead of the addition of probiotics have been taking attention recently. Postbiotics are metabolites such as exopolysaccharides, short chain fatty acids, enzymes, peptides, bacteriocins, vitamins and peptidoglycans secreted by probiotics. The addition of postbiotics to food products improve the quality parameters and longer the shelf life owing to antioxidant, antibacterial and antifungal effects. In this review, recent studies on the use of postbiotics in food formulations, production processes and packaging were compiled.
Key Words: *Postbiotics, postbiotic foods, probiotics,*

Postbiyotiklerin Gıdalarda Kullanımı

Özet
Gıda endüstrisinde yaygın olarak kullanılan canlı probiyotiklerin birçok gıdaya eklenmesinde yaşanan teknolojik sorunlar ve sağlık riskleri hakkında tartışmalar devam etmektedir. Bu nedenle son yıllarda gıdalarda probiyotik yerine postbiyotik kullanımına yönelik çalışmalar yapılmaktadır. Postbiyotikler; probiyotikler tarafından salgılanan ekzopolisakkaritler, kısa zincirli yağ asitleri, enzimler, peptitler, bakteriyosinler, vitaminler ve peptidoglikanlar gibi metabolitlerdir. Gıdalara antioksidan, antibakteriyel ve antifungal etkileri olan postbiyotiklerin eklenmesiyle depolama sürecinde kalite özelliklerinin kaybolmadığı ve daha uzun raf ömrüne sahip gıdaların üretilebildiği görülmektedir. Bu çalışmada postbiyotiklerin gıda formülasyonlarında, üretim süreçlerinde, paketleme alanlarında kullanımına ilişkin güncel çalışmalar derlenmiştir.
Anahtar Kelimeler: *Postbiyotikler, postbiyotik gıdalar, probiyotikler*

Giriş

Probiyotikler yeterli miktarda tüketildiğinde konakçıya sağlık açısından fayda sağlayan canlı mikroorganizmalar olarak tanımlanmaktadır (Moradi, ve diğerleri, 2020). Dünya Sağlık Örgütü postbiyotikleri "fermantasyon sırasında üretilen biyoaktif çözünür faktörler ve çoğunlukla hücre içermeyen kültür üst fazlarında bulunan moleküller" şeklinde tanımlamıştır (WHO & FAO, 2002). Postbiyotikler; hücre yüzeyi proteinleri, bakteriyel enzimler ve peptitler, teikoik asitler gibi bakteriler tarafından üretilen metabolitleri, peptidoglikan türevli nöropeptidleri, polisakkaritleri ve laktik asit gibi organik asitleri içerebilmektedir (Cuevas-González, Liceaga, & Aguilar-Toalá, 2020). Parabiyotikler ise yeterli miktarlarda uygulandığında tüketicilere fayda sağlayan inaktive edilmiş (canlı olmayan) mikrobiyal hücreler veya hücre fraksiyonları olarak tanımlanmıştır. Benzer şekilde parabiyotikler canlı olmayan probiyotikler, inaktive edilmiş probiyotikler veya hayalet probiyotikler olarak adlandırılır (Sabahi, ve diğerleri, 2021).

Postbiyotikler gıda proseslerinde işleme kolaylığı sağlaması, fonksiyonel gıdalarda duyusal özelliklerin geliştirilmesi, antimikrobiyal ve antioksidan etkileri ile raf ömrünü arttırması, biyo-ambalaj materyallerinde kullanılabilirliğinin bulunması, in vivo ve in vitro çalışmalarda hayvan denekler ve insan sağlığı üzerine olumlu ve iyileştirici etkilerinin bulunması gibi sebeplerle bu alanlardaki çalışmalar son yıllarda hız kazanmaktadır. Her geçen gün yeni postbiyotik üreten suşların bulunması, kimyasal yapılarının analizi, etki mekanizmaları, laboratuvar ortamında ve endüstriyel ortamlarda üretiminin araştırılması, yeni proseslerin geliştirilmesi söz konusudur. Yapılan analizler ve in vivo/in vitro denemeler iyi tanımlanmış suşlarda ve metabolitlerinde beklenen sonuçları ve etkileri verirken mekanizması tam olarak aydınlatılamamış suşların ve postbiyotiklerin var olduğu da bilinmektedir (Cuevas-González, Liceaga, & Aguilar-Toalá, 2020).

Probiyotikler ve Postbiyotikler

20. yüzyılın başlarında yoğurt gibi fermente süt ürünleri yoluyla laktik asit bakterilerinin düzenli tüketiminin Bulgar köylerinde yaşayan insanlar arasında genel olarak daha iyi sağlık ve uzun ömür ile ilişkili olduğu gözlemlendi. Böylece bazı bakterilerin sağlığa yararlı olabileceği gözlemi probiyotik kavramının gelişmesine yol açmıştır (Metchnikoff, 1907). Probiyotikler şu anda "yeterli miktarlarda uygulandığında konakçıya sağlık yararı sağlayan canlı mikroorganizmalar" olarak tanımlanmaktadır (Hill, ve diğerleri, 2014). FAO/WHO tarafından güncellenen tanımda ise probiyotikler hem bakteri (ör. başlıca *Lactobacillus, Bacillus ve Bifidobacterium*) hem de maya (örn. *Saccharomyces*) cinslerini içerir. Uluslararası Probiyotikler ve Prebiyotikler için Bilimsel Birlik

(ISAPP) konsensüs paneline göre probiyotik mekanizmalar suşa özgü olabilir, belirli bir türün sadece birkaç suşunda olabilir veya türe özgü olabilir (Rad, Hosseini, & Pourjafar, 2022).

Mevcut tanım gereği, bir probiyotik canlı olmalıdır; bu nedenle ölü bakteri hücreleri veya hücre bileşenleri probiyotik olarak değerlendirilemezler. Bu sebeple probiyotik kavramına geniş bir boyut sağlayan, probiyotiklerin doğal canlılıklarının ötesinde sağlık yararlarını belirtmek için parabiyotik ve postbiyotik gibi terimler oluşturulmuştur. Bu terimler son zamanlarda ortaya çıkmış olmasına rağmen gıda bilimi ve teknolojisi alanında olduğu kadar insan sağlığı ve beslenmesinde de hızla benimsenmiş ve fonksiyonel gıdalar, besin maddeleri ve ilaçlar olarak potansiyel uygulamaları için özellikle gıda, biyoteknoloji ve ilaç endüstrilerinde ilgi görmüştür. Tanımlarını sınırlayarak postbiyotik ve parabiyotik kavramlarını birbirinden ayırmak önemlidir. Postbiyotikler canlı probiyotik bakteriler veya mayalar tarafından salgılanan veya bakteri/maya lizisinden sonra salınan ve konakçıya olumlu etki sağlayabilen çözünebilir materyallerdir. Parabiyotikler ise yeterli miktarlarda alındığında tüketicilere fayda sağlayan inaktive edilmiş, probiyotik ya da probiyotik olmayan mikrobiyal hücreler veya bu hücrelerin kültür üst fazları olarak tanımlanmıştır (Vinderola, Sanders, & Salminen, 2022).

Postbiyotikler ve parabiyotikler gıda ve farmasötik uygulamalar için türetildikleri canlı mikroorganizmadan daha kararlı ve daha güvenlidir çünkü canlılıkları tüketim sırasında veya büyük ölçekli üretim sırasında gerekli değildir. Bu nedenle postbiyotikleri ve parabiyotikleri elde etmek için kullanılan teknoloji mikroorganizmada canlılık kaybını indüklemeye odaklanır. Yüksek sıcaklık, yüksek basınç, sonikasyon dahil olmak üzere bu amaçlar için yaygın olarak kullanılan birkaç yöntemdir. Postbiyotikler için hücre içi metabolitleri ve/veya hücre duvarı bileşenlerini fragmantlar halinde elde etmek için en az iki işlemin bir kombinasyonunu uygulayarak bakteri zarının parçalanması gerekmektedir (İçier, Güzelcan, Hıdır, & Türköz, 2022). Bununla birlikte bazı durumlarda ortaya çıkan karışımın, uygulanan işlem ve koşullara bağlı olarak aynı anda parabiyotikler ve postbiyotikler içerebildiği bildirilmiştir. Bu nedenle bozulmamış hücreleri ortadan kaldırmak ve yalnızca postbiyotik fraksiyonu kurtarmak için mikrofiltrasyon gibi ek adımlar gereklidir (Moradi, ve diğerleri, 2020). Bu arada canlı hücreler tarafından salgılanan postbiyotikleri, bunların kültür üst fazlarından geri kazanmak için gerekli yöntemler veya teknoloji, temel olarak canlı hücrelerin, santrifüjleme ve/veya filtrasyon yoluyla ortamdan çıkarılmasına dayanır. Elde edilen postbiyotik daha sonra dondurarak kurutma ya da püskürtmeli kurutucu ile toz hale getirilebilir (Cuevas-González, Liceaga, & Aguilar-Toalá, 2020).

Üretilen postbiyotiklerin tanımlanması için gaz kromotografisi (GC), sıvı kromotografisi (LC), ince tabaka kromotografisi (TLC), nükleer manyetik rezonans (NMR) spektroskopisi, Fourier transform kızılötesi (FTIR) gibi spektroskopi gibi yöntemler sıklıkla kullanılan analitik tekniklerdir (Moradi, ve diğerleri, 2020) (Cuevas-González, Liceaga, & Aguilar-Toalá, 2020). Bu cihazlarla tanımlanan postbiyotikler çeşitli gruplar altında şu şekilde toplanmıştır;

Proteinler: Bakteriyosinler, antimikrobiyal peptitler (AMP)
Enzimler: Glutatyon peroksidaz (GPx), süperoksit dismutaz (SOD), NADH peroksidaz
Kompleks moleküller: Peptidoglikandan türetilmiş muropeptitler, lipoteikoik asit
Vitaminler: B grubu vitaminleri
Organik Asitler: Propiyonik asit, 3-fenillaktik-asit
Lipidler: Propiyonat, bütirat, plasmalojen, kısa zincirlik yağ asitleri
Karbonhidratlar: Galaktoz bakımından zengin polisakkaritler, teikoik asit, ekzopolisakkaritler (EPS) (İçier, Güzelcan, Hıdır, & Türköz, 2022).

Postbiyotiklerdeki metabolitlerin tanımlanması veya parabiyotiklerin sağlam hücrelerindeki bütünlüğün veya değişikliklerin değerlendirilmesi için farklı analitik teknikler kullanılabilse de postbiyotiklerin ve parabiyotiklerin tanımlanması ve karakterizasyonu için tekniklerin ve analitik araçların seçimi analitik amaçlara, niteliksel ve/veya mikrobiyal komplekslerin ve incelenen moleküllerin nicel özelliklerine bağlıdır. Postbiyotikler söz konusu olduğunda kullanılan analitik teknikler ilgilenilen metabolitin tanımlanması veya yeni metabolitlerin keşfedilmesi için en çok belirtilen teknik olmalıdır (Shenderov, 2013).

Probiyotikler tarafından besiyerlerinde fermantasyon yoluyla üretilecek postbiyotikler besiyeri ve fermantasyon koşullarına bağlıdır ve aynı suş farklı koşullarda farklı postbiyotikler üretebilmektedir (Amiri, Rezazadeh-Bari, Alizadeh-Khaledabad, Rezai-Mokarram, & Sowti-Khiabani, 2021). Son yıllarda endüstriyel ölçekte postbiyotik üretimi için alternatif besiyerlerleri de araştırılmaktadır. Örneğin bir çalışmada yağsız süt, proteolitik *Laktobacillus* DSM-100H kültürünün postbiyotik üretimi için endüstriyel ölçekte başarılı bir şekilde kullanılmıştır (Dunand, Peralta, Forzani, Reinheimer, & Vinderola, 2019).

Artan sayıda bilimsel kanıt postbiyotiklerin ve parabiyotiklerin çeşitli yöntemler kullanılarak laboratuvar ölçeğinde üretilebileceğini göstermektedir. Bir çalışmada araştırmacılar anti-mikrobiyal etkili et paketlenmesinde kullanılmak üzere nano kâğıt geliştirmek için bakteriyel nanoselüloza dahil edilen *Lactobacillus plantarum* ATCC 14917'den türetilen postbiyotikleri içeren liyofilize bir toz hazırlamıştır (Yordshasi, Moradi, Tajik, & Molaei, 2020). Başka bir çalışmada araştırmacılar klinik bir çalışma için bir jöle içine dahil edilen *Lactobacillus paracasei* MCC1849'un ısıl işlemle canlı olmayan bakteri hücrelerini (1 x 10^{10} hücre/72 g ürün) hazırlamıştır(Maruyama, ve diğerleri, 2016). Ancak prosesin bahsedilen şekliyle gerçekleştirildiğinde yeterli miktarlarda elde ürün edilemeyeceği ve görece pahalı olduğu görülmüştür (Chaluvadi, Hotchkiss, & Yam, 2016). Ek olarak yoğurt,

lahana turşusu, salamura sebzeler ve kombucha içeceği gibi bazı gıdalar doğal olarak postbiyotikler ve parabiyotikler içerebilir ancak bunlar kontrol edilemez şekilde üretilir ve üretilen miktar in vivo fizyolojik bir yanıt oluşturmak için yetersiz olabilir. Sonuç olarak parabiyotiklerin ve postbiyotiklerin üretimini işlevsel hale getirmek ve uygun maliyetli seviyelere çekebilmek için kullanılabilecek teknolojik ve endüstriyel süreçleri gözden geçirmeye ihtiyaç duyulmaktadır (Cuevas-González, Liceaga, & Aguilar-Toalá, 2020).

Postbiyotiklerin Gıdalarda Kullanım Olanakları

Postbiyotiklerin teknolojik avantajları sebebi ile probiyotiklerin yerine gıdalarda kullanımının araştırılması ve çeşitli proseslere eklenmesi son yıllarda hız kazanmıştır. Gıda endüstrisinde postbiyotiklerin kullanımı yeni bir yaklaşımdır. Buna rağmen biyofilmlerin giderilmesi, antimikrobiyal etkileri, antioksidan etkileri, gıdalarda kimyasal kontaminantların biyolojik olarak parçalanması, gıda kaynaklı patojenlerin inhibe edilmesi, duyusal açıdan ürünlerin iyileştirilmesi ve yenilebilir kaplamalarda kullanılmaları gibi güncel uygulamalar mevcuttur. Probiyotiklerin fermantasyonu ile elde edilen kültür üst fazları çeşitli formlarda gıda matriksine eklenmektedir. Bu formlar doğrudan, liyofilize, çözelti, mikroenkapsüle ve konsantre olarak ekleme gibi çeşitlere ayrılmaktadır. Bu şekilde eklendikten sonra da postbiyotiklerin gıda üzerine etkileri incelenmektedir (Moradi, ve diğerleri, 2020). Postbiyotiklerin gıdalara eklenmesi doğrudan sıvı kültür üst fazı olarak ya da konsantre kültür üst fazının çözelti olarak eklenmesi şeklinde de yapılabilmektedir. Fakat yapılan çalışmalarda liyofilize ya da enkapsüle postbiyotiklerin gıda proseslerinde daha iyi sonuçlar verdiğini gözlemlenmiştir (İçier, Güzelcan, Hıdır, & Türköz, 2022).

Mikroenkapsülasyon yöntemi ile postbiyotiklerin çeşitli kimyasallar, safra tuzları, düşük pH, antimikrobiyal ajanlar ve yüksek sıcaklık gibi olumsuz koşullara karşı korunması yaygın bir yaklaşımdır. Akışkan yataklı kurutma, püskürtmeli soğutma, birlikte kristalleştirme ve birlikte biriktirme gibi teknikler kullanılarak birçok postbiyotik çeşidine mikroenkapsülasyon yapılmaktadır (Hosseini, Abbasi, Sabahi, & Khani, 2021). Postbiyotiklerin enkapsüle edilebilmesi için karbonhidrat, protein ve lipitler kullanılmaktadır (İçier, Güzelcan, Hıdır, & Türköz, 2022). Postbiyotiklerin gıda kullanımlarında bakteriyosinler ve diğer biyoaktif peptitler, ekzopolisakkaritler (EPS) ve antioksidan moleküller öne çıkmaktadır. Birçok probiyotik suşun antioksidan etkiye sahip postbiyotikler ürettiği görülmüştür. Bu antioksidan moleküller arasında proteinler, peptitler, glutatyon, pirol ve halkalı bileşikler vardır (Cuevas-González, Liceaga, & Aguilar-Toalá, 2020). Biyoaktif peptitler amino asit dizilerine ve üç boyutlu yapılarına bağlı olarak antioksidan ve antimikrobiyal etkiler gösterir. Ayrıca doğrudan insan sağlığı üzerine etki gösteren antihipertansif, antidiyabetik, anti-enflamatuvar gibi etkiler gösterebilen peptitlerdir (Ötleş, Bakar, & Kaplan Türköz, 2022). Biyoaktif peptitler proteinlerin enzimatik hidrolizi ile ya da fermantasyon yoluyla elde edilebilir. Laktik asit bakterilerinin fermantasyonu sonrasında postbiyotik fraksiyonlarında biyoaktif peptitler olduğunu gösteren çok sayıda çalışma mevcuttur (İçier, Güzelcan, Hıdır, & Türköz, 2022).

Ekzopolisakkaritler mikroorganizmalar tarafından üretilen ve hücre dışına salgılanan biyopolimerlerdir. Probiyotik organizmaları olumsuz çevre koşullarına karşı korumak, hücre tanıma ve biyofilm oluşumunda yer almak gibi görevleri vardır. Ekzopolisakkaritlere örnek olarak dekstran, gellan, ksantan, pullulan, aljinat verilebilir (İçier, Güzelcan, Hıdır, & Türköz, 2022). Başta gıda endüstrisi olmak üzere birçok endüstride kullanılırlar. Genel kullanım alanları jelleştirici, stabilizatör, koyulaştırıcı ve emülgatör olarak kullanılmalarıdır ve bu biyopolimerler aynı zamanda gıda ambalajlanmasında da kullanılabilirler (Moradi, ve diğerleri, 2020). Süt ürünlerinde su tutma kapasitesi ile viskoziteyi arttırmakta ve reolojiyi geliştirmede kullanılmaktadırlar. Hububat ürünlerinde de benzer reolojik özelliklerin geliştirilmesinde kullanılmaktadır (Shukla, Mehta, Parmar, Pandya, & Saraf, 2019).

Postbiyotiklerin et ürünlerinde kullanımları konusunda çok sayıda çalışma mevcuttur. Et ürünlerinde doğal katkı maddeleri olarak kullanımları söz konusudur. Bu kapsamda postbiyotik kullanımının özellikle antioksidan ve antimikrobiyal etkileri önem kazanmaktadır. Bir çalışmada *Lactobacillus salivarius, Lactobacillus acidophilus* LA-5 ve *Lactobacillus casei* 431 kültür üst fazlarının liyofilize edilerek dana kıymasına eklenmiş ve antimikrobiyal etkileri incelenmiştir. *L. monocytogenes*'e karşı inhibe edici etki gösterdikleri gözlemlenmiştir. *L. salivarius*'un postbiyotikleri, *L. monocytogenes* üzerinde en yüksek inhibitör aktiviteyi gösterirken *L. casei* 431'in postbiyotiklerinin ise en düşük aktiviteyi gösterdiği bildirilmiştir. Üç probiyotik suşun da üst fazları ile gaz kromatografisi-kütle spektrometrisi (GC-MS) analizi yapılmıştır ve bu analizler sonucunda hücre içermeyen kültür üst fazlarının benzoik asit, pirolo [1,2-a] pirazine-1,4-dion bakımından zengin oldukları belirlenmiştir. Bulunan bu ajanların antioksidan etki gösterdiği bilinmektedir. Bu suşlardan elde edilen postbiyotiklerin fonksiyonel gıdalarda potansiyel antioksidan ajan adayı olabileceğini gösterilmiştir (Moradi, ve diğerleri, 2020). Başka bir çalışmada laktik asit bakterilerinin çeşitli suşlarının parabiyotik ve postbiyotik ürünleri doğal fermente sucuklarda kullanılmış ve bu suşların antioksidan içerikli postbiyotikler ürettiği ve aktivitenin suşa bağlı olduğu gösterilmiştir (Aydın, Çiydem, Kaya, & Açık, 2021).

Lactobacillus paracasei N2 ve *L. casei* TM1B suşlarından elde edilen postbiyotiklerin keçi kıymasında kullanıldığı bir çalışmada *Pseudomonas aeruginosa* ve *E. coli* suşlarına karşı antimikrobiyal etki gösterdiği, raf ömrünü 15 güne kadar arttırdığı gözlemlenmiştir (Mouafo, Mbawala, Tanaji, Somashekar, & Ndjouenkeu, 2020). Domuz eti ile yapılan bir çalışmada yerel geleneksel Vietnam yoğurdundan izole edilen *L. plantarum* SC01 suşuna

ait bakteriyosinlerin farklı saklama koşulları altında domuz etine eklenmesi sonucunda çeşitli patojenlere karşı antimikrobiyal etki gösterdikleri görülmüştür (Le, ve diğerleri, 2019). Başka bir çalışmada *L. plantarum* ST16Pa'ya ait bakteriyosin benzeri postbiyotikler (BLIS) ve laktat farklı oranlarda tavuk göğüs etine eklenmiş ve 4˚C'deki buzdolabı koşullarında antimikrobiyal etkinin 7 gün boyunca devam ettiği gösterilmiştir (da Silva, Pérez-Rodríguez, Domínguez, & de Souza Oliveira, 2017). *Lactobacillus rhamnosus, Lactobacillus fermentum, Pediococcus acidilactici, Lactobacillus delbrueckii susp. lactis*'in liyofilize postbiyotiklerinin antimikrobiyal etkisini incelendiği başka bir çalışmada *L. rhamnosus* EMCC 1105 postbiyotiklerinin *Clostridium perfringens*'e karşı en fazla antimikrobiyal etki gösterdiği, tavuk etine doğrudan eklenmesi sonucunda antimikrobiyal etkisinin devam ettiği görülmüştür (Hamad, Abdelmotilib, Darwish, & Zeitoun, 2020). Postbiyotik varlığında gıdadaki duyusal ve tekstürel özelliklerini araştıran çalışmalardan birinde sucuğun duyusal özelliklerini geliştirmek amacıyla EPS üreten *L. plantarum* ve *Leuconostoc mesenteroides* suşları seçilmiş ve uygun fermantasyon koşullarında sucuk örneklerinin dokusal özelliklerinin geliştiği, daha sert ve daha az yapışkan sucuk ürünleri elde edildiği bildirilmiştir (Dertli, ve diğerleri, 2016).

Sardalya filetolarının vakumlu ambalajlarında ve normal ve modifiye atmosferde paketlenmiş ambalajlarında yapılan bir çalışmada *Enterococcus faecalis* A-48-32 bakteriyosinlerinin stafilokok türlerine karşı antimikrobiyal etki gösterdiği, biyojen amin oluşumunu azalttığı ve filetoların raf ömrünü uzattığı görülmüştür (Ananou, ve diğerleri, 2014). Füme somonlarla yapılan bir çalışmada *Lactobacillus reuteri*'den izole edilip saflaştırılan reuterin çözeltisinin 8˚C ve 30˚C'de 15 dakika uygulandığı soğuk füme somonlarda *L. monocytogenes'e karşı* antimikrobiyal etkisi olduğu gösterilmiştir (Montiel, ve diğerleri, 2014). Ayrıca yapılan başka bir araştırmada *Lactobacillus curvatus* BCS35 suşundan elde edilen sıvı ve liyofilize formdaki bakteriyosinlerin de farklı balık türlerinde antimikrobiyal etkileri olduğu gösterilmiştir (Gómez-Sala, ve diğerleri, 2016). Bakteriyosinler ile ilgili yapılan çalışmalarda doğrudan kültür üst fazının kullanılmasının bakteriyosinin antimikrobiyal etkisini göstermesi için yeterli olduğu sonucu ortaya koyulmuştur. Örneğin bir çalışmada *L. plantarum* suşundan elde edilen bakteriyosin içeren kültür üst fazları portakal suyu ve fermente mısır içeceği chicha suyuna eklenmiştir. Bu çalışmada bakteriyosinin *E. coli* ve *S. enterica*'ya karşı antimikrobiyal etkileri olduğu gösterilmiştir (Tenea & Barrigas, 2018).

Lactococcus lactis tarafından üretilen postbiyotikler olan nisin ve formik asit ile patateste yapılan çalışmada bu postbiyotikler taze patatese 10 dakika uygulanmış ve 0., 3., 5., 7. ve 10. günlerde depolama sırasında durumu takip edilmiştir. *Bacillus subtilis* gelişimini durdurduğu, aynı zamanda patateste renk değişiminin gözlenmediği ve raf ömrünün 10 güne çıktığı gösterilmiştir (Ruengvisesh, Khunrae, Rattanarojpong, & Jongruja, 2020). Ev yapımı domates salçası ile yapılan bir çalışmada *S. aureus, E. coli, Aspergillus niger* ve *Aspergillus flavus* organizmaları inokule edilmiş ev salçasına *L. plantarum* CS ve *L. acidophilus* ATCC 314 suşlarından elde edilen kültür üst fazları eklenmiş ve oda sıcaklığında 25 günden fazla antimikrobiyal ve antifungal etki gösterdiği gözlemlenmiştir (George-Okafor, Ozoani, Tasie, & Mba-Omeje, 2020). Meyve sebzelerle ilgili yapılan bir çalışmada çilek, mantar, mısır ve domates kullanılmıştır. Raf ömrünü uzatma amacı ile yapılan bu çalışmada *Pediococcus* spp.'den izole edilen bakteriyosinler, kimyasal koruyucular olan sodyum sülfit ve sodyum benzoatla karşılaştırılmıştır. Bakteriyosinlerin *E. coli* ile *S. sonnei* patojenlerine karşı antimikrobiyal etki gösterdiği ve bu meyve sebzelerin raf ömrünü uzattığı gözlemlenmiştir (Skariyachan & Govindarajan, 2019). Balda yapılan bir çalışmada baldan izole edilmiş *Lactobacillus kunkeei* ENH01 suşuna ait postbiyotikler bal içeren şekersiz limonataya kültür üst fazı olarak eklenmiştir. Bu çalışma sonucunda antimikrobiyal peptit içeren kültür üst fazlarının *Candida albicans*'a karşı antifungal etki gösterdiği belirlenmiştir (Ebrahimi, Sadeghi, Rahimi, Purabdolah, & Shahryari, 2021). Başka bir çalışmada Asya turşusu olan kimçiden izole edilmiş *L. plantarum* YML007 suşu postbiyotiklerinin antifungal etkisi kurutulmuş soya fasulyesi üzerinde gösterilmiştir (Ahmad Rather, ve diğerleri, 2013).

Süt ürünlerinde bakteriyosin ve ekzopolisakkaritlerin kullanımına yönelik çalışmalar öne çıkmaktadır. Yapılan çalışmalarda bakteriyosinlerin tek başına ya da diğer antimikrobiyal ajanlar ile birlikte kullanımının süt ürünlerinde başarılı sonuçlar verdiği görülmüştür. Probiyotik suşlar tarafından yaygın olarak üretilen bir bakteriyosin türü olan nisin ile sarımsak özütünün birlikte kapsüllenerek kullanıldığı bir çalışmada, buz dolabı koşullarında ve 37˚C'de bekletilen UHT sütün durumu 25 gün boyunca takip edilmiş ve *L. monocytogenes, S. enteritidis, E. coli* ve *S. aureus*'a karşı antimikrobiyal aktiviteleri gösterilmiştir (Pinilla & Brandelli, 2016). *L. sakei* 2a'dan elde edilen bakteriyosinlerini doğrudan ya da nanovesiküller içinde enkapsüle olarak UHT keçi sütüne eklediği bir çalışmada keçi sütünün durumu 7˚C'de 14 gün ve 30˚C'de 24 saat boyunca takip edilmiş ve enkapsüle bakteriyosinin antimikrobiyal etkisinin daha yüksek olduğu gösterilmiştir (Malheiros, Cuccovia, & Franco, 2016). Yeni doğal antimikrobiyal ajanların bulunmasına yönelik de çok sayıda çalışma yapılmaktadır. Bu çalışmalardan birinde araştırmacıların yerel Polonya peynirlerinden izole ettiği 29 farklı *L. plantarum* suşunun kültür üst fazları doğrudan sıvı olarak yağsız süte eklenmiş ve *S. aureus*'a karşı antimikrobiyal etki gösterdikleri saptanmıştır (Ołdak, Zielińska, Łepecka, Długosz, & D., 2020).

Manda sütünde yapılmış bir çalışmada *L. delbrueckii subsp. bulgaricus* suşundan izole edilen ekzopolisakkaritler farklı konsantrasyonlarda manda sütüne doğrudan ilave edilmiş ve yoğurdun su tutma kapasitesi ve jel sertliğini arttırdığı gösterilmiştir (Yang, ve diğerleri, 2014). *L. fermentum* Lf2 tarafından üretilen ekzopolisakkaritlerin yoğurda eklediği bir çalışmada ekzopolisakkarit eklenmesi ile yoğurtta sertlik, kıvam ve su tutma kapasitesinin arttığı gösterilmiştir (Ale, ve diğerleri, 2016). Az yağlı Cheddar peynirinde yapılan bir çalışmada *L. plantarum*

JLK0142'ye ait saflaştırılmış ekzopolisakkaritler peynire eklenmiş ve depolama sırasındaki durumu takip edilmiştir. Ekzopolisakkarit eklenmiş peynirlerin nem, proteoliz ve duyusal açıdan olgunlaşma karakteristiklerinin daha iyi olduğu gözlemlenmiştir. Ayrıca ekzopolisakkarit eklenmiş peynirlerin antioksidan ve ACE inhibitör biyoaktivitelerinin de daha iyi olduğu görülmüştür (Wang, Wu, Fang, & Yang, 2019). Postbiyotik eklenmesinin probiyotik ürün stabilitesine etkilerinin incelendiği bir çalışmada ise *Lactarius volemus Fr.* suşuna ait ekzopolisakkaritler 3 farklı probiyotik yoğurda eklenmiştir. Üretilen probiyotik yoğurtlarda yaşayan probiyotik canlı sayısının, esansiyel amino asitlerin ve su tutma kapasitesinin arttırdığı gösterilmiştir (Huang, ve diğerleri, 2020).

Çölyak hastaları için üretilen glutensiz ekmeklerde su absorpsiyonunda azalma, kırıntı yapısında değişim, somun hacmi, dokusal ve reolojik özellikler açısından zarar görme gibi durumlar söz konusu olabilir. Bu özellikleri iyileştirme ve gıdalardaki yapay katkı maddelerinin kullanımını azaltmak için hububat ürünlerinde ekzopolisakkaritlerin kullanımı son zamanlarda gündeme gelmeye başlamıştır (Ryan, Ross, Fitzgerald, Caplice, & Stanton, 2015). Laktik asit bakterileri tarafından sentezlenen ekzopolisakkaritlerin literatürde hamur reolojisi ve ekmek tekstürünün geliştirilmesi için önemli bir bileşen oldukları belirtilmiştir. Ekzopolisakkaritlerin ticari hidrokolloid ve sakızlar gibi ağ oluşturma ve suyu bağlama yetenekleri vardır ve bu sebeple somun hacmini ve raf ömrünü arttırma ve bayatlamayı geciktirme açısından kaliteyi arttırabilecekleri düşünülmektedir (Lynch, Coffey, & Arendt, 2018). Ekzopolisakkarit kullanımının glutensiz ekmek kalitesi üzerine etkisinin araştırıldığı bir çalışmada 4 farklı suştan elde edilen ekzopolisakkaritler liyofilize formda karabuğday ve pirinç unundan yapılmış ekmeğe eklenmiştir. En fazla *L. curvatus* TMW 1.624 suşundan elde edilen dekstranın glutensiz ekmeğin nem içeriğini arttırdığı, pişirme kaybını azalttığı ve kırıntı sertliğini geliştirdiği gösterilmiştir (Rühmkorf, ve diğerleri, 2012). Düşük kalorili unlu mamüllerde yapılan bir çalışmada *L. delbrueckii* subsp. *bulgaricus,* ve *Streptococcus thermophilus* suşlarından elde edilen ekzopolisakkaritler keklere yağ oranını azaltıcı bileşen olarak eklenmiş ve standart yağlı kek ile sertlik, hacim, tekstür, çiğnenebilirlik ve esneklik gibi özellikleri karşılaştırılmıştır. Ekzopolisakkaritlerin kullanıldığı düşük yağlı keklerde ürün özelliklerinin iyileştiği gözlemlenmiştir (Doğan, Akbaş, & Tunçtürk, 2012).

Postbiyotiklerin hububat ürünlerine starter kültür ile beraber ilave edildiği bir çalışmada *L. reuteri* kültür üst fazlarının çavdar ve tam buğday ekmeklerinde antifungal etkileri olduğu gösterilmiştir (Jonkuvienė, Vaičiulytė-Funk, Šalomskienė, Alenčikienė, & Mieželienė, 2016). Başka bir çalışmada ise *Lactobacillus* RM1 suşunun kültür üst fazları liyofilize edildikten sonra 10 kat konsantre edilip buğday tanelerine eklenmiş ve depolama sırasında antifungal etkileri olduğu gösterilmiştir (Shehata, Badr, El Sohaimy, Asker, & Awad, 2019).

Son yıllarda postbiyotiklerin gıda ambalajlarında kullanımı için dekstran, levan, kefiran ve hyaluronik asit gibi ekzopolisakkaritler üzerinde çalışılmış ve yenilebilir film ve kaplamaların üretiminde suda çözünmeyen polisakkaritlere alternatif olarak kullanılabilecekleri gösterilmiştir. Ekzopolisakkaritler yenilebilir film ve kaplamalarda yapısal polimer, katkı maddesi veya probiyotik taşıyıcısı olarak görev alabilir. Böylece gıda güvenliği ve kalitesi iyileştirilebilir (Moradi, Guimarães, & Sahin, 2021). Levan ile yapılan başka bir çalışmada ise *B. subtilis natto* suşundan üretilen levan polisakkariti manyok nişastasına dayalı yenilebilir filme farklı nişasta:levan oranlarında çözelti şeklinde eklenip plastikleştirici olarak gliserol kullanılmıştır. Tüm formülasyonlarda iyi bir görünüme sahip yenilebilir film üretilmiştir. Levanın çözünürlüğü yükselttiği, gerilme direnci ve uzamayı arttırdığı ve su buharı geçirgenliğini düşürdüğü gözlemlenmiştir (Mantovan, Bersaneti, Faria-Tischer, Celligoi, & Mali, 2018).

Liyofilize *L. sakei* konsantre kültür üst fazlarının ambalaj filmlerine eklendiği bir çalışmada *E. coli* ve *L. monocytogenes* inokule edilmiş taze biftek küplerinin bu film ile kaplanmış ve filmin patojenlere karşı inhibisyon etkisi olduğu gösterilmiştir (del Carmen Beristain-Bauza, Mani-López, Palou, & López-Malo, 2017). Başka bir çalışmada enterosin AS-48 bakteriyosini eklenen filmler ile kaplanan elma küplerinde de bu bakteriyosinin *L. monocytogenes'*e karşı antimikrobiyal etkisi olduğu gösterilmiştir (Aguayo, Burgos, Pulido, Gálvez, & López, 2016). Bir diğer çalışmada taze domatesler antimikrobiyal filmler ile kaplanmıştır. *L. plantarum* UTNGt2 suşu kültür üst fazı antimikrobiyal peptitleri yenilebilir kaplamalara eklenmiştir. Peptitlerin küf gelişimini azaltarak domatesin depolama süresini uzattığı ve domatese inoküle edilen *Salmonella* hücre karışımında da hücre ölümüne sebep olduğu gösterilmiştir (Tenea & Pozo, 2019). Aynı çalışma grubunun yaptığı bir başka çalışmada *L. plantarum* UTNCys5-4 ve *L. lactis subsp. lactis* Gt28 suşlarından elde edilen Cys5-4/Gt28 antimikrobiyal peptitleri *S. enterica, S. sonnei* ve *E. coli* ile kontamine edilmiş ananas dilimleri üzerine eklenmiş ve soğuk depolama koşullarında patojenlerin gelişimini inhibe ettiği gözlemlenmiştir (Tenea, Olmedo, & Ortega, 2020). Aktif gıda kaplamalarında liyofilize olarak postbiyotiklerin ilave edilmesi ile ilgili yapılan bir çalışmada *L. monocytogenes* ile kontamine edilmiş dana kıyması *L. plantarum* liyofilize üst fazı içeren bakteriyel nanoselüloz film ile kaplanmıştır. Üretilen bu nanokâğıdın kıymanın duyusal özelliklerinde istenmeyen değişikliklere sebep olmadığı ve patojenlerin büyümesini kontrol ettiği, raf ömrünü de iki katına çıkardığı belirlenmiştir (Yordshasi, Moradi, Tajik, & Molaei, 2020). Yapılan bir diğer çalışmada *Pediococcus pentosaceus*'dan elde edilen pediosin içeren filmlerle kaplanmış papayada raf ömrünün uzadığı görülmüştür (Narsaiah, ve diğerleri, 2015). Başka bir çalışmada ise *Bacillus methylotrophicus* BM47 suşu bakteriyosinini içeren yenilebilir filmlerin taze çileklere kaplanmasının ise küflenmeyi geciktirdiği ve ağırlık kaybını büyük ölçüde azalttığı gösterilmiştir (Tumbarski, Nikolova, Petkova, Ivanov, & Lante, 2019).

Sonuç

Postbiyotiklerin biyolojik etkileri gıda işlemlerinde, hücre kültürlerinde ve yapılan bazı laboratuvar deneylerinde doğrulanmıştır. Bununla birlikte postbiyotiklerin kanıtlanmış sağlık yararları olan fonksiyonel gıdalar olarak kabul edilebilmesi için Uluslararası Probiyotikler ve Prebiyotikler Derneği (ISAPP), Dünya Sağlık Örgütü (WHO) veya Gıda Tarım Örgütü (FAO) gibi kuruluşlar tarafından tanımlanması ve uzmanlar tarafından belirgin ifadelerle açıklanabilmesi gerekmektedir. Sonuç olarak postbiyotiklerin bütün mekanizmaları tam olarak aydınlatılmamış olsa da gıda proseslerindeki iyileştirici etkileri ve konakçı sağlığının iyileştirilmesine katkıda bulunabildiği belirtilmiştir. Ancak konu üzerine yapılacak daha pek çok çalışmaya ihtiyaç vardır. Postbiyotikler depolama ve raf ömrü açısından probiyotiklere kıyasla daha az zorluk içerdiğinden ve canlı probiyotikler gibi uzun süreli kullanımlarında bilinmeyen reaksiyonlara yol açmadığından gıda endüstrisi ve sağlık için daha iyi bir alternatif olma potansiyeli taşımaktadırlar. Bunlara ek olarak postbiyotikler ve biyoaktif bileşikler, probiyotiklerin fonksiyonel bileşenlere veya terapötik ajanlara dönüşme gücünü artırmanın etkili bir yolu olabilirler.

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Adoption Index of Recommended Onion Production Practices and Correlation of Multivariate Factors among Smallholder Farmers

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Abstract
Adoption of improved technologies and agricultural practices are prerequisites for increased farm productivity. Assessing the appropriateness of potential new technologies or practices increases the likelihood of adoption or modification to suit farmers' needs; however, low farm output still persists among smallholders, attributable to several factors including poor and low adoption of modern production practices. This study therefore analyzed the index of adoption of recommended onion production practices (ROPPs) and correlation of multivariate factors among smallholder farmers in Dambatta, Kano State, Nigeria. A multistage sampling procedure was used in selecting 100 respondents for this study. Primary data collected via well-structured questionnaires were analyzed using Descriptive statistics, Adoption index and Multivariate Correlation techniques.The results revealed that the prevalent ROPPs adopted by the farmers include improved onion varieties (78%), plant spacing (69%), planting method (55%), weed management (50%) and fertilizer application (44%). Moreover, most (72%) of the farmers have low adoption index (≤0.33). Further, significant correlations between multivariate factors (farm output, adoption cost and adoption index) exists and the estimated correlation coefficients for r_{xz}, r_{yz} and r_{xy} were -0.53, 0.71 and -0.82 respectively. Subsidizing cost of adoption of ROPPs, improving access to modern production practices/technologies, agricultural credit/farm capital, extension services, adequate labour supply and tenure policy modification are recommended to ameliorate adoption constraints.
***Key Words**: Adoption, correlation, multivariate factors, production practices, smallholders*

Introduction

The introduction of improved inputs and agricultural practices are prerequisite for increased production in particular and agricultural development in general. Onion (*Allium cepa L.*) is believed to have originated in the Middle East region which includes Iran, Afghanistan and Pakistan. It is also cultivated in the West African region both as a food and cash crop (Nisar *et al*., 2011). According to the United Nations Food and Agriculture Organization estimates, there are seven million acres of land in the world producing over 37 million tons of onions each year. Onion is produced in almost 170 countries of the world. China ranks first in the world with respect to onion production followed by India, USA, Turkey, Pakistan, Iran, Indonesia, Vietnam and Myanmar (Ojo *et al*., 2009). Onion (*Allium cepa L*) is a vegetable crop belonging to the family *Liliaceae* (Alabi and Adebayo, 2008). In Nigeria, onion production is concentrated in the northern region, most especially in dry tropical zones; specifically in Kaduna, Kano, Jigawa, Katsina, Sokoto, Kebbi, Plateau and Bauchi States (Ojo *et al*., 2009; Nisar *et al*., 2011). The natural features of these regions, especially the presence of flood prone plain and river basins and above all the development of vast irrigated lands, create conditions that greatly favour the development of this crop in the area. Onions need well-drained humus and alluvial soils with high organic matter content, capable of retaining moisture during the dry season (Nisar *et al*., 2011). Commercial onion production in Nigeria was mainly by smallholder *Fadama* farmers particularly under irrigation in dry seasons (Ojo *et al*., 2009). It is therefore a major source of income for the rural farmers. Several factors influence adoption of recommended onion production practices. The identification and understanding of these factors will certainly provide valuable and significant information for policy formulation. Assessing the appropriateness of potential new technologies or practices increases the likelihood that they will be adopted, and if necessary modify them to suit farmers' needs better.

Agricultural technology or practice responds to farmers' concerns in specific ways. Any technology or practice used by farmers represents a particular way to solve one or several problems. The choice of one technology/practice over others is greatly influenced by the balance between its positive and negative characteristics; preferences, resources, and constraints that individual farmers face. Any new technology presented to farmers will either improve or substitute for the technological options they currently have. It is fundamental to identify these options and understand farmer's perceptions. Despite years of onion production in Nigeria, the yield is still very low (15ton/ha) compared to other regions with potential yields of 70ton/ha. This can be attributable to poor adoption of improved production practices by the farmers (NAERLS, 2014; Nagaraj and Katteppa, 2002). Moreover, a lot of recommended practices or technologies have been developed by Research institutes in Nigeria (Bawa and Ani, 2014; Komolafe *et al*., 2010; and Nagaraj and Katteppa, 2002). The recommended onion production practices (ROPPs) available in the study area include: (i) Improved onion varieties; (ii) Spacing 15cm x 20cm, 15cm x 15cm to 20cm x 20cm; (iii) Planting method (seed or sets); (iv) Weed management; (v) Transplanting (mid-June or Nov/Dec) (vi) Fertilizer application (20-25 ton/ha of farm yard manure (FYM) or 300 kg/ha NKP 15-15-15); (vii) Pest and disease control (use of *Toxipkan*, *Malathion*, *Heptactilor dieldrin*, *Parathion*); and (viii) Harvesting (onions are hand pulled and kept in shelter; bulbs are left in the shelter to cure for two weeks). However, low yields among onion farmers persist despite the availability

and introduction of improved practices. The study will provide information on the index of adoption and constraints encountered in the adoption of recommended onion production practices to facilitate adjustments that improves productivity and farm income. Besides, it would help stakeholders (private and public sector) in designing policies and intervention programs that will improve the yield, income and standards of living of farmers engaged in onion production. Based on the foregoing this study analyzed the adoption index of ROPPs and the correlation matrix among smallholder farmers. It specifically identifies ROPPs available in the area, evaluates the adoption index of ROPPs, and estimates the correlation matrix of multivariate factors among smallholders.

Materials and Methods

Study Area

This study was carried out in Dambatta, Kano State, Nigeria. Dambatta Local Government Area (LGA) has coordinates between latitude 12º25'N and longitude 8º35'E; with a land mass of 2732km^2 (NBS, 2012). It has a land mass area of 305.51km^2. Average daily temperature and rainfall are 26.8ºC and 700mm respectively (NBS, 2012). Most of the populations are smallholder farmers; moreover, villages that are located close to the nearby oasis irrigation project engage in the production of rice, pepper, onions, tomatoes and wheat. In addition, they rear livestock like; goats, sheep and poultry.

Sampling Techniques

Primary data used for this study was derived through field survey, using well-structured questionnaires. Multi-stage sampling technique was employed in the selection of respondents for this study. In the first stage Dambatta Local Government Area (LGA) was purposively selected. The second stage involved the systematic random selection of four districts in the study area out of ten (10) due to the prevalence of onion production in these districts, which include Dambatta-Yamma, Dambatta-Gabas, Ajumawa and Gwarabjawa. The final stage involved the random selection of respondents from a sample frame of 1,182 onion famers compiled by the Agricultural Development Project (ADP) at the LGA in synergy with local enumerators; hence, at constant sampling proportion of 9% (0.09) a sample size of 100 onion farmers was derived and validated using raosoft sample size calculator at 95% confidence level and 10% margin error as adapted from Onuwa *et al*., 2022.

Analytical Techniques

Data for the study were analyzed using descriptive statistics (percentages and frequency distribution), adoption index and multivariate correlation techniques.

Adoption Index

The index of adoption of ROPPs was measured using the adoption index. Adoption index was computed for individual farmer following Saka and Lawal (2009) whereby adoption index (B_i) is presented in equation (1) as follows:

$B_i = \sum (R_i/R_T)$ …….. (1)

Where:

B_i = the adoption index of ROPPs by i_{th} farmer; R_i = number ROPPs adopted by i_{th} farmer; and R_T = Total number of ROPPs available to the i_{th} farmer.

i = (1…….n)

For this study, an index of ≤0.33 indicates low adoption, while an index of ≥0.55 indicates high adoption. Some of the recommended onion production practices (ROPPs) in the study area include: (i) Improved onion varieties; (ii) Plant spacing (15cm x 20cm, 15cm x 15cm to 20cm x 20cm); (iii) Planting method (seed or sets); (iv) Weed management; (v) Transplanting (mid-June or Nov/Dec) (vi) Fertilizer application (20-25 ton/ha of farm yard manure (FYM) or 300 kg/ha NKP 15-15-15); (vii) Pest management and disease control (use of *Toxipkan*, *Malathion*, *Heptactilor dieldrin*, *Parathion*); (viii) Harvesting techniques (bulbs are hand pulled and kept in shelter to cure for two weeks); and (ix) Storage methods.

Multivariate Correlation

The correlation analysis was used to analyze the multivariate relationship between adoption cost (x) (₦), adoption index (y) (ratio/index) and farm output (z) (kg), where multiple correlation coefficients (R, r) are defined in equation (2), following Gujarat (2004) and Wikipedia (2018):

$Rz, xy = \sqrt{r^2_{xz} + r^2_{yz} - 2r_{xz} . r_{yz} . r_{xy} / 1-r^2_{xy}}$…….. (2)

Where:

Rz, xy= multiple correlation coefficient between dependent and independent factors; z = dependent variable z; x = independent variable x; y = independent variable y; r^2 = coefficient of determination; r^2_{xz} = coefficient of determination between x and z; r^2_{yz} = coefficient of determination between y and z; r^2_{xy} = coefficient of determination between x and y; r_{xz}= correlation coefficient between x and z; r_{yz}= correlation coefficient between y and z; and r_{xy}= correlation coefficient between x and y.

***Decision Rule*:** The strength of relationships based on the correlation coefficient (r) is expressed as follows: ≥+/- 0.7 (strong linear relationship); +/- 0.4 - 0.69 (moderate linear relationship); and ≤+/-0.39 (weak linear relationship).

Results and Discussion

Recommended Onion Production Practices (ROPPs)

Table 1: Distribution Based on Production Practices Adopted

Production practice	Frequency*	%	Ranking
Improved onion varieties	78	78	1st
Plant spacing	69	69	2nd
Planting method	55	55	3rd
Weed management	50	50	4th
Fertilizer application	44	44	5th
Adjustments in transplanting	31	31	6th
Harvesting techniques	23	23	7th
Storage methods	11	11	8th
Pest management and disease control	5	5	9th

Source: Field Survey, 2020; * = Multiple response

Table 1 revealed the various production practices adopted by onion farmers in the study area. The significant practices adopted among onion farmers include improved onion varieties (78%), plant spacing (69%), planting method (55%), weed management (50%), fertilizer application (44%), adjustments in transplanting (31%), harvesting techniques (23%), storage methods (11%) and pest management and disease control (5%). These production practices when adopted significantly affect onion yield and enhanced the level of farm productivity. However, low adoption of onion production practices in the study area among the respondents was observed. This result corroborates with Sabo and Dia (2009); Nagaraj and Katteppa (2002) who reported similar outcomes in their respective studies on adoption of production technologies and agricultural practices**.**

Index of Adoption of Production Practices

Table 2: Distribution based on the Index of Adoption of Production Practices

Adoption index	Frequency	%
Low adoption index (≤0.33)	72	72
High adoption index (≥0.55)	28	28

Source: Field survey, 2020.

The result in Table 2 reveals that most (72%) of the farmers have low adoption index of ≤0.33; while, 28% have high adoption index of ≥0.55. Moreover, it was evident that several technologies for improved agricultural technologies for onion farming are available in the area; however, the index of adoption of these technologies was very low and not satisfactory. This trend was responsible for the existing low farm productivity of this crop in the area; as observed in previous studies (Bonabana- Wabbi, 2002). It is well known that in sub-Saharan Africa low agricultural productivity by smallholder farmers have been attributed to poor adoption of improved agricultural technologies. Therefore, identification of factors hindering adoption/uptake of improved agricultural technologies is pertinent and particularly critical to agrarian communities (Adesope *et al*., 2012; Bonabana- Wabbi, 2002).

Correlation of Multivariate Factors

Table 3: Correlation Coefficient Matrix

Factors	Farm Output (z)	Adoption cost (x)	Adoption index (y)
Farm Output (z)	1.00		
Adoption Cost (x)	-0.53*	1.00	
Adoption index (y)	0.71*	-0.82*	1.00

Source: Field Survey, 2020; *Correlation coefficient (r) is significant at 5% level (2-tailed).

Table 3 revealed that the result of the correlation analysis was significant at 5% level of probability. This suggests that a significant correlation between multivariate factors (output, adoption cost and adoption index) exists. The estimated correlation coefficient between x and z (r_{xz}) was -0.53; which suggests a moderate and inverse linear relationship between the factors. This implies that as adoption cost increases technology adoption decreases and consequently overall farm output declines. The estimated correlation coefficient between y and z (r_{yz}) was 0.71 which suggests a strong linear relationship between the factors. This implies that as the adoption index increases the level of farm productivity (output) tend to also increase. The estimated correlation coefficient between x and y (r_{xy}) was -0.82, which suggests a strong and inverse linear relationship between the factors. This implies that as adoption cost increases the index of adoption of ROPPs among the farmer's declines. The implication of these findings is that adoption of ROPPs tends to increase the level of farm productivity in the study area and hence

improve agricultural sustainability. Furthermore, the cost of production practices determines farm level adoption. Thus, this result corroborates with Matata *et al*. (2010) and Yasin (2003) who also evaluated the correlation of similar multivariate factors in their respective studies on adoption of production practices and technology among farmers.

Conclusion and Recommendations

This study analyzed the adoption index of ROPPs and the correlation of multivariate factors among smallholders. The findings revealed that there were several ROPPs available in the study area; however, adoption of these production practices was relatively low. Moreover, a low index of adoption of ROPPs among respondents in the study area was very prevalent. Furthermore, a significant linear relationship between the multivariate factors (farm output, adoption cost and adoption index) exists; thus, positive correlates facilitate agricultural sustainability. Based on the foregoing, this study recommends formulation and implementation of policies that will subsidize the cost of adoption of ROPPs; improved farmer's access to modern technologies, agricultural credit and farm capital; to enable smallholders adopt more options of ROPPs. Further, improving extension services by establishing agro service centers in the area will also facilitate technology transfer. Additionally, adequate farm labor supply and tenure policy modification facilitates technology intensification for agricultural sustainability and expansion of farm holdings for agricultural commercialization.

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Author A and Author B designed the study, managed the literature searches, handled the computation of the statistical analysis and wrote the protocol and first draft of the manuscript. Author A and Author B also read and approved the final manuscript.

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Evaluation Of Energy Potential In Dumping Sites: A Case Study For Akhisar- Manisa

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Abstract
The study consists of the determination and evaluation of the waste composition, leachate and biodegradable waste characterization in the dump site in Akhisar district, Manisa. Considering the wastes to be disposed of between 2018 and 2020 on the site, biomass energy potential based on biogas content and methane gas has been determined using the LandGEM model. It was seen that 59% of the waste brought to the site for disposal was biodegradable and 26% were composed of basic recyclable materials. The water content of the biodegradable waste in the site was 73% on average and the organic content of the dry matter was 68%. The mean of the stored waste height was 2.5 m, and there was no methane gas detected in the profile. However the acidic and acetogenic bacteria were observed in the profile samples. The BOD/COD value in the leachate was calculated as 0.37 and it is concluded that a conventional biological treatment would not be suitable. Approximately 207000 tons of waste will come to the landfill between 2018 and 2020. According to the LandGEM model, the methane gas potential of the stored waste is 5,288.383 m3 in total and the highest methane gas production is found to be 418000 m3 in 2021. These values express the gross energy generation potential of 1.694 GWh and net 96.69 KW electrical energy.
Keywords: *solid waste, dumping, biogas, energy, Akhisar*

Düzensiz Depolama Sahalarının Enerji Potansiyellerinin Değerlendirilmesi: Akhisar- Manisa Örneği

Özet
Çalışmada, Manisa Akhisar ilçesindeki düzensiz depolama sahasına kabul edilen evsel atık kompozisyonu belirlenmiş, atığın biyo-bozunur kısmının ve atıktan oluşan sızıntı suyunun özellikleri değerlendirilmiştir. Sahada 2018-2020 yılları arasında bertaraf edilecek atıklar dikkate alınarak, biyokütle kaynaklı enerji potansiyeli LandGEM modeli kullanılarak tespit edilmiştir. Sahaya ulaşan atığın %59'u biyo-bozunur özellikte olup, %26'sı temel geri dönüşümlü malzemelerden oluşmaktadır. Biyo-bozunur atığın ortalama su içeriği %73, kuru maddenin organik içeriği ise %68'tir. Sahada depolanmış haldeki atık kütlesinin ortalama yüksekliği 2.5 m'dir, atık kütlesi içinde metan varlığına rastlanmamış olup asidojenik ve asetojenik bakteriler mevcuttur. Sızıntı suyunda belirlenen BOİ/KOİ değeri (0.37) geleneksel bir biyolojik arıtmanın uygun olmayacağı göstermektedir. Depolama sahasında 2018-2020 yılları arasında yaklaşık 207,000 ton atık gelecektir. LandGEM modeline göre, depolanacak atığın metan gazı potansiyeli toplamda 5,288,383 m3,en yüksek metan gazı üretimi ise 2021 yılında 418,000 m3 olarak bulunmuştur. Depolanacak atıkta bulunan biyokütlenin enerji üretim potansiyeli brüt 1.694 GWh olup, bu değer net 96.69 KW elektrik enerjisine karşılık gelmektedir.

Anahtar kelimeler: *katı atık, düzensiz depolama, biyogaz, enerji, Akhisar*

Giriş

Türkiye'de, 82 milyona ulaşan nüfus, ilerleyen endüstrileşme ve yaşam standartları, atık yönetimi uygulamalarının önemini arttırmaktadır. Türkiye İstatistik Kurumunun verilerine göre 2018 yılında yaklaşık 32 milyon ton atık belediyeler tarafından toplanmış olup, bunun %67'si düzenli depolama sahalarında bertaraf edilmiştir. Çevre mevzuatındaki gelişmeler, özellikle atık konusundaki yaptırımların artmasının bir sonucu olarak, 2018 yılında toplanan atığın %12'si çeşitli geri kazanım işlemleri ile ekonomiye kazandırılmıştır. Ancak halen, Türkiye'de oluşan atıkların %20'si belediyelerin işletmekte olduğu sahalarda kontrolsüz bir biçimde bertaraf edilmektedir (TUİK, 2020)

Manisa, Türkiye'nin batısında ve toplam nüfus bakımından İzmir'den sonra Ege Bölgesi'nin 2. büyük ili ve ticaret merkezidir. Kent, 2012 yılında çıkarılan 6360 sayılı kanun ile büyükşehir olmuştur (Resmi Gazete, 2012). 2018 yılı toplam nüfusu yaklaşık 1.43 milyon olan Manisa'da, Büyükşehir Belediyesinin 2018 yılında bertaraf etmek üzere topladığı atık miktarı 642,222 ton olarak kaydedilmiştir. Toplanan atıkların %63'ü biyo-bozunur özelliği olan yiyecek atıkları olarak tespit edilirken, %20 si plastik, cam, karışık kağıt-karton ve metalden oluşan geri kazanılabilir atıklar grubuna girmektedir (ÇŞB, 2020). Şehirde 2017 yılının son aylarında hizmete giren Uzunburun Entegre Atık Bertaraf Tesisi ile geçmişte sayısı 70 olan düzensiz depolama sahaları kapatılmış olup, sadece dört adet belediye çöplüğü atık kabulüne devam etmektedir. Mevcut durumda kişi başı atık üretim hızı 1.25 kg/gün olan şehirde, toplanan atığın %47'si 2017 yılında işletmeye alınan entegre sistemde bertaraf edilmekte olup, %6.3 ü geri kazanılmaktadır. Bununla beraber, oluşan atıkların %46'lık büyük bir kısmı Büyükşehir

Belediyesine ait diğer sahalarda depolanmaya devam etmektedir (TUİK, 2020). Bu sahalardan en büyüğü Manisa merkezine karayolu ile 48 km mesafede bulunan Akhisar Atık Depolama Sahasıdır. İlçede yaşayan 171,381 kişilik nüfusa ait atıkların getirildiği bu saha, depolama amaçlı olarak kullanılabilecek yaklaşık 13 hektar alana sahiptir. Sahanın 2020 yılı sonuna kadar aktif olacağı bilgisi Manisa Belediyesi tarafından sahayı işletme yetkisi verilen firma tarafından beyan edilmektedir.

Sunulan çalışmada, sahaya ulaşan atıkların kompozisyonu gelir seviyesine bağlı olarak belirlenecek, sahadaki anaerobik bozunma değerlendirilecek ve atığın biyo-bozunur kısmı ile atıktan kaynaklanan sızıntı suyunun karakterizasyonu gerçekleştirilecektir. Ayrıca, sahada tesis edilebilecek biyokütle enerji üretim tesisi için alandaki mevcut ve gelecekte depolanacak atıkların enerji potansiyeli belirlenecektir. Çalışma kısa ve orta vadede kullanım dışı kalacak kontrolsüz atık depolama sahalarının rehabilitasyon planlarına esas hızlı bir karakterizasyon örneği oluşturmakta, ayrıca bu tür sahalardaki atık kaynaklı biyokütlenin enerji potansiyelinin değerlendirilmesine yönelik fizibiliteye esas verilerin belirlenmesinde yol göstermektedir.

Materyal ve Yöntem

Örnekleme ve kompozisyon belirleme

Atık örneklemesi Temmuz 2018'de Akhisar Atık Depolama Sahası'nda gerçekleştirilmiştir. Atıkların karakterizasyon çalışması; düşük, orta ve yüksek gelir grupları ile çarşı atığını temsil edecek şekilde yapılmıştır. Bunun için, atık sahasına çeşitli gelir seviyesi bölgelerinden gelen evsel atık toplama ve taşıma kamyonları kaydedilmiş, her gelir seviyesini ve çarşı bölgelerini temsil edecek ikişer bölge belirlenerek, bu bölgelerden gelen atıklar depolama sahası atık kabul noktası yakınında kalın naylon bir tabaka ile kaplanmış bir bölgeye boşaltılmıştır. Atık yığınları, elle bileşenlerine ayrıldıktan sonra plastik kovalar ile tartılarak kompozisyonu belirlenmiştir. Kompozisyon belirleme çalışmasında atıkta bulunan 13 ayrı bileşenin (biyo-bozunur, kağıt-karton, PET plastik, PE-Nylon plastik, diğer plastik, cam, metal, poşet türü kompozit, tetrapak kompozit, tekstil, hijyenik, tehlikeli, diğer yanabilirler) tespiti yapılmıştır. Yoğunlukla mutfak ve bahçe atıklarını içeren kalan kısım önce tartılmış, ardından çeyrekleme yöntemi ile azaltılarak laboratuvar örneği elde edilmiştir. Laboratuvar örnekleri (≥5 kg) plastik poşetler ile hızlı bir şekilde laboratuvara iletilerek analizlere kadar +4°C'de saklanmıştır.

Sahada halihazırda bulunan atığın karakterizasyonu için de profil örneklemesi gerçekleştirilmiştir. Bu amaçla yaklaşık 2.5 m yüksekliğe ulaşmış durumda bulunan atık kütlesinden kepçe makinası yardımı ile en yukarıdan tabana kadar bir profil açılarak derinlik boyunca her 0.5 m'de bir örnek alınmıştır. Profil örnekleri derhal kalın plastik poşetlere alınmış, poşetler sıkıştırılarak içindeki hava uzaklaştırılmış, poşetlerin ağzı bağlanarak derhal laboratuvara ulaştırılmış, laboratuvar ortamına ulaşan poşetlerin içinden azot gazı geçirilerek olası hava varlığı uzaklaştırılmıştır. Sahada ayrıca profil derinliği boyunca 50 cm uzunluğunda bir kontrol çubuğu kullanılarak atık kütlesi içindeki biyogazın metan içeriği Drager marka PacEx 2 model gaz ölçüm cihazı kullanılmak suretiyle belirlenmiştir.

Sahada kontrolsüz biçimde depolanan atıklardan sızan sular, sahanın düşük kotlu bir bölgesinde doğal bir sızıntı suyu göleti oluşturmuş olup, sızıntı suyu örneği plastik bir numune şişesine alınarak +4 ^{0}C'de laboratuvara ulaştırılmış ve saklanmıştır.

Biyo-bozunur atık karakterizasyonu

Laboratuvara ulaştırılan biyo-bozunur özellikteki atıklar öncelikle homojenize hale getirilmiş, ardından atığın su içeriği gravimetrik metod kullanılarak, atığın 105 0C de kurutulması yoluyla belirlenmiştir (ASTM, 1993). Atıkların organik madde içerikleri de gravimetrik bir yöntem olan TS 8336 'ya göre belirlenmiştir (TSE, 2008). Kuru atığın kalorifik değer analizi ASTM D5468–02 standardına göre kalorimetre bombası (İKA, C200) kullanılarak yapılmıştır (ASTM, 2007).

Sızıntı suyu karakterizasyonu

Atık sahasından alınan sızıntı suyunun pH, elektriksel iletkenlik ve toplam çözünmüş katı madde değerleri, WTW Multi 3620 İDS SetG marka multimetre ile yerinde ölçülmüştür. Örnekteki biyokimyasal oksijen ihtiyacı (BOİ) değeri, Velp BOD Evo 6 Sensor Set kullanılarak belirlenmiş olup, kimyasal oksijen ihtiyacı (KOİ) kapalı çevrim (closed reflux) kolorimetrik metot ile tespit edilmiştir (APHA, 1995).

Profil atığı örneklerinde anaerobik mikroorganizmaların tespiti

Profil örneklerinde bulunan anaerobik bakteriler asidojenik, asetojenik ve metanojenik bakteriler olarak ayırt edilmiş olup, bu kültürler için tanımlanmış besiyerleri kullanılarak tespit edilmiştir (Sponza ve Cigal, 2008). Numune içindeki organizmalar, petri kaplarında +37^{0}C'de 15 gün boyunca inkübe edilmiştir ve en muhtemel sayı (EMS) yöntemi ile sayıları belirlenmiştir (Franson vd, 1995).

Gaz Potansiyeli Belirleme

Yıllar içinde oluşacak metan gazı miktarını hesaplamak için LandGEM v.3.0 modeli kullanılmıştır (USEPA, 2005). Modelin çalıştırılabilmesi için, atıkların depolanmaya başladığı yıl, atıkların depolanmasının bittiği yıl, her yıl için oluşan biyo-bozunur atık miktarı, metan oluşum hızı (k), metan oluşum kapasitesi (L_0), depo gazı içindeki metan gazı oranı ve diğer organik bileşiklerin oranı verilerine ihtiyaç duyulmaktadır (Güven, 2019). Bu veriler modelde kullanılarak yıllar içinde oluşan toplam biyogazın ve metan gazının miktarı hesaplanmaktadır.

Bulgular ve Tartışma

Atık kompozisyonu

Düşük, orta ve yüksek gelir seviyeleri ile çarşı bölgesinden alınan atık örneklerinde yapılan kompozisyon belirleme çalışmaları sonucunda atık bileşenlerinin toplam atık içindeki payları Tablo 1 ile sunulmuştur. İlçede düşük, orta ve yüksek gelir seviyelerinin nüfus içindeki dağılımının sırasıyla %11.6, %59.1 ve %29.3 olduğu ve çarşı bölgesi atıklarının toplam atık içindeki payının %5 olduğu dikkate alınarak ağırlıklı ortalama hesaplanmıştır[(TUİK, 2018). Buna göre Akhisar'da oluşan atıkların %59'u biyo-bozunur nitelikte olup, bu durum Türkiye ve bilhassa Ege Bölgesi geneli ile uyumludur (Akinci vd, 2012). Depolama sahasına gelen atığın %26'sını temel geri dönüşümlü malzemeler olan kağıt-karton, plastikler, cam ve metal oluşturmaktadır. Plastikler yaklaşık %12 gibi bir payla atık içinde önemli bir yer tutmaktadırlar. Plastiği takiben cam atıkların payı %7.9 olarak belirlenirken, kağıt-karton %4.9'luk bir paya sahiptir. Metal atıklar, metalin piyasa değerinin yüksek olması sebebi ile muhtemelen sokak toplayıcıları tarafından titizlikle atıktan ayrılmakta ve depolama sahasına gelen atıkta ancak % 1.7'lik bir paya sahip olabilmektedir.

Tablo1. Akhisar ilçesi atık kompozisyonu, % dağılımı

Atık Bileşeni	Düşük Gelir	Orta Gelir	Yüksek Gelir	Çarşı	Ağırlıklı Ortalama
Biyo-bozunur	65.45	57.33	60.84	55.67	58.94
Kağıt-karton	4.06	4.71	3.65	9.91	4.88
Plastik-PET	1.08	0.80	1.01	5.09	1.31
Plastik-PE-Nylon	5.42	8.29	8.64	8.12	8.07
Plastik-diğer	1.89	2.70	2.29	4.80	2.72
Cam	7.33	9.20	6.38	5.30	7.87
Metal	0.16	1.53	0.99	1.77	1.27
Kompozit-Poşet	1.19	0.86	0.74	0.84	0.86
Kompozit-TetraPak	0.62	1.41	1.95	0.50	1.38
Tekstil	3.41	2.62	2.19	4.75	2.80
Hijyenik	6.81	4.90	9.65	2.65	6.13
Tehlikeli	0.28	2.27	1.18	0.27	1.58
Diğer yanabilirler	2.29	3.38	0.49	0.34	2.20
Toplam	100.0	100.0	100.00	100.0	100.0

Biyo-bozunur atık özellikleri

Temel olarak yiyecek artıkları, meyve sebze kabukları/köklerinden ibaret olan biyo-bozunur atıklar sahaya gelen ve kompozisyonu belirlenen atıkların ayıklanması suretiyle örneklenmiştir. Tablo 2'den de görüleceği üzere, ilçeden toplanarak sahaya gelen biyo-bozunur atıkların su içeriği %69-75 arasında bulunmuştur. Atığın organik madde içeriği de kuru maddede ortalama %68 tir. Atığın kalorifik değeri, özellikle orta ve yüksek gelir seviyelerinde oldukça yüksektir. Bu da ortalama değeri yükseltmektedir.

Tablo 2. Biyo-bozunur atık özellikleri

	Su Muhtevası, %	Organik Madde, % km	Kalorifik Değer, kcal/kg
Düşük Gelir Seviyesi	69.60	57.95	2888
Orta Gelir Seviyesi	75.44	62.76	3888
Yüksek Gelir Seviyesi	69.44	84.24	4453
Çarşı	73.31	63.98	3178
Ağırlıklı Ortalama	73.02	68.27	3899

Profil Atık Özellikleri

Sahada depolama işlemi ile 2.5 m derinliğe ulaşan yeni atık tabakasında açılan profil ile beş farklı derinlikten atık örnekleri alınmış olup, bu örneklerin genel özellikleri Tablo 3 ile sunulmuştur.

Profil örneklerinde su içeriğinin sahaya kabul edilen biyo-bozunur atığa göre daha düşük olduğu görülmektedir (%46.64). Bunun iki temel sebebi mevcuttur; bunların ilki depolanmış kütlenin üst tabakalarında yer alan atığın alt tabakaları bir miktar sıkıştırması sonucu gerçekleşen su kaybıdır. İkinci sebep ise, atığın sahaya ilk ulaştığı dönemde boşluklarında bulunan havanın içerdiği oksijen sebebi ile biyo-bozunur maddede gerçekleşen aerobik

dekompozisyon ve bunun sonucunda yükselen sıcaklık ile atık kütlesindeki suyun bir kısmının buharlaşmasıdır. Depolanmakta olan atık, Tablo 2'de analiz sonuçları sunulan biyo-bozunur atık gibi diğer atık bileşenlerinden ayıklanmış halde değildir. Bunun yanı sıra, saha toprağı ile gelişigüzel karışmış haldedir, ayrıca su muhtevasında görülen azalmanın sebeplerinden biri olan atığın sahaya ilk kabul edildiği dönemde gerçekleşen aerobik dekompozisyon da organik madde içeriğinde bir azalmaya yol açmaktadır. Bu sebeple profil atıklarında organik madde oranı ortalama %40.97 gibi hanelerden toplanan atığa göre daha düşük olarak belirlenmiştir.
Profil atıklarının kalorifik değeri de sahaya yeni ulaşan hane atıklarından örneklenen biyo-bozunur atıklar kadar yüksek bulunmamıştır. Bu durum da yukarıda belirttiğimiz sahadaki aerobik üst tabakada gerçekleşen biyokimyasal reaksiyonlar sonucu kaybedilen organik karbondan kaynaklanmaktadır.
Profil boyunca alınan metan gazı ölçümleri sahada % 0 ila %2 arasında metan gazı varlığını göstermiştir. Bu bulgular sahanın henüz anaerobik koşulları sağlayamadığını ve hatta depolanan kütleye atmosferden doğrudan veya yağışlar ile dolaylı olarak hava (oksijen) girişinin söz konusu olabileceğini göstermektedir.

Tablo 3. Profil atık özellikleri

Profil Derinliği	Su Muhtevası, %	Organik Madde, % km	Kalorifik Değer, kcal/kg
-0.50 m	25.87	14.69	1047
-1.00 m	55.01	54.14	3135
-1.50 m	51.87	53.29	2979
-2.00 m	43.90	38.73	1698
-2.50 m	56.55	43.99	2001
Ortalama	46.64	40.97	2172

Profil örneklerinde anaerobik bakteri populasyonu belirlenmiştir. Asidojenik, asetojenik ve metanojenik bakterilerin profil örneklerindeki sayım sonuçları Tablo 4 ile sunulmaktadır. Sonuçlara göre, depolama alanının en derin noktası olan yüzeyden 2,5 m derinlikte dahi henüz metanojenik bakterilerin aktivite göstermeye başlamadığı anlaşılmaktadır. Ortamda faaliyet gösteren asidojenik bakterilerin populasyonunun derinlikle azalmakta olduğu görülmektedir. Asidojenik fazda organik moleküllerin uçucu yağ asitlerine dönüşmesini takiben asetojenik faz başlamaktadır. Asetojenik bakterilerin populasyonlarının derinlikle artıyor olması olumlu olarak değerlendirilmiştir. Zira metanojenik bakterilerle asetojenik bakteriler arasında simbiyotik bir ilişki vardır (Filibeli vd., 2000). Asetojenik bakterilerin derinlikle artış göstermesi metanojenik bakterilerin sistemde faaliyete başlamaları için gerekli ortamın sağlanmaya başlandığının bir göstergesidir.

Tablo 4. Profil örneklerinde anaerobik bakteri sayısı

Profil Derinliği	Bakteri türü	EMS/100 ml
-0.50 m	Asidojenik	33
	Asetojenik	8
	Metanojenik	<1.8
-1.00 m	Asidojenik	20
	Asetojenik	10
	Metanojenik	<1.8
-1.50 m	Asidojenik	17
	Asetojenik	15
	Metanojenik	<1.8
-2.00 m	Asidojenik	13
	Asetojenik	15
	Metanojenik	<1.8
-2.50 m	Asidojenik	12
	Asetojenik	24
	Metanojenik	<1.8

Sızıntı suyu özellikleri

Sahadan alınan sızıntı suyu örneğinin pH değeri 7.35 iken, iletkenlik 47700 µS/cm gibi oldukça yüksek bir seviyede tespit edilmiştir. Sızıntı suyunda toplam katı madde seviyesi 63117 mg/l iken çözünmüş katı madde 23900 mg/l'dir. Yani sızıntı suyunun bir litresinde 63 g katı madde mevcut olup, bunun %38'lik bir kısmı çözünmüş haldedir (~24 g). Bulunan çözünmüş ve toplam katılara ait yüksek konsantrasyonların yanı sıra sızıntı suyunda BOİ (12900 mg/l) ve KOİ (34300 mg/l) değerleri de oldukça yüksektir. Suyun BOİ/KOİ oranı 0.37 olup, bu oran atıksuyun biyolojik sistemlerle arıtılabilirliğinin iyi bir göstergesi olan BOİ/KOİ >0.5 değerinden düşüktür (Genç, 2008). Bu bulgu, sızıntı suyunun geleneksel biyolojik arıtma yöntemleri ile arıtılmasının uygun olmadığını göstermektedir.

Depolama sahasının metan gazı potansiyeli

LandGEM modelinde kullanılan verilerin hesaplanması

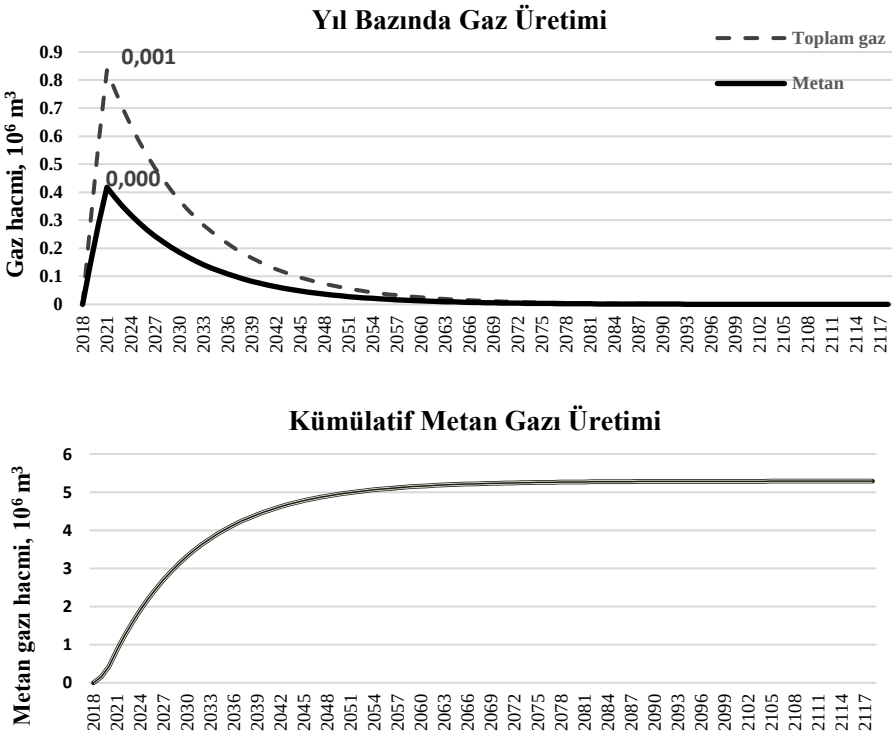
Model çalıştırılmadan önce, sahada 2018-2019-2020 döneminde depolanacak biyo-bozunur atık miktarı belirlenmiştir. Bunun için Akhisar ilçesinin son 5 yıllık nüfus verilerinden faydalanarak 2019 ve 2020 yıllarına ait nüfus projeksiyonu lineer regresyon ile hesaplanmıştır (TUİK, 2020). İl Çevre Durum Raporlarına göre, Akhisar'da kişisel atık üretim hızı, 2018 yılı için 1.08 kg/kişi.gün iken, bu değer 2015-2018 yılları için ortalama 1.1 kg/kişi.gün olarak hesaplanmış olup, düzenli bir artma veya azalma eğilimi göstermemektedir (ÇŞB, 2019). Bu sebeple 2019-2020 yılları kişisel atık üretim hızı 1.1 kg/kişi.gün olarak kabul edilmiştir. 2016 yılında Çevre ve Şehircilik Bakanlığı (mülga Çevre ve Orman Bakanlığı) tarafından yayımlanan Katı Atık Ana Planı'nda, Ege Bölgesi'nde İzmir dışındaki iller, 1c model grubuna dahil edilmiş olup, 2018 yılı için biyolojik olarak ayrışabilir atıkların oranı %58.69 olarak öngörülmüştür (ÇOB, 2006). Mevcut çalışmamızda ise hanehalkı atık kompozisyonu belirlenerek, sahaya gelen atığın %58.9 unun biyo-bozunur malzeme olduğu belirlenmiş olup, tespit edilmiş olan değer Katı Atık Ana Planı öngörüleri ile birebir örtüşmektedir. Modelde kullanılacak biyo-bozunur atık miktarı 2019-2020 yılları için %58.9 oranı kabul edilerek hesaplanmıştır. Bu durumda 2018-2020 yılları arasında sahaya toplam 206,955 ton atık gelecek olup bu miktarın 121,896 tonu biyo-bozunur atık olacaktır. Hanehalkı biyo-bozunur atık analizlerinin sonuçlarından yararlanarak modelde atığın ortalama su içeriğinin %73 olduğu kabul edilmiştir. Anaerobik bozuma hızı (k, yıl-1), atık depolanmaya başladıktan hemen sonra biyogaz üretiminin başladığı birinci derecede reaksiyondaki ayrışma hızıdır. Çalışmada k değerleri, Kanada Çevre Bakanlığı için Conestoga-Rovers & Associates (CRA) isimli kuruluş tarafından hazırlanarak yayınlanan bir yaklaşım ile, illerdeki yıllık ortalama yağış verilerine dayanarak seçilmiştir (CRA, 2009). Bunun için, Manisa iline ait son iklim periyoduna (1930-2018) göre kaydedilmiş ortalama yıllık yağış verileri kullanılmıştır [20]. Buna göre yıllık ortalama yağış yüksekliği 727.9 mm olan Manisa ili için k değeri 0.09 yıl-1 olarak kabul edilmiştir. Metan üretim potansiyeli (L_0, m^3 CH_4/ton kuru atık), birim atık kütlesinden elde edilebilecek metan potansiyelini ifade etmektedir. Bu değer, atığın kompozisyonuna ve organik madde içeriğine bağlı olarak değişim göstermektedir. Hanelerden sahaya ulaşan biyo-bozunur atıkta elde edilen ortalama organik madde oranı %68.27 (km) olarak belirlenmiştir. Organik madde kütlesinin yaklaşık olarak %40'lık bir kısmının ayrışabilir organik karbon olduğu bilinmektedir. Bu durumda, Akhisar ilçesinde üretilen bir ton kuru biyo-bozunur atığın metan üretim potansiyeli 254.8 m3 olmaktadır. Bununla birlikte, bu çalışmada LandGEM modeli ile yürütülen hesaplamalarda emniyetli tarafta kalmak amacı ile L0 değeri için CRA tarafından biyo-bozunur atıklar için önerilen 160 m3 CH4/ton kuru atık değeri kullanılmaktadır [19]. Depolama gazı içindeki ortalama metan gazı oranı, %50 olarak kabul edilmiştir (Themelis ve Ulluoa, 2007). LandGEM Modelinde kullanılan değerler Tablo 5 ile özetlenmiştir.

Tablo 5. LandGEM modelinde kullanılan değerler

	2018	**2019**	**2020**
Akhisar İlçesi Nüfusu (kişi)	171,381	172,574	174,561
Kişisel Atık Üretim Hızı, q=kg/(kişi.gün)	1.08	1.1	1.1
Kuru biyo-bozunur atık kütlesi (ton)	10,743.81	11,018.94	11,145.82
k ($yıl^{-1}$)	0.09		
L_0 (m^3 CH_4/ton kuru atık)	160		

LandGEM modeline göre düzensiz depolama sahasında oluşan metan gazının ve toplam gazın yıllar içindeki değişimi Şekil 1 ile gösterilmektedir. 100 yıllık bir öngörüde, sahaya gelen biyo-bozunur atıkların metan gazı oluşturma potansiyeli 5288383 m^3 olarak bulunmuştur. Çalışmada, mevcut sahaya ilave üç yıllık bir depolama süresi öngörüldüğü için, yıllık bazda oluşacak en fazla metan gazı miktarını 2021 yılı için 418,000 m^3 olarak gerçekleşeceği hesaplamış olup, sahadaki metan gazı potansiyelinin %80'i ilk 20 yıl içinde açığa çıkacaktır.

Akhisar evsel atık depolama sahasında oluşan metan gazının brüt enerji potansiyeli, gazın birim enerji değeri 8720 kcal/m^3 esas alınarak hesaplanmıştır(Özal ve Alamur, 2018). Sahadaki gazın toplanma verimi %40 kabul edilmiştir. Depo gazından elektrik üretimi verimi, tesislerde kullanılan teknolojilere göre %20-42 arasında değişim göstermektedir (Güven, 2019). Hesaplamalarda, metandan elektrik dönüşüm verimi %40 ve bir yılda tesisin aktif çalışacağı saati gösterir kapasite faktörü %80 kabul edilmek suretiyle net enerji potansiyelleri belirlenmiş olup, elde edilen bulgular, 2018-2020 yılları arasındaki atık depolama işlemi için hesaplanmıştır. Buna göre, bir yılda oluşacak maksimum metan gazı miktarı dikkate alındığında 2021 yılında brüt 1.694 GWh enerji üretim potansiyelinden bahsedilebilmektedir. Aynı yıl üretilen metan gazının net elektrik enerjisi karşılığı ise 96.69 KW olacaktır (Tablo 6).



Şekil 1. Akhisar düzensiz depolama sahasında yıl bazında deponi gazı üretim miktarı

Tablo 6. Depolama sahasından elde edilebilecek brüt ve net enerji potansiyeli (2019-2033)

Yıllar	Metan Gazı Üretimi, m^3/yıl	Brüt Enerji Potansiyeli-KWH/yıl	Net enerji potansiyeli KW
2019	148619.9	602774.7	34.4
2020	288254.2	1169105	66.7
2021	417625.3	1693811	96.7
2022	381680.8	1548026	88.4
2023	348830	1414790	80.8
2024	318806.6	1293020	73.8
2025	291367.3	1181732	67.5
2026	266289.7	1080021	61.6
2027	243370.4	987065.2	56.3
2028	222423.8	902109.7	51.5
2029	203280.1	824466.2	47.1
2030	185784.0	753505.4	43.0
2031	169793.8	688652	39.3
2032	155179.8	629380.6	35.9
2033	141823.7	575210.5	32.8

TEİAŞ 2011 yılında yaptığı bir araştırmada, iki çocuklu dört kişilik bir ailenin yıllık ortalama elektrik tüketimini belirlemiştir. Bu çalışma, öncelikli elektrik tüketimi ihtiyaçları olan aydınlatma, ısınma ve elektrikli aletler gibi tüketimleri dikkate alarak, bir ailenin yıllık elektrik tüketiminin 3.036 MWh olduğuna işaret etmektedir (TEİAŞ, 2018). Bu durumda, sadece üç yıl boyunca sahada depolanacak biyo-bozunur atıktan üretilecek metan gazı, diğer kurulum ve işletme giderleri gibi ekonomik giderler dikkate alınmadığında, 2021 yılında Akhisar'da 223 ailenin yıllık elektrik ihtiyacını karşılayabilecek düzeyde olacaktır.

Sonuçlar

Sunulan çalışmada, Manisa ili Akhisar ilçesinde işletilen depolama sahasına ulaşan atıkların kompozisyonu belirlenmiş, halen depolanmış halde mevcut atıkların özellikleri belirlenmiş, oluşan sızıntı suyunun karakterizasyonu değerlendirilmiş ve burada tesis edilebilecek bir biyokütle enerji üretim tesisi için sahada 2018-2020 döneminde depolanacak olan atıkların biyogaz üretim ve metan gazına bağlı olarak enerji üretim potansiyeli tespit edilmiştir. Sahaya bertaraf için getirilen atığın %59'u biyo-bozunur türde olup bu atıkların su içeriği gelir

seviyesine göre %69-75 arasında değişmektedir. Depolama sahasına gelen atığın %26'sını ise temel geri dönüşümlü malzemeler oluşturmaktadır.

Sahadaki mevcut depolanmış atık kütlesi 2.5 m olup, profil alma çalışmaları sırasında bu atık kütlesi içinde metan varlığına rastlanmamıştır. Ancak metanojenik bakteriler için gerekli yaşam koşullarını oluşturan asidojenik ve asetojenik bakterilerin mevcut olduğu ve anaerobik ortama geçişi ifade eden asetojenik bakterilerin derinlikle arttığı belirlenmiştir. Metan varlığının mevcut olmaması ve depolanan kütledeki metanojenik bakteri sayısındaki yetersizlik, atık kütlesi yüksekliğinin anaerobik koşulları sağlamak için yeterli seviyelere erişmemiş olması ile açıklanabilir. Depolamanın sürdürülmesi ile atık yüksekliğinin en az 10 m'ye çıkarılması ve ara örtülemeye ilave olarak atığın sıkıştırılması, depolama sahalarında anaerobik ortamın sağlanması ve buna bağlı olarak metan gazı üretimi açısından önemlidir.

Depolama sahasına 2018-2020 yılları arasında yaklaşık 207,000 ton atık gelecek olup, bu miktarın 33,000 tonu kuru halde biyo-bozunur malzemedir. Bu veriler ışığında depolanan atığın metan gazı potansiyeli toplamda 5,288,383 m^3 olarak bulunmuştur. LandGEM modeli ile atık kütlesi ve bölge özellikleri dikkate alınarak yapılan hesaplamalar sonucunda en fazla metan gazı üretiminin 2021 yılında 418,000 m^3 olarak gerçekleşeceği belirlenmiş olup, bu değer brüt 1.694 GWh enerji üretim potansiyeli ve net 96.69 KW elektrik enerjisine eşdeğerdir. Hesaplanan bu enerji, Akhisar Bölgesi'nde 223 ailenin yıllık elektrik ihtiyacını karşılayabilecektir.

Çalışmada izlenen bulgular, sayıları giderek azalmakla beraber, ülkemizde halen işletilmekte olan düzensiz depolama sahalarının biyogaz potansiyellerinden yararlanma yoluna gidilmesi konusunun incelemeye değer olduğu sonucunu işaret etmektedir. Görülmektedir ki bu tür kontrolsüz evsel atık depolama sahaları hızlı bir şekilde karakterize edilebilir, enerji üretim potansiyelleri belirlenebilir ve gerekli fizibilite yapılarak ekonomik yönden uygun olan sahalar için rehabilitasyon çalışmalarının projelendirildiği dönemde gaz toplama ve dönüştürme sistemleri planlanarak enerji potansiyelleri değerlendirilebilir.

Teşekkür

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Investıgatıon of the development of purslane plant (*Portulaca Oleracea L.)* under soil stress conditions

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Abstract
Purslane (*Portulaca oleracea L.*) is an edible wild plant that is widely grown in the world, including Türkiye. Purslane plant, which is an important component of Mediterranean cuisine, can grow spontaneously in nature. There are various factors that directly or indirectly affect its growth and development in the environment in which it is grown. These factors, which we call soil stress conditions, are soil organic matter content, irrigation water amount and irrigation water salinity. In the current study, pot experiments were used to determine plant growth and characterization under these conditions. This work, which was carried out within the scope of the Prima 2019 Section 2 call, project number 19N594, was carried out in the 72 m^2 greenhouse established on the Dokuz Eylül University Tınaztepe campus. From the variables, organic matter was determined as 1%, 1.8% (control), 3% and 5%. 15 purslane seeds were planted in each pot and left to germinate. Irrigation water amounts were based on field capacities and irrigation water amounts were chosen as 100%, 75%, 50%, 30%, 15%. The last variable in the application was determined as the salinity of the irrigation water, and the conductivity of the prepared irrigation water was control (tap water-about 0.5 mS/cm), 4 mS/cm, 8 mS/cm, 16 mS/cm. All pots were prepared in four repetitions and the study was carried out with a total of 320 pots. Experiments were carried out for 90 days from the first planting. In the study, it was observed that the increase in organic matter increased plant germination. As the field capacity decreased, various decreases were observed in plant growth, but this was mostly observed at 30% and 15% field capacity. The negative effects of salinity on plant growth were observed at 8 mS/cm and 16 mS/cm values.
Keywords: *Purslane, Portulaca aleracea, organic matter, drought, salinity*

Özet
Semizotu bitkisi (*Portulaca oleracea L.)* ülkemiz de dahil olmak üzere dünya üzerinde yaygın bir yetişme olan yenilebilir yabani bir bitkidir. Akdeniz mutfağının önemli bir bileşeni olan Semizotu bitkisi doğada kendiliğinden yetişebilir. Yetiştiği ortamda büyümesini, gelişmesini doğrudan veya dolaylı bir şekilde etkileyen çeşitli faktörler vardır. Toprak stres koşulları olarak adlandırdığımız bu faktörler, mevcut çalışmada toprak organik madde içeriği, sulama suyu miktarı ve sulama suyu tuzluluğudur. Bu koşullar altında bitki gelişimini ve karakterizasyonunu belirlemek amacı ile saksı deneyleri ile çalışılmıştır. Prima 2019 Section 2 çağrısı, 19N594 numaralı proje kapsamında gerçekleştirilen bu çalışma, Dokuz Eylül Üniversitesi Tınaztepe kampüsünde kurulan 72 m^2 lik serada gerçekleştirilmiştir. Değişkenlerden organik madde %1, %1.8 (kontrol), %3 ve %5 olarak belirlenerek saksılar hazırlanmış ve saksılara 15 er adet semizotu tohumu ekilerek çimlenmeye bırakılmıştır. Sulama suyu miktarları tarla kapasiteleri üzerinden gerçekleştirilmiş ve sulama suyu miktarları %100, %75, %50,% 30, %15 olarak seçilmiştir. Uygulamadaki son değişken sulama suyu tuzluluğu olarak belirlenmiş, hazırlanan sulama suları iletkenlikleri musluk suyu, 4 mS/cm, 8 mS/cm, 16 mS/cm değerlerinde olacak şekilde sulamalar yapılmıştır. Tüm saksılar dörder tekrarlı olacak şekilde hazırlanarak toplamda 320 adet saksı ile çalışma yürütülmüştür. Deneyler ilk ekimden itibaren 90 gün süreyle gerçekleştirilmiştir. Çalışmada organik madde artışının bitki çimlenmesini arttırdığı görülmüştür. Tarla kapasitesi azaldıkça bitki büyümelerinde çeşitli düşüşler görülmüş, ancak bu durum daha ziyade %30 ve%15 tarla kapasitesinde gözlemlenmiştir. Tuzluluğun bitki gelişiminde olumsuz etkisi, 8 mS/cm ve 16 mS/cm değerlerinde gözlenmiştir.
Anahtar kelimeler: *Semizotu, Portulaca aleracea, organik madde, kuraklık, tuzluluk*

Introduction

Compared to other plants, purslane contains high levels of omega-3 fatty acids, is a good source of vitamin C, is rich in B-complex vitamins such as riboflavin, niacin, pyridoxine and carotenoids It is a vegetable with important nutritional value in terms of containing important minerals such as iron, phosphorus, copper, zinc, magnesium, calcium, potassium and manganese (Açak, 2017; Dweck 2001; Turan et al., 2003). Purslane is an annual, multi-leaved, creeping herbaceous plant belonging to the family of purslane (Portulacaceae). In the gardens where vegetable farming is carried out, wild forms begin to emerge in the spring with the warming of the weather. In winter, in the cold, it dries up and dies. Although its wild forms have been known for many years, its place and importance in human nutrition has only just begun to be understood. In our country, the culture form of purslane is produced commercially in the Aegean, Marmara and Mediterranean regions, and its wild forms are mostly used in other regions. (Eşiyok, 2012; Vural et al., 2000; Yurdagül,2019). In places where it is hot and day long and if

there is a water problem, the plant quickly passes into the generative phase and blooms. With the aging of the plant, the amount of dry matter increases. Likewise, the amount of dry matter increases in plants grown from spring to summer (Convington, 2004; Günay, 2005; Uğur et al., 2014).

The growth of purslane plant under various soil stress factors has been the subject of various studies in the literature. For example, soil salinity is seen as an important environmental factor with serious adverse effects on agricultural productivity and sustainability in semi-arid regions. Salt stress during the germination stage negatively affects the osmotic balance or the ionic balance, or both (Zivkovic, 2007). Yazıcı et al., (2007) conducted research on the effects of salt stress on purslane. Purslane plants were grown in pots for two months under 65% humidity and 30/20 °C temperature conditions. At the end of two months, 0, 70 and 140 mM doses of salt were applied to the plants, and a decrease was observed in plant height after salt applications. Kılıç et al., (2008) cultivated purslane plants at salt levels of 0.65 (control), 3.5, 5.0 and 6.5 dS/m. After harvesting, it was observed that the weight and dry weight decreased due to the increase in salinity. This decrease was 8.75% in 5.0 dS/m salt application and 8.21% in 6.5 dS/m salt application. As the salt level increased, the ratio of Na and Cl increased, while the ratio of K decreased. Purslane is considered to be an economical plant to use in removing Na and Cl from the soil in arid and semi-arid land conditions due to its salt tolerance, short vegetation period and its ability to be produced several times a year. Jin et al. (2015) examined the changes in plant structure in purslane during drought stress and subsequent water application. After the drought stress, leaf samples were taken on the 5th, 10th, 15th and 22nd days and harvested. At the end of the 22nd day, the leaves were wilted and rehydrated. However, drought stress caused decreases in leaf water content and chlorophyll content.

Another soil stress factor in plant growth is soil type and organic matter content. Kocamanoğlu (2018) investigated the effects of humic acid application doses on yield and quality characteristics of purslane grown in environments prepared using different ratios of peat and perlite in the early spring season. When the growing media were evaluated in terms of yield, all mixtures containing peat gave higher yield. Cros et al., (2007) studied the variation of yield and quality in purslane grown in different environments. Peat, perlite, vermiculite, coal, peat/perlite (1:1), peat/perlite (3:1) media were used in the study, peat, peat/perlite (1:1) and peat/perlite (3:1) media were used as 14.7, respectively. , 13.6 and 14.2 cm plant height values, while perlite (6.2 cm) and coal dust (6.3 cm) media gave the lowest values. Montoya-Garcia et al. (2018) investigated the relationship between fertilization and changes in the fatty acid content and antioxidant capacity of purslane plant. Taking into account the effects of these ingredients with abiotic factors such as nitrogen, phosphorus and potassium, N, P, K fertilizations were applied and two different harvest turns (27 and 42 days) and different fertilizer doses were used. Nitrogen fertilization was investigated for the amount of total phenolic, flavonoid, β-carotene and chlorophyll at low doses, and the amount of linoleic and α-linoleic acid at high doses. P and K application increased the total phenolic and ascorbic acid content. It formed the idea that the content and antioxidant capacity of purslane plant could be controlled by fertilization adjustment.

The present study aims to investigate the development of purslane plant under different soil stress conditions. For this, different organic matter contents, different irrigation conditions and different salinity levels were tested in pot experiments, plant germination under variable conditions and plant growth at the end of the harvest were monitored.

Materials and Methods

For pot experiments, natural purslane seeds were purchased from the market and the seeds were found to have a high germination rate in preliminary trials before the current study. The soil used in the project was obtained through a local landscape firm that is in contact with the soil sellers in the Aegean Region. In addition to these, goat manure and peat were obtained from the same seller to obtain higher organic matter contents and to use in the studies. Stream sand is needed to obtain low organic matter, for this, sand produced from crushed stone was supplied from river mining facilities. These supplied materials will be mixed in different proportions to meet the desired conditions for the pot experiments.

pH, electrical conductivity, water content, organic matter content were determined in soil samples. pH and electrical conductivity values of soil samples were determined regarding TS ISO 10390 and TS ISO 11265 standards, respectively. Measurements were made with Hanna HI 2030-02 pH/EC model measuring device. Water contents of soil samples were determined gravimetrically according to TS EN ISO 11461 standard. Moreover, organic matter contents of soil samples were analyzed regarding ASTM D2974-13 standard. The field capacity of the soil mixtures were measured according to the standard gravimetric methods.

Pot experiments were carried out in plastic trial pots of 8 L volume, each containing 6 kg of soil mix. Plant growth was monitored for 3 different parameters in the experiments. Sets were created by mixing sand, peat and goat manure with the first parameter, the organic matter content of the control, 1%, 3% and 5%. The second parameter, drought, was carried out by irrigation of plant growth with field capacities of 100%, 75%, 50%, 30% and 15% after germination. The third parameter, salinity, refers to the amount of salt in the irrigation water. For this, the plants were irrigated by preparing irrigation water containing control (tap water), 4dS/m, 8dS/m, and 16 dS/m

salinity. While preparing brine, table salt was used and firstly a high salinity stock saline solution was prepared (200 dS/m), then the desired saline irrigation water was obtained by making dilutions.
The experiments were carried out in a specially designed greenhouse on the university campus (Figure 1). Seeds (15 seeds for each pot) were planted in March 2022 and the main irrigation was started at the end of the 4-week germination period. During germination, irrigation was carried out every other day, while the main irrigation was applied twice a week.
During the experiments, plant growth was carried out using calipers by taking the height and diameter measurements of the plants once a week.60 days of growth was followed and then the plants were harvested.
Pots containing all trial parameters were prepared with 4 replications and average values were taken.



a) b)

Figure 1. a) Seed preparation b) Experimental pots in the greenhouse

Results and Discussion

General characteristics of the soil, peat, goat manure and the sand are given with Table 1. There was no organic matter arrangements in the control pots and they were named as OM1.8. Considering the organic matter content, soil and sand were mixed at the rates of 43 and 57%, respectively, for the 1% OM (OM1) trial pots. For higher organic matter contents than the control pots, a goat manure/peat mixture was first prepared and a fertilizer with 50% organic matter was obtained. For 3% OM (OM3), 97.5% soil and 2.5% fertilizer were added. For the soil mixture containing 5% OM (OM5), the ratios of soil and fertilizer mixture were 93.4% and 6.6%, respectively.
The field capacities (100% FC) determined for 6 kg mixtures in soil mixtures are as follows; 980 ml for OM1, 1153 ml for OM1.8, 1250ml for OM3 and 1510 ml for OM5. In the irrigations carried out, 100 FC refers to irrigation with full field capacity, while other values express the percentage of full capacity of that value.

Table 1. General characteristics of materials used in soil mixtures

	Water content, %	***Organic matter, %***	***pH***	***EC (dS/m)***
Soil	2.61	1.80	7.72	0.167
Sand	0.09	0.32	8.03	0.067
Peat	9.98	30.95	6.17	0.404
Goat manure	9.58	73.58	7.81	3.240

The germination process within 4 weeks after sowing purslane seeds in pots was monitored. For nearly all the pots, the germination started in 4-10 days after the sowing. At the end of the 4-week germination period, the average germination rates in pots with different organic matter contents are given in Table 2. When the sprout numbers were examined in pots containing soil and river sand with 1% organic matter, it was observed that the germination number of 15 seeds planted in pots was between 0-10 in 80 pots. The final germination rate of purslane in OM1 pots was 23%. According to the number of sprouts in pots containing only soil with 1.8% organic matter, it was observed that 15 seeds planted between 0-11 in 80 pots. Accordingly, the germination rate of OM 1.8 pots was calculated as 31% at the end of 4 weeks. Germination numbers were investigated in pots containing 3% organic matter, including goat manure and peat. It was observed that the number of sprouts were between 4-14 in 80 pots of 15 seeds planted in pots. When the average of the germinating plants is taken, the germination rate of purslane in OM3 pots was calculated as 52%.Germination numbers were investigated in pots containing 5% soil, goat manure and peat. It was observed that the germination number of 15 seeds planted in pots was between 3-15 in 80 pots. When the average of the germinating plants is taken, the germination rate of purslane in OM5 pots was calculated as 66%.

Table 2. Germination ratios after 4 weeks

OM content, %	*OM1*	*OM1.8 (control)*	*OM3*	*OM5*
Germination rate, %	23	31	52	66



OM1.8 OM1 OM3 OM5

Figure 2. Young sprouts in different OM pots

The date of the study covers the months of April-May-June. High temperatures inside the greenhouse were controlled by constantly ventilating the greenhouse and covering the greenhouse ceiling with lime. The highest temperature measured is 46.8 °C, while the lowest temperature is 10 °C. Considering the humidity values, the highest 64% humidity was measured while the lowest 3% was measured. In line with the measured values, the average temperature is 29.4°C and the average humidity percentage is 25.4.

During the irrigation process, plant growth was followed as the number of thin stems, the number of thick stems, thin diameter, thick diameter, thin stem length and thick stem length. Table 3 presents the number of plants in the pots due to different conditions.

Table 3. Number of plant growths in the pots due to different conditions.

# ofplants	*OM1*	*OM1.8*	*OM3*	*OM5*
100FC	3	7	8	6
75FC	5	8	8	7
50FC	2	8	8	8
30FC	2	5	7	7
15FC	3	7	6	5
100FC/4salinity	6	4	6	7
75FC/4salinity	6	3	6	8
50FC/4salinity	4	3	6	8
30FC/4salinity	4	4	7	8
15FC/4salinity	6	2	7	8
100FC/8salinity	2	3	5	8
75FC/8salinity	5	4	8	7
50FC/8salinity	2	5	8	8
30FC/8salinity	5	3	6	7
15FC/8salinity	1	3	4	8
100FC/16salinity	3	5	7	5
75FC/16salinity	3	4	7	8
50FC/16salinity	2	4	8	8
30FC/16salinity	1	6	8	8
15FC/16salinity	1	1	7	7

Thick stem diameters in pots vary between 4-9 mm. Pots with high thick stem diameters are OM3 and OM5 pots where growth is observed more. Thin diameters in pots vary between 1-3,8 mm. When the thick stem lengths in the pots are examined, it is seen that they vary between 11-30 cm. Plant height elongation was clearly observed in all pots except OM 1.

When we look at the changes of thin stems in pots, it is seen that thin stems generally develop towards thicker diameters over time. This situation can be interpreted as the growth of thin stems by turning into thick stems and the development of the plant. However, this improvement was not seen in pots with 30% and 15% field capacity. This shows the negative impact of water scarcity on development. Similarly, there was no thickening of thin stems in pots with salinity of 8-16 mS/cm, indicating the negative effect of saline water on growth.

It is seen that the number of thick stems in the pots increases over time in the pots where the irrigation is applied with 50% TK and above and the salinity is below 4 mS/cm. 15% TK irrigation greatly reduces growth, this is more evident in OM 1 and OM 1.8 pots. Although saline irrigation was somewhat tolerated in OM3 and OM5 pots, it was determined that 16 mS/cm irrigation stopped the development. Pots with the highest number of thick stems are those in which OM3 and OM5 are watered with 75%-100% TK with unsalted wate.

Table 4. Number of slim and thick stem growths in the pots due to different conditions

	# of slimstems					*# of thickstems*			
	OM 1	OM1.8	OM3	OM 5		OM1	OM1.8	OM 3	OM 5
100FC	1	2	2	1	100FC	1	5	5	5
75FC	4	4	4	2	75FC	1	4	4	5
50FC	2	5	3	4	50FC	0	3	4	4
30FC	1	3	4	2	30FC	1	2	3	5
15FC	3	6	4	5	15FC	0	1	2	1
100FC/4salinity	6	2	2	3	100FC/4salinity	0	3	4	4
75FC/4salinity	4	1	2	3	75FC/4salinity	2	2	5	5
50FC/4salinity	4	1	2	6	50FC/4salinity	1	2	3	2
30FC/4salinity	4	2	4	5	30FC/4salinity	0	1	3	3
15FC/4salinity	6	1	6	6	15FC/4salinity	0	1	1	2
100FC/8salinity	2	1	3	5	100FC/8salinity	0	3	2	2
75FC/8salinity	5	2	6	3	75FC/8salinity	0	2	2	5
50FC/8salinity	2	1	6	5	50FC/8salinity	0	4	2	3
30FC/8salinity	5	3	5	6	30FC/8salinity	0	1	1	2
15FC/8salinity	1	3	4	7	15FC/8salinity	0	0	1	1
100FC/16salinity	2	3	5	3	100FC/16salinity	1	2	2	2
75FC/16salinity	1	4	5	7	75FC/16salinity	1	1	3	1
50FC/16salinity	1	3	6	8	50FC/16salinity	0	1	2	1
30FC/16salinity	1	5	6	7	30FC/16salinity	0	0	1	1
15FC/16salinity	1	1	6	6	15FC/16salinity	0	0	1	1

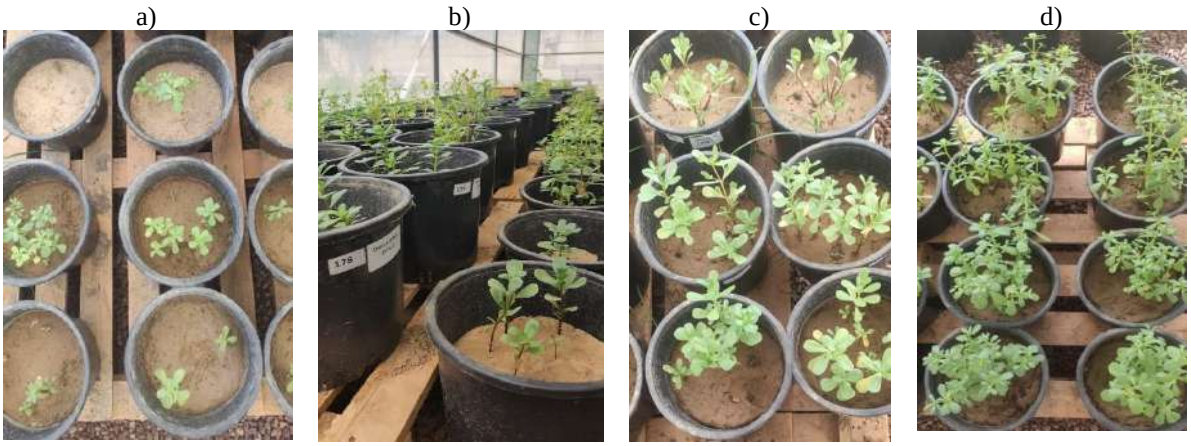

Figure 3. Plant growth under saline water irrigation a)OM1 b)OM1.8 c)OM3 d)OM5

When thin and thick stem diameters of plants are examined, it is seen that organic matter content does not have a serious effect on thin plant stems, but causes an increase in thick stem diameters. Decreased irrigation amount causes a decrease in plant diameters. Similarly, it was observed that there were significant decreases in thin and thick plant diameters as salinity increased.

In the study, the effects of different soil stress conditions on purslane plant growth were observed. At the end of the 90-day plant growing process, it was observed that the increase in organic matter was effective in plant growth in every sense from the germination stage. Considering the irrigation effect, it is seen that field capacities below 50% affect plant growth negatively. Similarly, irrigation with salt water above 4 dS/m has a negative effect on plant growth, especially on thick stem growth.

Acknowledgements

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Table 5. Stem diameters due to the changing conditions

	slimstemdiameter,mm					*thickstemdiameter,mm*			
	OM1	OM1.8	OM3	OM5		OM1	OM1.8	OM3	OM5
100FC	2.2	2.4	2.6	0.7	100FC	2.3	4.7	5.4	5.5
75FC	3.4	3.5	3.1	2.9	75FC	2.1	4.6	5.6	6.1
50FC	1.9	3.7	3.4	3.7	50FC	1.2	4.4	4.8	5.1
30FC	2.2	2.6	3.1	1.9	30FC	0.0	4.3	4.6	5.4
15FC	2.9	3.4	3.2	3.7	15FC	1.0	2.3	3.9	3.1
100FC/4salinity	3.5	3.4	2.7	3.6	100FC/4salinity	1.0	6.4	4.9	5.5
75FC/4salinity	3.1	0.9	2.7	3.2	75FC/4salinity	4.2	6.6	5.4	5.6
50FC/4salinity	3.4	1.6	2.6	3.3	50FC/4salinity	3.1	3.7	5.0	4.0
30FC/4salinity	2.8	2.9	3.6	3.0	30FC/4salinity	1.1	5.5	4.4	4.7
15FC/4salinity	2.6	2.0	3.3	3.3	15FC/4salinity	0.0	3.4	3.4	4.9
100FC/8salinity	1.8	2.2	3.3	2.7	100FC/8salinity	1.2	5.2	5.1	4.8
75FC/8salinity	3.4	2.2	3.3	2.2	75FC/8salinity	0.0	5.2	4.7	5.0
50FC/8salinity	1.7	2.4	3.4	3.3	50FC/8salinity	1.2	5.7	4.1	5.3
30FC/8salinity	2.7	3.6	2.7	3.3	30FC/8salinity	0.0	2.5	3.7	4.7
15FC/8salinity	1.5	2.9	2.5	3.4	15FC/8salinity	0.0	1.0	3.0	2.7
100FC/16salinity	0.9	3.7	3.5	2.5	100FC/16salinity	3.2	5.5	4.5	6.4
75FC/16salinity	1.3	3.6	3.6	3.5	75FC/16salinity	2.3	2.4	4.5	3.5
50FC/16salinity	1.4	3.0	3.5	3.6	50FC/16salinity	1.1	4.7	4.7	1.3
30FC/16salinity	1.9	2.4	3.5	3.5	30FC/16salinity	0.0	2.3	4.1	2.1
15FC/16salinity	0.6	1.8	3.4	3.2	15FC/16salinity	0.0	0.0	3.8	2.2

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ID: 789

The Effects of Different Organic and Inorganic Fertilizer Applications on Yield and Improvement of Maize Plant

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Abstract
In this study, it was aimed to determine the effects of organic and inorganic fertilizer applications at different rates on the yield and development of maize plant. The research was carried out in three replications in greenhouse conditions, according to the randomized plot design, in plastic pots with a capacity of three kg. Applications in research; control, conventional fertilization, gypsum (1% and 2% w/w), anhydrite (1% and 2% w/w), calcite (1% and 2% w/w), perlite (1% and 2% w/) w), vermicompost (5% and 10% w/w) and animal manure (5% and 10% w/w). Maize was used as the test plant. Maize plant was harvested approximately 60 days after planting and analysis of dry matter production and nitrogen, phosphorus, potassium, calcium, magnesium, iron, zinc, manganese and copper were made. According to the results of the research, the highest dry matter production was determined at 15.4 g pot^{-1} and 10% of the vermicompost application. This application was followed by conventional fertilizer application (13.64 g pot^{-1}). In addition, vermicompost application in general had higher values in macro and micro element concentrations of maize plant.
Key Words: *Organic, Inorganic, Maize, Yield, Nutrient Elements*

Farklı Organik ve İnorganik Gübre Uygulamalarının Mısır Bitkisinin Verimine ve Gelişimine Etkileri

Özet
Araştırmada farklı oranlarda organik ve inorganik gübre uygulamalarının mısır bitkisinin verimine ve gelişimine olan etkilerinin belirlenmesi amaçlanmıştır. Araştırma sera koşullarında üç tekerrürlü olarak tesadüf parselleri deneme desenine göre üç kg kapasiteli plastik saksılarda yürütülmüştür. Araştırmada uygulamalar; kontrol, geleneksel gübreleme, jips (%1 ve %2 w/w), anhidrit (%1 ve %2 w/w), kalsit (%1 ve %2 w/w), perlit (%1 ve %2 w/w), vermikompost (%5 ve %10 w/w) ve hayvan gübresi (%5 ve %10 w/w) şeklindedir. Test bitkisi olarak mısır kullanılmıştır. Mısır bitkisi ekimden yaklaşık 60 gün sonra hasat edilmiş ve kuru madde üretimi ile azot, fosfor, potasyum, kalsiyum, magnezyum, demir, çinko, mangan ve bakır analizleri yapılmıştır. Araştırma sonuçlarına göre, en yüksek kuru madde üretimi 15.4 g/saksı ile vermikompost uygulamasının %10'luk dozunda belirlenmiştir. Bu uygulamayı ise geleneksel gübre uygulaması takip etmiştir (13.64 g/saksı). Ayrıca mısır bitkisinin makro ve mikro element konsantrasyonlarında genel olarak vermikompost uygulaması daha yüksek değerlere sahip olmuştur.
Anahtar Kelimeler: *Organik, İnorganik, Mısır, Verim, Besin Elementi*

ID: 790

Investigation of Some Morphological Traits of Hair Goats in Under Breeder Conditions in Isparta Province

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Abstract
Our country is one of the important centers of sheep and goat breeding. The Mediterranean region, especially in our country, is one of the places where goat breeding is done intensively. The province of Isparta has an important potential in terms of goat breeding. In this study, the morphological body characteristics of hair goats bred in Isparta province, such as withers height, back height, rump height, chest width and body length, were investigated. The animal material of the study consisted of 3 farms in total, in lowland conditions, high pasture and highland conditions located in the center of Isparta province. The wither, back and rump height, 78.1 cm, 71 cm, 74.6 cm, chest width 80.5 and body length were determined as 73.5 cm, respectively, in hair goats in 3 enterprises located in the central villages of Isparta province. It will make important contributions to the literature on programs
Key Words: *Hair Goat, Morphological Traits, Body Measurements, Isparta*

Isparta İlinde Yetiştirici Koşullarındaki Kıl Keçilerinin Morfolojik Özellikleri

Özet
Ülkemiz küçükbaş hayvan yetiştiriciliğinde önemli merkezlerdendir. Akdeniz bölgesi özellikle ülkemiz keçi yetiştiriciliğinin yoğun olarak yapıldığı yerlerin başında gelmektedir. Isparta ili keçi yetiştiriciliği bakımından önemli bir potansiyele sahiptir. Bu araştırmada Isparta ilinde yetiştiriciliği yapılan kıl keçilerin morfolojik vücut özelliklerinden olan cidago yüksekliği, sırt yüksekliği, sağrı yüksekliği, göğüs genişliği ve vücut uzunluğu incelenmiştir.
Çalışmanın hayvan materyalini Isparta ilinde merkezinde bulunan ova koşulları yüksek mera ve yayla koşullarında olmak üzere toplam 3 işletmede bulunun 45 baş kıl keçisi oluşturmuştur. Yapılan incelemelerde sırasıyla cidago, sırt ve sağrı yüksekliği, 78,1 cm, 71 cm, 74,6 cm göğüs genişliği 80,5 ve vücut uzunluğu 73,5 cm olarak belirlenmiştir. Elde edilen bilgiler yetiştirme ve ıslah programları ile ilgili literatüre önemli katkılar sağlayacaktır.
Anahtar Kelimeler: *Kıl keçisi, Morfolojik özellikler, vücut özellikleri, Isparta*

ID: 791

Investigation of the Changes In Rheological Properties of Purple Basil Sherbet Samples Concentrated By Ohmic Heating At Different Voltage Gradient

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Abstract
Purple basil is widely used medicinally and aromatically due to its essential oil properties, and it is a plant that stands out with its antibacterial, antimutagenic and antioxidant properties. It has been determined that purple basil has positive effects on health such as appetizing, insomnia, sputum, diuretical and antispasmodic. Purple basil contains high concentrations of anthocyanins and with these properties it stands out as a potential new source of stable red pigments for the food industry. In recent years, it has been seen that purple basil has been processed into different products such as tea and sherbet in order to benefit from its functional properties. With the processing of purple basil into different products, it is seen that the consumption of basil and basil products has increased by consumers. In this study, purple basil sherbet samples were concentrated at different voltage gradient values (14, 17 and 20 V/cm) under atmospheric conditions with ohmic heating up to 25% soluble solid content (SSC) and the changes in their rheological properties during the concentration process was investigated. The changes in the rheological properties of the purple basil samples were determined in the range of 1-148 s^{-1} shear rate values and measurement temperature was 25°C. The compatibility of different rheological models (Newton, Power-Law and Herschel-Bulkley) to the experimental data was statistically evaluated to determine the flow behavior index of the purple basil sherbet samples. It has been determined that the shear stress values increased as the shear rate values increased in all the process conditions. Similarly, at the same shear rate values, it was determined that the shear stress values increased as the SSC values increased. It has been determined that the best suitable rheological model was Herschel-Bulkley Model for all purple basil sherbet concentrates. It is thought that the results obtained will provide important data to the food and machinery industry for the installation of pilot and industrial scale ohmic heating systems.
Key Words: *Ohmic heating, evaporation, purple basil sherbet, rheology*

Farklı Voltaj Gradyanı Kullanılarak Ohmik Isıtma İle Konsantre Edilen Mor Reyhan Şerbeti Örneklerinin Reolojik Özelliklerindeki Değişimlerin İncelenmesi

Özet
Reyhan (mor fesleğen), uçucu yağ özelliğinden dolayı tıbbi ve aromatik olarak yaygın olarak kullanılan, antibakteriyel, antimutajenik ve antioksidan özellikleri ile öne çıkan bir bitkidir. Reyhan iştah açıcı, uykusuzluk, balgam, idrar söktürücü ve spazm giderici gibi sağlık üzerinde olumlu etkileri olduğu tespit edilmiştir. Reyhan yüksek konsantrasyonlarda antosiyanin içermekte ve bu özellikleri ile gıda endüstrisi için potansiyel bir stabil kırmızı pigment kaynağı olarak öne çıkmaktadır. Son yıllarda reyhanın sahip olduğu fonksiyonel özelliklerinden yararlanmak için işlenerek çay ve şerbet gibi farklı ürünlere dönüştürüldüğü görülmektedir. Reyhanın farklı ürünlere dönüştürülmesiyle birlikte tüketiciler tarafından reyhan ve reyhan ürünlerinin tüketiminin arttığı görülmektedir. Bu çalışmada, reyhan şerbeti örnekleri, %25 suda çözünür kuru madde içeriğine (SÇKM) kadar ohmik ısıtma ile atmosferik koşullar altında farklı voltaj gradyanı değerlerinde (14, 17 ve 20 V/cm) konsantre edilmiş ve konsantrasyon işlemi sırasında reolojik özelliklerinde meydana gelen değişimler incelenmiştir. Reyhan örneklerinin reolojik özelliklerindeki değişimler 1-148 s^{-1} kayma hızı değerleri aralığında, 25°C ölçüm sıcaklığı gerçekleştirilmiştir. Reyhan şerbeti örneklerinin akış davranış özelliklerini belirlemek amacıyla farklı reolojik modellerin (Newton, Power-Law ve Herschel-Bulkley) deneysel verilere uygunluğu istatistiksel olarak değerlendirilmiştir. Tüm konsantrasyon işlemi koşullarında kayma hızı değerleri arttıkça kayma gerilimi değerlerinin artış gösterdiği tespit edilmiştir. Benzer şekilde aynı kayma hızı değerlerinde, SÇKM değerleri arttıkça kayma gerilimi değerlerinin de artış gösterdiği tespit edilmiştir. Tüm reyhan şerbeti konsantreleri için en uygun reolojik modelin Herschel-Bulkley Modeli olduğu belirlenmiştir. Elde edilen sonuçların pilot ve endüstriyel ölçekli ohmik ısıtma sistemlerinin kurulumu için gıda ve makine sektörüne önemli veri sağlayacağı düşünülmektedir.
Anahtar Kelimeler: *Ohmik ısıtma, evaporasyon, reyhan şerbeti, reoloji*

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Global Epidemic and Its Effects on Livestock

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Abstract

In this study, the effects of the COVID-19 pandemic process on farm animals in our country were evaluated. The situation in our country has been revealed by examining the available resources on this subject. In addition, information on the characteristics of the COVID-19 agent and the differences between animal species was given, and the production of cattle, sheep, poultry and bee products was examined by examining the number of farm animals. The Covid-19 outbreak has revealed the importance of the food and livestock industry. The continuation of production in the livestock sector prevented a possible food crisis. The Covid 19 epidemic has had some effects on livestock in our country, and there has been an increase in costs along with the global markets. Unfortunately, the increase in costs still continues and puts the producer in a difficult situation.

This study has been prepared to contribute to the literature by compiling data on the effects of COVID-19 in the livestock sector and animals.

Keywords: Pandemic, Covid-19, livestock sector, Impact.

Küresel Salgın ve Hayvancılık Üzerine Etkileri

Özet

Bu çalışmada, yurdumuzda pandemi sürecinin çiftlik hayvanları üzerine olan etkileri değerlendirilmiştir. Bu konu ile ilgili ulaşılabilen kaynaklar incelenerek yurdumuzdaki durum ortaya konulmuştur. Ayrıca, COVID-19 etkeninin özelliği ile hayvan türleri arasındaki farklılıklara ait bilgiler verilmiş ve çiftlik hayvanları sayıları incelenerek büyükbaş, küçükbaş, kanatlı ve arı ürünleri üretimleri incelenmiştir. Covid-19 salgını gıda ve hayvancılık sektörünün önemini ortaya çıkarmıştır. Hayvancılık sektöründe üretimin devam etmesi olası gıda krizini önlemiştir. Covid 19 salgını ülkemizde hayvancılık üzerinde bazı etkiler yaratmıştır ve küresel piyasalarla birlikte maliyetlerde artış olmuştur. Ne yazık ki maliyetlerdeki artış halen devam etmekte ve üreticiyi zor duruma sokmaktadır. Bu çalışma COVID-19'un hayvancılık sektöründe ve hayvanlarda görülen etkileri ile ilgili veriler derlenerek literatüre katkı sağlamak üzere hazırlanmıştır.

Anahtar Kelimeler: Pandemi, Covıd-19, hayvancılık sektörü, Etki

ID: 793

Geographical Indication Ayran and Yogurts of Türkiye

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Abstract
Geographical Indication (GI) registration is very important in distinguishing traditional foods from their counterparts and protecting them against unfair competition, ensuring continuity in quality and production conditions, increasing their value and branding. GI's are registered as Protected Designation of Origin (PDO: all features of the product must be specific to the known geographical area) or Protected Geographical Indication (PGI: at least one feature of the product must be specific to a known geographic region). In Türkiye as of September 2022, 55 dairy products (34 cheese, 9 yogurt, 2 ayran, 4 kaymak, 2 butter, 2 ice cream, 2 keş) have been protected by the GI registration certificate. Among these, yogurt and ayran are our important fermented milk products spread all over the world from Central Asia. The production of these products, which have an important place in Turkish culture, is basically based on the fermentation of milk (such as cow, buffalo, sheep and goat milk), specifically with cultures of *Streptococcus thermophilus* and *Lactobacillus bulgaricus*. As of September 2022, 9 yogurt (3 PDO, 6 PGI) and 2 ayran (PGI) have been registered by the Turkish Patent and Trademark Office (TÜRKPATENT). **PDO:** Çaycuma Buffalo Yogurt (2020), Afyon Buffalo Yogurt (2021), and Eşmekaya Yogurt (2021). **PGI:** Antakya Salted Yogurt (2020), Emirdağ Sheep Yogurt (2021), Mamak Ravak Yogurt (2021), Ereğli Sheep Yogurt (2021), Silifke Yogurt (2022), Silivri Yogurt (2022), Susurluk Ayran (2017) and Malatya Pirpirim (Purslane) Hot Ayran (2022). 8 yogurt (2 PDO, 4 PGI and 2 TSG/Traditional Speciality Guaranteed) for which GI and TSG applications have been made, are under evaluation by TÜRKPATENT. There is no application for ayran. In this study, information (registration certificate mainly) about ayran and yoghurts registered with GI in our country is given.
Key Words: *Geographical Indication, PDO, PGI, Yogurt, Ayran*

Türkiye'nin Coğrafi İşaretli Ayran ve Yoğurtları

Özet
Geleneksel gıdaların; benzerlerinden ayrılması ve haksız rekabete karşı korunması, kalitesi ve üretim koşullarında sürekliliğin sağlanması, değerinin artırılması ve markalaşmasında Coğrafi İşaret (Cİ) tescilinin payı oldukça önemlidir. Coğrafi İşaret (Cİ)'ler menşe adı (Protected Designation of Origin, PDO: ürünün tüm özellikleri bilinen coğrafi bölgeye özgü olmalı) ya da mahreç işareti (Protected Geographical Indication, PGI: ürünün en az bir özelliği bilinen coğrafi bölgeye özgü olmalı) olarak tescillenmektedir. Türkiye'de Eylül 2022 itibariyle 55 adet süt ürünü (34 adet peynir, 9 adet yoğurt, 2 adet ayran, 4 adet kaymak, 2 adet tereyağı, 2 adet dondurma, 2 adet keş) Cİ almıştır. Bunlar içerisinde, yoğurt ve ayran Orta Asya'dan tüm dünyaya yayılmış önemli fermente süt ürünlerimizdir. Türk kültüründe önemli bir yere sahip olan bu ürünlerin üretimi temelde sütün (inek, manda, koyun ve keçi sütü gibi), spesifik olarak *Streptococcus thermophilus* ve *Lactobacillus bulgaricus* kültürleri ile fermantasyonuna dayanmaktadır. Eylül 2022 itibariyle 9 adet yoğurt (3'ü Menşe, 6'sı Mahreç) ve 2 adet ayran (Mahreç) Türk Patent ve Marka Kurumu (TÜRKPATENT) tarafından tescillenmiştir. **Menşe işaretliler:** Çaycuma Manda Yoğurdu (2020), Afyon Manda Yoğurdu (2021) ve Eşmekaya Yoğurdu (2021). **Mahreç işaretliler:** Antakya Tuzlu Yoğurt (2020), Emirdağ Koyun Yoğurdu (2021), Mamak Ravak Yoğurdu (2021), Ereğli Koyun Yoğurdu (2021), Silifke Yoğurdu (2022), Silivri Yoğurdu (2022), Susurluk Ayranı (2017) ve Malatya Pirpirimli (Semizotu) Acılı Ayran (2022). Cİ ve geleneksel ürün adı başvurusu yapılmış 8 adet yoğurt da (2 Menşe, 4 Mahreç ve 2 geleneksel ürün adı) TÜRKPATENT tarafından değerlendirme aşamasındadır. Ayran için başvuru bulunmamaktadır. Bu çalışmada, ülkemizde Cİ tescili almış ayran ve yoğurtlar hakkında bilgiler (tescil belgesi ağırlıklı) verilmiştir.
Anahtar Kelimeler: *Coğrafi İşaret, Menşe, Mahreç, Yoğurt, Ayran*

1.Giriş

"Sınai Mülkiyet Kanunu" kapsamında Menşe adı (ürünün tüm özellikleri bilinen coğrafi bölgeye özgü olmalı) veya Mahreç işareti (ürünün en az bir özelliği bilinen coğrafi bölgeye özgü olmalı) olarak tescillenen Coğrafi İşaretler (Cİ), geçmişi eskiye dayanan ve karakteristik özelliklerinden dolayı bir coğrafyaya ait ürünlerin orijinini gösteren işarettir. Geleneksel ürün adı ise Cİ olmayıp, en az 30 yıldır üretimi yapılan ürünlerin bileşim veya geleneksel üretim yöntemini koruyan bir sistemidir (Mevzuat, 2016; Tekelioğlu, 2019). Cİ ürünlerin orijini ve üretim yöntemini korumayıp üretici çıkarlarını da korumaktadır.

Türkiye, dünyanın Cİ potansiyeli çok yüksek nadir ülkelerinden birisidir (Tekelioğlu, 2019; Çakmakçı ve Salık, 2021). Eylül 2022 itibariyle 1217 adet ürün Cİ tescil belgesi ile koruma altına alınmıştır. Türk Patent ve Marka

Kurumu (TÜRKPATENT) tarafından değerlendirilmesi için 681 adet ürün de başvurusu yapılmıştır. TÜRKPATENT'in verilerine göre, tescilli Cİ'lerin ürün gruplarına göre dağılımında gıda ürünleri 1011 adet tescille %83'lük payı oluştururken, el sanatları ve diğerleri 206 adet tescille %17'lik payı oluşturmaktadır. Süt ürünleri [(55 adet: 34 peynir, 2 tereyağı, 4 kaymak, 9 yoğurt, 2 dondurma, 2 ayran ve 2 keş] ise gıda ürünleri içerisindeki payın %5.4'ünü oluşturmaktadır. Bunlar içerisinde ise yoğurdun (%16) ve ayranın (%3.6) payı peynire (%61.8) göre oldukça azdır (TÜRKPATENT, 2022).
Bu çalışmada; Cİ kavramına değinerek, Türkiye'de Cİ almış ayran ve yoğurtlar derlenerek (tescil belgesi ağırlıklı bilgilerle) ürünlerin tanımları, özgünlükleri, karakteristik ve kalite özellikleri ile ilgili özet bilgiler verilmiş, tanınırlıklarına katkı yapmak amaçlanmıştır.

2. Ci Tescili Almış Ayran ve Yoğurtlar

İlk olarak Türkler tarafından Orta Asya'da keşfedilen ve oradan tüm dünyaya yayılan yoğurt ve bir yoğurt içeceği olan ayran (Chandan *et al*., 2017), günümüzde süte (inek sütü başta olmak üzere manda, koyun ve keçi sütü) spesifik olarak *Streptococcus thermophilus* ve *Lactobacillus bulgaricus* kültürleri ilave edilerek üretilen önemli Türkiye'nin önemli fermente süt ürünleridir (Tamime and Deeth, 1980; Fazilah *et al*., 2018).
Dünya çapında yaygın tüketim potansiyeli olan yoğurt ve ayran geleneksel ve endüstriyel olarak üretilmektedir. Besin maddesi içeriği süte en benzer süt ürünü olan yoğurt; biyolojik değeri yüksek protein, B_2, B_6, B_{12} vitaminleri ile kalsiyumun mükemmel bir kaynağıdır (Fazilah *et al*., 2018). Yoğurt, kalsiyum biyoyararlınımı artırması ve laktoz intoleransına olumlu etkisi nedeniyle de önemlidir (Ghasempour *et al*., 2020). Yapılan araştırmalarda; yoğurt tüketiminin bağışıklık sistemini güçlendirdiği, kabızlığı azalttığı, kolon kanseri ve inflamatuar bağırsak hastalıklarını azalttığı, laktoz sindirimini kolaylaştırdığı ve kan şekerini dengelemede faydalı olduğu şeklinde çok sayıda terapötik etkiler sağladığı bildirilmektedir (Amadarshanie *et al*., 2022).
Ayran, Türkiye'de özellikle yaz aylarında yaygın olarak tüketilen yoğurt içeceğidir. Ayran geleneksel olarak yoğurdun belirli oranda su ile seyreltilmesi ve tuz ile karıştırılmasıyla hazırlamaktadır (Köksoy and Kılıç, 2004). Yoğurda benzer olarak ayran da, kalsiyum, fosfor, magnezyum ve potasyum mineralleri ile B_2, B_{12}, A, D ve K vitaminleri bakımından iyi bir kaynaktır (Ötleş and Nakilcioğlu Taş, 2019).
Ülkemiz genelinde TÜRKPATENT tarafından 2 adet ayran (Susurluk Ayranı ve Malatya Pirpirimli (Semizotu) Acılı Ayran) ve 9 adet yoğurt (Çaycuma Manda Yoğurdu, Afyon Manda Yoğurdu, Eşmekaya Yoğurdu, Antakya Tuzlu Yoğurt, Emirdağ Koyun Yoğurdu, Mamak Ravak Yoğurdu, Ereğli Koyun Yoğurdu, Silifke Yoğurdu ve Silivri Yoğurdu) Cİ tescili almıştır. Cİ ile koruma altına alınmış ayran ve yoğurtların tescil belgelerinde bildirilen bazı bilgiler Tablo 1'de, bu ürünlere ait fotoğraflar ise Şekil 1'de verilmiştir. Ayrıca, TÜRKPATENT tarafından değerlendirilmek üzere 8 adet yoğurt için de başvuru yapılmıştır.

Tablo 1. Türkiye'de Cİ almış ayran ve yoğurtların tescil belgelerinde belirtilen bazı bilgiler

Cİ Adı	Tescil Tarihi	Başvuru Sahibi	Cİ Türü	Coğrafi Sınır	Kullanım Biçimi	R*
Susurluk Ayranı	20.11.2017	Susurluk Ticaret Odası	Mahreç	Balıkesir ili Susurluk	Markalama	1
Malatya Pirpirimli (Semizotu) Acılı Ayran	11.04.2022	Battalgazi Belediyesi	Mahreç	Malatya ili	Markalama	2
Antakya Tuzlu Yoğurt	10.09.2020	Antakya Ticaret ve Sanayi Odası	Mahreç	Hatay ili	Markalama	3
Çaycuma Manda Yoğurdu	08.05.2020	Çaycuma Ticaret ve Sanayi Odası	Menşe	Çaycuma ilçesi	Markalama	4
Afyon Manda Yoğurdu	27.07.2021	Afyonkarahisar Ticaret ve Sanayi Odası	Menşe	Afyonkarahisar ili	Markalama	5
Eşmekaya Yoğurdu	25.05.2021	Aksaray Ticaret Borsası	Menşe	Aksaray ili Eskil ilçesi Eşmekaya kasabası	Markalama	6
Emirdağ Koyun Yoğurdu	06.09.2021	Emirdağ Belediyesi	Mahreç	Afyonkarahisar ili Emirdağ ilçesi	Markalama	7
Mamak Ravak Yoğurdu	06.08.2021	Mamak Belediyesi	Mahreç	Ankara ili Mamak ilçesi	Markalama	8
Ereğli Koyun Yoğurdu	12.07.2021	Konya Ereğli Belediyesi	Mahreç	Konya ili Ereğli ilçesi	Markalama	9
Silifke Yoğurdu	07.02.2022	Silifke Ticaret ve Sanayi Odası	Mahreç	Mersin ili Silifke ilçesi	Markalama	10
Silivri Yoğurdu	26.07.2022	Silivri Belediyesi	Mahreç	İstanbul ili Silivri ilçesi	Markalama	11

Markalama; üreticilerin marka ile birlikte Cİ'yi ürünlerinin üzerinde kullanmalarıdır. **R*:** Referanslar. **1:** TÜRKPATENT (2017), **2:** TÜRKPATENT (2022a), **3:** TÜRKPATENT (2020a), **4:** TÜRKPATENT (2020b), **5:** TÜRKPATENT (2021a), **6:** TÜRKPATENT (2021b), **7:** TÜRKPATENT (2021c), **8:** TÜRKPATENT (2021d), **9:** TÜRKPATENT (2021e), **10:** TÜRKPATENT (2022b), **11:** TÜRKPATENT (2022c).

2.1. Susurluk Ayranı

Susurluk Ayranı, Balıkesir'in Susurluk ilçesine özgü teknikle ve tadı klasik ayrana göre farklılık gösteren yöresel bir içecektir. Susurluk Ayranı'nın üretiminde; tam yağlı (%en az %3.8) ve kurumadde oranı artırılmış (en az %13) tam yağlı inek sütünden yapılan yoğurt (10 kg), bir miktar su (8-9 L) ve tuz (2 yemek kaşığı) ile karıştırıldıktan sonra insan gücü veya makine yardımı ile istenen kıvama gelinceye kadar karıştırılıp köpürtülür. Hazırlanan ayran, bidonlara aktarılarak buzdolabında (0 ile 4°C'de) muhafaza edilir ve sunum öncesinde en az 5 dakika karıştırılarak servis edilir. Böylece Susurluk Ayranı'na has köpüğün sürekliliği sağlanmış olmaktadır. Bu ayranın en önemli ayırt edici özellikleri; köpüklü olması, az tuzlu olması ve üretiminde hiçbir katkının kullanılmamasıdır. Türkiyee genelinde bir ün yakalamış Susurluk Ayranı (Şekil 1-1) adına her yıl, "Susurluk Ayran Festivali" düzenlenmektedir (TÜRKPATENT, 2017).

2.2. Malatya Pirpirimli (Semizotu) Acılı Ayran

Malatya Pirpirimli Acılı Ayran; yoğurt/süzme yoğurt, pirpirim (semizotu), acı kırmızıbiber, su ve tuz kullanılarak üretilen bir ayrandır. Coğrafi sınırda "yandım çavuş ayranı" olarak da bilinen Pirpirimli Acılı Ayran (Şekil 1-2) Malatya ilinin mutfak kültüründe önemli yere sahiptir. Pirpirimli Acılı Ayran'ın üretiminde; yoğurt (2 kg)/süzme yoğurt (800 g), 1 demet pirpirim (bölge sınırları içerisinde yetişmiş olmalı ve isteğe bağlı olarak çiğ veya haşlanmış kullanılabilir), acı kırmızıbiber (300 g), su (1 L) ve tuz (isteğe bağlı) karıştırılarak toprak küplere aktarılır ve 4°C'de 15-18 gün süreyle fermente edilir. Hazırlanan ayran 4°C'de muhafaza edilir ve servisi bakır kupalarda yapılır (TÜRKPATENT, 2022a).

2.3. Antakya Tuzlu Yoğurt

Antakya Tuzlu Yoğurdu; inek veya keçi sütlerinden üretilen yoğurdun süzülmesi, kazanlarda pişirilmesi ve tuz ilavesi ile üretilen bir yoğurt çeşididir. Geleneksel üretimde, Antakya Tuzlu Yoğurdu (Şekil 1), ekşi ve tuzlu tadı dışında, odun ateşinde pişirilmesinden dolayı hafif tütsülenmiş tat ve koku ile pişmiş tada sahiptir. Endüstriyel olarak da üretilebilen yoğurtta tütsülenmiş tat ve koku bulunmamaktadır. Bu yoğurdun rengi, üretiminde kullanılan sütün çeşidine ve uygulanan ısıl işleme bağlı olarak beyaz-krem renk aralığında değişmektedir. Yoğurt, pürüzlü ve dil üzerinde pütürlü bir yapı hissi bırakan, sürülebilir kıvamda bir üründür. Antakya Tuzlu Yoğurdunun üretim aşamaları sırasıyla; sütün yoğurda işlenmesi, yoğurdun süzülmesi, yoğurdun pişirilmesi, yoğurt belli bir kıvama geldiğinde tuz ilave edilmesi (%2-5), geniş leğenlerde soğutulması ve ambalajlanması (bu aşamada genellikle yoğurdun üzerine zeytinyağı dökülerek hava ile temas kesilir) şeklindedir. Elde edilen yoğurt 4°C'de en az 6 ay kadar muhafaza edilebilmektedir. Ürün hem geleneksel hem de endüstriyel olarak üretimektedir. Geleneksel yöntemle üretilen tuzlu yoğurtların ambalajında "geleneksel üretim", endüstriyel yöntemle üretilen tuzlu yoğurtların ambalajında "endüstriyel üretim" ifadesi yer alır (TÜRKPATENT, 2020a).

Antakya Tuzlu Yoğurdu'nun bazı fiziksel ve kimyasal özellikleri: kurumadde en az %22.5, asitlik (laktik asit cincinden) %2.7, kurumaddede (KM) protein en az %34.8, KM'de yağ en az %29.3 ve KM'de tuz en çok %17.7'dir. Antakya Tuzlu Yoğurdu'nda 50'den fazla (30 kadarı aroma aktiftir) uçucu bileşik bulunmakta; etilbutanoat, metiyonal, etanoik, butanoik ve hekzanoik asit ile Maillard reaksiyonu ürünleri (asetofenon, asetoaseton, 2-furankarboksaldehit, 5-metilfurfuraldehit ve 5-hidroksimetilfurfural) ana bileşikleri oluşturmaktadır (TÜRKPATENT, 2020a).

2.4. Çaycuma Manda Yoğurdu

Çaycuma Manda Yoğurdu, Çaycuma (Zonguldak) meralarında otlayan Anadolu manda ırkının sütlerinden ticari veya geleneksel maya kullanılarak üretilen bir yoğurt çeşididir. Çaycuma Manda Yoğurdu'nun üretiminde; manda sütü kaynatıldıktan (15-20 dakika) sonra 39-40°C'de 4 saat kadar mayalandıktan sonra soğutularak buzdolabında muhafaza edilir. Yoğurdun üretiminde kullanılan manda sütünün bileşimi; kurumadde %16-18, yağ %6-8, protein %4.2-4.6, laktoz 4.2-5.0, kül %0.7-0.9, özgül ağırlık 1.027-1.040 ve pH 6.1-6.56'dır. Kurumadde oranı yüksek olan manda sütünden üretilen Çaycuma Manda Yoğurdu'nun (Şekil 1-4) bazı fiziksel ve kimyasal özellikleri: kurumadde %14-20, yağ %2-8, protein %4-8, laktoz %2-5, kül %0.8-1.2 ve asitlik %0.9'dur (TÜRKPATENT, 2020b).

2.5 Afyon Manda Yoğurdu

Afyon Manda Yoğurdu; manda kaymağı üretiminden geriye kalan kaymakaltı sütünden üretilen bir yoğurt çeşididir. Bölgede manda sütü (Anadolu mandası olarak bilinen yerli ırklardan elde edilen) genellikle kaymak üretiminde kullanıldığı için kaymakaltı sütleri yoğurda işlenerek değerlendirilmektedir. Afyon manda yoğurdu; porselen beyazı renkte, kendine has tat ve kokuya sahip, sıkı ve kıvamlı yapıda bir yoğurttur. Yoğurt genellikle küçük ölçekli işletmelerde üretilmekle birlikte, endüstriyel olarak büyük ölçekli üretimleri de yapılmaktadır. Afyon Manda Yoğurdu'nun üretiminde; yağ oranı %3'e ayarlanmış kaymakaltı manda sütü; homojenizasyon (isteğe bağlı), ısıl işlem (90-95°C'de 5-10 dakika) ve soğutma (40-45°C'de) işlemlerinin ardından starter kültür inokülasyonuyla (%1-2) 42-45°C'de 3-5 saat mayalanır. Mayalama sonunda soğutularak buzdolabında (4-6°C) muhafaza edilir. Bu yoğurdun raf ömrü, üretiminden sonra buzdolabı koşullarında en fazla 20 gündür. Afyon

Manda Yoğurdu'nun özellikleri: pH 4.2-4.9, asitlik %0.6-1.5, yağ en az %3 ve protein en az %5'dir (TÜRKPATENT, 2021a).

2.6. Eşmekaya Yoğurdu

Eşmekaya Yoğurdu (Şekil 1-5), Eşmekaya kasabasının zengin ve endemik bitki (gökbaş, yağlıca, pıtırak, tilki kuyruğu, güvenik, yabani buğday, kangal sitili, yavşan otu, keme otu, yabani yonca, tosbağa otu, üzerlik, keçi biciği gibi) örtüsüyle beslenen koyunlardan elde edilen sütten geleneksel maya (yoğurdun kendisi) kullanılarak üretilen koyu kıvamlı bir yoğurttur. İki kez süzülen koyun sütü kaynatıldıktan sonra 36-38°C'de 2.5-3 saat oda sıcaklığında bekletilerek mayalanır. Mayalama işlemini takiben yoğurtlar soğutularak buzdolabında muhafaza edilir. Eşmekaya Yoğurdu'nun protein oranı %6.2 ve yağ oranı %8,5'dir (TÜRKPATENT, 2021b).

2.7. Emirdağ Koyun Yoğurdu

Emirdağ Koyun Yoğurdu; Afyonkarahisar ilinin Emirdağ ilçesindeki yaylalarda otlayan koyunların sütünden geleneksel maya (yoğurtun kendisi) kullanılarak üretilen, yağ oranı yüksek, beyazımsı-kremsi renkte, kıvamlı bir yoğurttur. Yoğurdun üst kısmında, sarımsı bir kaymak tabakası bulunur. Emirdağ Koyun Yoğurdu'nun üretiminde; süzülen koyun sütü kısık ateşte kaynatıldıktan (8-10 dakika) sonra kış mevsiminde 50-55°C, yaz mevsiminde 40-45°C'de 5-6 saat mayalanır (%2 maya ilavesi). Emirdağ Koyun Yoğurdu (Şekil 1-7), tercihen bakraç/helke olmak üzere gıda ile temasa uygun kaplarda ve en az 4 °C'de muhafaza edilir. Emirdağ Koyun Yoğurdu'nun kurumadde miktarı %15-19, yağ miktarı %6-8.5, protein miktarı %5.5-7.5 ve karbonhidrat miktarı %3.5-6.5'dir (TÜRKPATENT, 2021c).

2.8. Mamak Ravak Yoğurdu

Mamak Ravak Yoğurdu, Ankara ili Mamak ilçesinden temin edilen inek sütünden "ravak mayası" olarak bilinen geleneksel maya ile bölgeye özgü yöntemle üretilen bir yoğurttur. Bu yoğurt; porselen beyazı renginde, kendine özgü tat ve kokuya sahip, sıkı ve kıvamlı yapıdadır. Ravak mayasının üretiminde; inek sütünden seperatör yardımı ile ayrılmış krema, pastörizasyon işleminden sonra gıda mevzuatına uygun starter kültür ile mayalanır. Böylece, ravak mayası olarak bilinen yoğurt mayası elde edilir. Mamak Ravak Yoğurdu (Şekil 1-8) inek sütünden kremanın alınması sonucunda kaymakaltı sütü; kaynatma ve soğutma işlemlerinin ardından ravak mayası inokülasyonuyla (%2) birlikte 45°C'de 4-5 saat mayalanır. Mayalama sonunda yoğurtlar soğutularak buzdolabında (4-6°C) muhafaza edilir (TÜRKPATENT, 2021d).

2.9. Ereğli Koyun Yoğurdu

Ereğli Koyun Yoğurdu, Konya ili Ereğli ilçesinde beslenen koyunların sütünden geleneksel ve endüstriyel yöntemlerle üretilen, yanıksı tat ve aromaya sahip bir çeşittir. Bu yoğurdun üretiminde, koyun sütü 90°C'de 20-30 dakika kaynatıldıktan sonra soğutularak 40-45°C'de 2-3 saat mayalanır (%2 maya ilavesiyle). Mayalama sonrasında yoğurt 0-6°C'de muhafaza edilir. Sütün pişirilmesi sırasında yoğurda özgü yanıksı tat kazandırılır. Ereğli Koyun Yoğurdu (Şekil 1-9) %15-25 kurumadde, %1-2 asitlik, %6-13 yağ ve %5-10 protein içermektedir (TÜRKPATENT, 2021e).

2.10. Silifke Yoğurdu

Silifke Yoğurdu; esas olarak kıl keçisinden elde edilen sütten üretilen ancak keçi sütünün azaldığı dönemlerde %80 inek sütü + %20 keçi sütü karışımından da üretilebilen, toprak kaplarda veya çingillerde (bakraç veya helke olarak da bilinmekte) mayalanan bir yoğurt çeşididir. Silifke Yoğurdu yüksek kuru madde ve yağ içeriğine sahip olduğu için kıvamlı ve ağızda kremsi bir his bırakır. Silifke Yoğurdu (Şekil 1-10), sütünün odun ateşinde kaynatılması nedeniyle tütsü aromasına sahiptir. Ancak, endüstriyel üretimde ısıl işlemin kızgın buharla yapılması nedeniyle tütsü aroması oluşmamaktadır (TÜRKPATENT, 2022b).

Silifke Yoğurdu'nun geleneksel üretiminde çiğ süt; ısıl işlem (90-95°C'de 5-10 dakika) ve soğutma (40-48°C) işlemlerinin ardından bir önceki günün yoğurdu (%0.5-1) ile toprak kaplarda veya çingillerde yaklaşık 12 saat mayalanır. Mayalama işlemini takiben yoğurtlar soğutularak (<10°C) buzdolabında muhafaza edilir. Endüstriyel üretimde ise yağ standardizasyonu ve homojenizasyon işlemlerinin (isteğe bağlı) ardından kontrollü şartlarda mayalama yapılır. %100 keçi sütünden üretilen yoğurdun pH değeri 4.2-4.6, asitliği %1-1.2, kurumaddesi %19-22, yağ miktarı %7-8.5, protein miktarı %7.5-8.5, laktoz miktarı %2.5-3.5 ve kül miktarı %1-2'dir. %80 inek sütü + %20 keçi sütü karışımından üretilen yoğurdun özellikleri ise: pH değeri 4.2-4.6, asitliği %1-1.2, kurumadde miktarı %16-17.5, yağ miktarı %6.3, protein miktarı %5.5-6, laktoz miktarı %2-3 ve kül miktarı %1-1.5'dir (TÜRKPATENT, 2022b).

2.11. Silivri Yoğurdu

Silivri Yoğurdu; inek, koyun, manda, eşit oranda inek - koyun veya eşit oranda inek - manda sütünden geleneksel veya endüstriyel yöntemlerle üretilen, sarımtırak, koyu kıvamlı ve üzerinde pürüzlü kalın bir kaymak tabakası

bulunan yoğurt çeşididir. Silivri Yoğurdu'nun (Şekil 1-11) endüstriyel olarak üretiminde; kurumadde ve yağ standardizasyonu yapılmış süt, 90-95°C'de 30 dakika uygulanan ısıl işlemin ardından köpük oluşması için ambalajlara üstten sıcak dolum yapılır. Daha sonra 50°C'ye ayarlanmış inkübasyon odasında en az 2 saat bekletildikten sonra, 42-45°C'de starter kültür ilavesiyle (%1.5-3) yaklaşık 2-3 saat (pH 4.6'ya ulaşıncaya kadar) mayalanır. Daha sonra yoğurtlar soğutularak 4°C'de muhafaza edilir. Silivri Yoğurdu'nun bileşimi, üretiminde kullanılan sütün çeşidine göre değişmekte olup yağ miktarı %4-6 ve yağsız kurumadde miktarı %10-12 aralığındadır (TÜRKPATENT, 2022c).



Şekil 1. Türkiye'de Cİ almış ayran ve yoğurtlar

1: Susurluk Ayranı (TÜRKPATENT, 2017), **2:** Malatya Pirpirimli (Semizotu) Acılı Ayran (TÜRKPATENT, 2022a), **3:** Antakya Tuzlu Yoğurt (Anonim, 2022a), **4:** Çaycuma Manda Yoğurdu (Anonim, 2022b), **5:** Afyon Manda Yoğurdu (TÜRKPATENT, 2021a), **6:** Eşmekaya Yoğurdu (TÜRKPATENT, 2021b), **7:** Emirdağ Koyun Yoğurdu (TÜRKPATENT, 2021c), **8:** Mamak Ravak Yoğurdu (TÜRKPATENT, 2021d), **9:** Ereğli Koyun Yoğurdu (TÜRKPATENT, 2021e), **10:** Silifke Yoğurdu (TÜRKPATENT, 2022b), **11:** Silivri Yoğurdu (TÜRKPATENT, 2022c)

3. Sonuç

Yoğurt ve Ayran Türk kültüründe önemli yere sahip geleneksel fermente süt ürünlerimizdendir. Ülkemizde coğrafi koşullar ve kültürel alışkanlıklara bağlı olarak farklı sütlerden (inek, koyun, keçi, manda veya bu sütlerin belirli oranlarda karıştırılmasıyla elde edilen) çeşitli yöresel yoğurtlar üretilmektedir. Geleneksel olarak üretimi yapılan yoğurtlardan; Çaycuma Manda Yoğurdu, Afyon Manda Yoğurdu, Eşmekaya Yoğurdu, Antakya Tuzlu Yoğurt, Emirdağ Koyun Yoğurdu, Mamak Ravak Yoğurdu, Ereğli Koyun Yoğurdu, Silifke Yoğurdu ve Silivri Yoğurdu ile ayranlardan Susurluk Ayranı ve Malatya Pirpirimli (Semizotu) Acılı Ayran Cİ tescili ile koruma altına alınmıştır. Türkiye'nin Eylül 2022 itibariyle, Cİ ve geleneksel ürün adı başvurusu yapılmış 8 adet yoğurt çeşidi (Ayrancı Yanıksı Yoğurdu, Kandıra Manda Yoğurdu, Karapınar Koyun Yoğurdu, Mazıdağı Yoğurdu, Sandıklı Kese Yoğurdu, Silivri Yoğurdu, Yoğurt ve İstanbul Manda Yoğurdu) daha TÜRKPATENT tarafından değerlendirme aşamasındadır. Ayran için başvuru bulunmamaktadır. Şüphesiz, yoğurt ve ayran gibi geleneksel ve orjinal üretim tekniğine sahip gıdalarımızın; benzerlerinden ayrılması, haksız rekabete karşı korunması, kalitesi ve üretim koşullarında sürekliliğin sağlanması, değerinin artırılması, kayıtlara geçirilmesi ve markalaşmasında Cİ tescilinin payı oldukça önemlidir. Ayrıca, her geçen gün tescillenen ve tescil başvurusu yapılan ürün sayısının artması, Cİ kavramının Türkiyee genelinde yaygınlaştığını, farkındalığın arttığını ve Cİ'in işlevlerinin anlaşıldığını/anlaşılmaya başlandığını göstermektedir.

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The Effect of Different Drying Techniques and Conditions on Drying Parameters and Thermo-physical Properties of Peach

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Abstract
Peach is a fruit that contains 78%-85% water and has a very high production. Due to the high humidity it contains, it must be stored to be kept for a long time in a consumable condition without spoiling. In this study, 8 sliced peach fruits were dried in an oven (50, 60, 70 °C) and in an air conditioning cabinet (50, 60, 70 °C at constant 30% relative humidity). In the study, the shortest drying time was found with 12 h at a drying temperature of 70 °C in the oven, while the longest drying time was determined by 41.5 h in the experiment carried out in the air conditioning cabinet at 50 °C and 30% RH. Considering all color values, the method that best preserves the color values of peach fruit was determined in the experiment performed at 60 °C in an oven. While creating the curves, Lewis, Page and Yağcıoğlu drying models, which are the most used in the literature, were selected and the drying data were best estimated by the Yağcıoğlu model (R2: 0.9999). Yağcıoğlu model best modeled the drying data at 60 °C in the oven drying method. The highest specific heat, thermal conductivity, thermal diffusivity and specific mass values of the dried samples were determined in the samples dried in an oven at 60 °C.
Keywords: *Peach; Drying; Modelling; Thermo-Physical Properties*

Farklı Kurutma Teknikleri ve Şartların Şeftalinin Kuruma parametrelerine ve Termo-fiziksel Özellikler Üzerine Etkisi

Özet
Şeftali %78-85 oranında su içeren ve üretimi oldukça fazla olan bir meyvedir. İçerdiği yüksek nemden dolayı bozulmadan tüketilebilir halde uzun süre tutulabilmesi için muhafaza edilmesi gerekir. Bu çalışmada, 8'e dilimlenmiş şeftali meyvesini etüvde (50, 60, 70 °C) ve iklimlendirme kabininde (sabit %30 bağıl nemde 50, 60, 70 °C) kurutulmuştur. Çalışmada en kısa kuruma süresi 12 saat ile etüvde 70 °C kurutma sıcaklığında bulunurken, en uzun kuruma süresi ise 41.5 saat ile iklimlendirme kabini 50 °C %30 RH nemde yapılan denemede tespit edilmiştir. Tüm renk değerlerine bakıldığında şeftali meyvesi renk değerlerini en iyi muhafaza eden yöntem etüv 60 °C sıcaklıkta yapılan denemede tespit edilmiştir. Eğriler oluşturulurken literatürde en çok kullanılan Lewis, Page ve Yağcıoğlu kurutma modelleri seçilmiştir ve arasında kuruma verilerini en iyi Yağcıoğlu modeli (R^2: 0.9999) tahmin etmiştir. Yağcıoğlu modeli etüv kurutma yönteminde 60 °C sıcaklıkta kuruma verilerini en iyi modellemiştir. Kurutulan örneklerin en yüksek özgül ısı, termal iletkenlik, termal difüzivite ve özgül kütle değerleri etüv 60 °C de kurutulan örneklerde belirlenmiştir.
Anahtar Kelimeler: *Şeftali; Kurutma; modelleme; Termo-Fiziksel Özellikler*

ID: 796

Lebanese Consumer Perception towards *Moringa Oleifera* : Sensory Evaluation of *Moringa Oleifera* Fortified Labneh

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Abstract

Labneh is one of the most consumed dairy products in the Lebanese community, on breakfast, as a snack or on dinner, plane or mixed with herbs. Its various health benefits plus its acceptability among people makes it an important part of the Lebanese diet. In both its synthetic and homemade forms, several additives are usually incorporated to enhance its flavor and offer a variety of tastes. The problem with Labneh is its short shelf life, as well as its sensitive sensory profile. That is why most industries mix chemical additives with Labneh to prolong its shelf life and conserve its taste. The aim of this research is to preserve Labneh naturally by adding *Moringa Oleifera* dried leaves to extend its shelf life and inhibit rapid spoilage. Working on a natural preservation of Labneh instead of chemical preservation will be assessed by the survey's results and prepare for studying the overall acceptability of the product by making a sensory analysis. The results of the questionnaire showed that the Lebanese community which is not totally aware of *Moringa Oleifera* benefits and availability, is willing to try fortified Labneh with *Moringa* as a new product with extended shelf life and more health benefits. The results of the sensory analysis showed that the sensory attributes of the samples with *Moringa* after 21 days of storage, where not significantly different than normal plane Labneh, which indicate that adding *Moringa* did not affect the sensory attributes of Labneh giving it more acceptability to consumers.

Key Words: *Labneh, Moringa Oleifera , fortification, overall acceptability, sensory attributes.*

Introduction

Dairy products contribute to the major part of Middle Eastern breakfast due to their nutritional benefits and unique flavor. Benefits of consuming dairy products include providing proteins, vitamins, minerals and fatty acids, muscle building, decreasing blood pressure and low-density lipoprotein cholesterol, and play an important role in prevention of diabetes, cancer, and obesity (Tunick & Van Hekken, 2015). Labneh is one of these dairy products that is obtained mainly from milk, which is fermented to obtain yogurt followed by further concentration.

Labneh, so called in the Middle East, strained yogurt in Greece and Europe or Suzme yogurt in Turkey (Abbas et al., 2015) is widely consumed as a main dish at breakfast worldwide, but more frequently in the Middle Eastern countries such as Lebanon, Iraq and Iran (Tarakci et al., 2011).

Making and consuming Labneh is mainly done in the Middle Eastern countries since ancient times but there is no specified date or history of origin about it. Labneh is made from yogurt as mentioned earlier, and the word 'yogurt' comes from Turkish word "yogurmak," which means to thicken, coagulate, or curdle. Despite knowing that yogurt is an extremely old dish in the kitchens of our ancestors, no one is completely sure of the exact origins of the dish. The Greek were the first to mention yogurt in a written reference 100 BC, and Indian Ayurvedic scripts mentioned benefits of consuming fermented milk back in 6000BC.(Fisberg & Machado, 2015).

Labneh is a semisolid food produced by removing water and its soluble compounds from yogurt (Nsabimana et al., 2005). It has properties of good spreadability, cream/white color and a slightly acidic and clean flavor (M. El-Saye et al., 2017; Nsabimana et al., 2005). From a nutritional point of view, Labneh is considered to have 2.5 times higher protein content, 50% more minerals, and a larger number of viable microorganisms when compared to normal yogurt (Ismail et al., 2016). Labneh is composed of 230-250g/kg total solids, 80-100g/kg fat and acidity of 1.8-2.0g/100 g lactic acid (Tarakci et al., 2011). In many villages of the Lebanese countryside, Labneh can be further concentrated to reach 40% solids and made as balls then placed in jars filled with olive oil. In this shape, people call it Labneh Anbaris or Labneh cheese. This step is usually done to prolong the shelf life of Labneh more due to covering the surface with olive oil and thus inhibition of mold and yeast growth (Ahmad et al., 2013).

Labneh (concentrated yogurt) is prepared by draining whey and part of its soluble compounds by using traditional or modern techniques. The traditional method is still widely used in many dairy plants. It consists mainly of pouring the plain yogurt into a cloth bag or sometimes into an animal skin and allow the whey to drain until the desired semi-solid consistency is reached. After that, the content of the bag is removed and salt is being added in 1-2% and then the product is being filled in containers and refrigerated. Modern techniques include using mechanical separator (centrifugation) or ultrafiltration. Centrifugation is applied to heated yogurt at different speeds to obtain Labneh. (Nsabimana et al., 2005)

Although water, the main contributor of microbial spoilage is removed in Labneh, it still has a short shelf life even under refrigeration. This is mainly due to the growth of large amount of lactic acid bacteria combined with low access to air during storage. These conditions facilitate the growth of yeasts and molds causing deterioration of

the product, and signs of yeast spoilage was observed at 7-14 days in many cases. (Nsabimana et al., 2005). Due to its short shelf life, several artificial preservatives were used during Labneh manufacturing, and those include potassium sorbate and sodium benzoate, and sometimes natamycin to produce Labneh that is yeast and mold-free with a longer shelf life. (Zamani Mazdeh et al., 2017).

According to the World Health Organization WHO, food-borne illness is responsible for 400,000 deaths and 600 million cases of food poisoning per year around the world (Yu et al., 2021). In year 2004, the World Health Organization (WHO), Food and Agricultural Organization (FAO), and the International Food Safety Authorities Network (IFOSAN) addressed this problem by creating a joint program with the purpose of reducing the increasing number of food poisoning cases caused by the wide spread of food contamination by strengthening the food safety systems worldwide (Ritota & Manzi, 2020)

Awareness against harmful effects of chemicals used in food, lead to attempts in replacing those chemical preservatives with natural ones. Natural preservatives can be herbs and spices as well as their oils or extracts which are rich in antioxidants and antimicrobial substances, vitamins and minerals. So their use with Labneh will increase its shelf life without any harm with the advantage of increasing the nutritional value of the product.(El-Tawab et al., 2019).

One of the essential technique to extend shelf life and reduce food poisoning cases is food processing. It is done through several methods, including physical preservation by applying heat (pasteurization) or reducing temperature (freezing), chemical preservation by adding manufactured preservatives, biological preservation by using certain microorganisms with antagonistic effects against targeted pathogens, or natural preservation that has been gaining noticeable attention lately. (Yu et al., 2021).

Moringa tree, composition and health benefits

The Moringaceae family consists of 13 different species of *Moringa*, found originally in Kenya, Ethiopia, Somalia, Namibia, Angola, Madagascar, and the Horn of Africa. *Moringa Oleifera* which is the most widely spread species originates from the sub-Himalayan tracts of Northern India, while the derivatives of *Moringa Oleifera* are now found in the Middle East, African and Asian countries (Leone et al., 2015). *Moringa Oleifera* is also planted for ornamental purposes in several cities such as Mexico, Bolivia and Argentina. (Milla et al., 2021)

Many studies were performed on the Moringa tree to study its composition. One of the latest studies was done on 5 samples of Moringa leaves gathered from 3 distinct areas of Bangladesh (Sultana, 2020). Moringa leaves were shade dried for 3 days, then grinded and sieved to remove debris. Resulted powder was kept in sealed sample bags at the temperature of -20 degrees (Sultana, 2020). Table 1 shows the composition of Moringa leaves. (Leone et al., 2016; Sultana, 2020)

Table 1: Moisture, ash, protein, fat, fiber and carbohydrates content of Moringa dried leaves and Moringa seeds. (Leone et al., 2016; Sultana, 2020)

Component	Moringa Dried Leaves	Moringa Seeds
Moisture	8.13%	7%
Ash	9.34%	6.2%
Crude Protein	25.04%	31.4%
Crude Fat	5.75%	36.7%
Crude Fiber	7.34%	7.3%
Crude Carbohydrates	52.52%	18.4%

Due to the rich nutrient profile and mineral content of *Moringa Oleifera* leaves, it shows a wide range of anti-oxidant, anti-inflammatory, and anti-microbial effects (Anwar et al., 2007; Hodas et al., 2021; Leone et al., 2015). These effects promoted the use of Moringa as a hypoglycemic, hepato and kidney protective, and anti-cancer agent (Anwar et al., 2007; Leone et al., 2015).The phytochemical content of Moringa is responsible for the anti-microbial activity, especially benzyl-isothiocyanate, which acts directly on cell membrane synthesis of the microorganisms, leading to the disruption of its growth (Hodas et al., 2021).

The leaves extract was shown to inhibit the growth of eight pathogenic bacteria and fungi, which are *Streptococcus pyogenes, Streptococcus agalactiae, Staphylococcus epidermis, Staphylococcus aureus, Salmonella senftenberg, Escherichia coli, Bacillus subtilis,* and *Candida albicans*. It also showed anti-microbial effect against gram-positive and gram-negative bacteria (Hodas et al., 2021).

Effect of Moringa on the Shelf Life of Labneh

In the past years, many studies were done on Moringa oil and its use with Labneh. Adding Moringa oil to Labneh increased fat and total solid content, however it decreased protein content and ash as the concentration of oil increased. Acidity was an important factor to take into consideration as it affects the acceptability of the final product. It was shown that acidity increased and pH decreased as the concentration increased; thus the oil had excellent effect on the starter culture and maintained typical sour taste of the product. The Samples mixed with the

highest concentration of Moringa oil had the highest antioxidant activity even after 30 days of storage over the other samples. However, it decreased in all samples as storage period increased.
Mold and yeast count are very important when determining the quality and shelf life of Labneh. When adding Moringa oil, samples remained free from mold and yeast up to 30 days while it was observed in the control after 15 days. This was explained by the presence of phenolic and flavonoid compounds that have antimicrobial activity as explained in table 4. (M. El-Saye et al., 2017)
As such, *Moringa Oleifera* was used as natural preservative since it is highly rich in a wide variety of minerals and vitamins and can serve the intended use as preservative. The Moringa oil was not accessible in the Lebanese markets, therefore, the samples of Labneh were prepared, shaped as balls and covered with dried Moringa leaves. People in the Lebanese countryside usually shape the Labneh in balls and cover it with dried thyme or other herbs, but no one has ever covered Labneh with dried Moringa leaves. In the purpose of studying any change that might occur in the sensory attributes of Labneh. A questionnaire was conducted to study the community's basic knowledge and consumption of Labneh with natural additives, as well as their familiarity of Moringa and its health benefits. Based on the findings, Labneh fortified with dried *Moringa Oleifera* leaves was prepared. Its sensory profile and overall acceptance by the consumers were studied and analyzed.

Materials and Methods
This research was based on the need of the Lebanese communities to work on prolonging the shelf life of Labneh and help preserve it without using chemical substances as preservatives.
After looking at the different herbs available in the Lebanese Markets, we found that Moringa leaves were recently known in the society, and a few people were consuming them as hot drink. Since the profile of the Moringa is rich and suits well the Labneh, it was decided to prepare fresh Labneh and fortify it by covering Labneh balls with dried grinded Moringa leaves. The first step was to prepare a survey to investigate the people's knowledge on Moringa, its uses and benefits, as well as investigate their willingness to try this new product. The second step was to study the sensory profile of Labneh covered with Moringa and compare it to that of plane Labneh.
The questionnaire consisted of three sections. The first one was set to collect demographic information. The second section contained questions about Labneh, it aims to know how often people consume Labneh, in what form, plane or coated with herbs, handmade or industrial and whether or not they know that industrial Labneh contains chemical substances as preservatives. The third section was about Moringa, the first question was whether the respondents have ever heard of Moringa. For those who did, they were asked if they knew the benefits of Moringa and its uses in the food science, how frequent they consume it and in what forms. The final question was set in a separate section that asks respondents if they are willing to try Labneh covered with Moringa. After finishing the validity and reliability steps, the questionnaire was sent to the Institutional Review Board at the Lebanese International University for approval before going public. The IRB approval letter was received in May 2022 under the reference code Ref: LIUIRB-220509-WAB-162. Only then, the questionnaire went public and the collected data from 332 respondents was analyzed via IBM SPSS Statistics Data Editor Version 25.
The next stage in this study was to prepare fresh Labneh, make it in ball shapes, and divide the set prepared into plane balls and balls covered with dried Moringa leaves. The sensory profile was prepared for the panelists to taste and evaluate.
The Sensory evaluation of Labneh fortified with Moringa dried leaves was done 21 days after preparation. The 11 panelists were chosen trained, aged between 22 to 28 years old (all females). The analysis was conducted in the lab premises of the Lebanese International University LIU. Each panelist received the following: 3 samples of the control group designated by 3 random digits presented in dishes, 3 samples of the designated product labelled each by 3 random digits, profile sheet, pen, biscuits, water, tissues, spittoons and a hedonic scale.
Labneh samples were evaluated for their compactness, firmness, cohesiveness, wetness, saltiness, sourness, metallic taste and overall acceptability. Three pieces of each Labneh sample were served on white plastic plates together with detailed information on the procedure and advice to rinse their palates with biscuits and sips of water. The panelists used the hedonic scale for attribute intensity ranging from one (dislike extremely) to nine (like extremely). The data obtained was analyzed using IBM SPSS Statistics Data Editor Version 25.

Results and Discussion
The results of the questionnaire were analyzed and it was found that 65.66% of the respondents consume Labneh the most among other dairy products. 33.34% of dairy products consumers find the health benefits of Labneh of great importance for their bodies, while 55.42% of participants are unaware of chemical preservatives added to industrial Labneh and their negative impact on human health.
52.3% consume home-made Labneh, while 10.8% consume industrial Labneh. On the other hand, 39.46% of participants believe that home-made Labneh has longer shelf-life than industrial Labneh. Out of the 332 participants who filled the questionnaire, 43.7% agreed that the Covid-19 pandemic made them move towards consuming more natural foods.

84.60% of the respondents were familiar with the Moringa and practically use it as hot drink, but unfortunately 73.28% of them were unaware of its use as a natural preservative. The results also showed that 44.83% of the respondents are willing to try *Moringa Oleifera* fortified Labneh.
When analyzing the data of the sensory analysis, the results obtained for the samples with or without Moringa (control) after 21 days of storage, where not significantly different, as shown in tables 2 and 3.

Table 2: Kruskal-Wallis Test applied to compare means of different variables for control samples.

Variable	Total Number	Mean	Std.Deviation
compactness	66	7.33	±2.18
firmness	66	6.81	±1.72
cohesiveness	66	6.27	±1.91
Wetness	66	3.36	±1.81
Saltiness	66	3.12	±2.03
Sourness	66	4.94	±2.56
Metallic taste	66	3.42	±2.16
Overall acceptability	66	3.48	±2.03

Table 3: Kruskal-Wallis Test applied to compare means of different variables for samples of Labneh covered with Moringa.

Variable	Total Number	Mean	Std.Deviation
compactness	66	7.48	±2.01
firmness	66	6.51	±1.56
cohesiveness	66	6.18	±1.91
Wetness	66	3.3	±1.78
Saltiness	66	3.48	±2.14
Sourness	66	5.66	±2.52
Metallic taste	66	3.39	±2.06
Overall acceptability	66	3.97	±2.09

According to the results obtained, p values were greater than 0.05 in the control samples and those with Moringa after 21 days of storage, which indicates that there is no significant difference between samples of Labneh with and without Moringa. Thus, adding Moringa does not affect the sensory attributes of normal Labneh. Therefore, if people buy Labneh fortified with Moringa as a new innovative product, it would not be different for them in terms of sensory attributes of normal Labneh, except that they would be intensifying its health benefits. In previous similar researches, the addition of herbs to Labneh including mint, parsley, diplotaxis, dill, coriander, purslane, cress or rocket was tested for any change in appearance and color, body and texture, flavor, and overall acceptability. The different results showed that coriander and diplotaxis had the lowest flavor scores, appearance and color of mint samples were the lowest, and highest overall acceptability was for purslane, dill, parsley and rocket samples while the lowest score for acceptability was for coriander and diplotaxis. Dill, mint, parsley, coriander, diplotaxis, purslane are more recommended as Labneh preservatives.(Tarakci et al., 2011). In another study, culinary herbs such as mint, poppy seeds, cinnamon, and basil were added to Labneh, and firmness, appearance, color/brightness, surface water, taste, flavor and overall acceptability were assessed. Firmness was the highest in the control sample and lowest in cinnamon added sample but it decreased in all samples with 21 days of storage. Color and appearance of mint were the lowest while it gave the best result regarding firmness. Basil was the lowest in having water on the surface. However, in this study, control samples showed best taste and flavor and overall acceptability decreased during storage and the lowest was in mint while the highest was in the control. Olive dried leaves were also added to Labneh to make an innovative product. Adding 1%, 2%, and 3% of dried olive leaves had the best appearance, flavor, consistency over 4% and 5% , and as concentration and storage period increase , the sensory attributes of Labneh decrease. (Ismail et al., 2016). Consequently, culinary herbs were not recommended as Labneh preservatives.(Ahmad et al., 2013).

Conclusion

The increasing demand on healthy foods especially after the Covid-19 pandemic placed the natural preservatives under spotlight, giving them more attention and appreciation. Dried *Moringa Oleifera* leaves added to Labneh as a natural preservative to increase shelf life while maintaining acceptable quality aspects proved to be a suitable process for a new product in the Lebanese community, where *Moringa Oleifera* is widely available, have no strong effect on sensory attributes of Labneh and the process of making the product is easily applicable. Moreover, it had a similar effect on Labneh as other additives such as thyme which is very popular in the Lebanese communities. The addition of *Moringa Oleifera* as dried herbs to Labneh is a potential new product that can be easily introduced into the Lebanes cuisine as well as others.

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The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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Serological Detection of Three Common Tomato Viruses in Tomato Cultivation Areas of Ereğli District in Konya Province

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Abstract

Tomato (*Lycopersicon esculentum* Mill.) which is a member of *Solanaceae* family, is one of the commonly growing plant species worldwide and Türkiye as well. The fruits of the tomato plant are consumed both raw and cooked. In addition, being the raw material of tomato paste also causes an increase in the amount of consumption. In addition to producing tomato paste from tomato fruits, it also constitutes an important export item as dried fruit. There are many biotic and abiotic factors that can cause negative effects on yield and quality in tomato cultivation. Virus diseases also have an important place among these factors. In this study, it was aimed to reveal some viruses that are a problem in tomato production areas in the Ereğli district of Konya, where tomato production is common. For this reason, in the 2019 production season, leaf samples were taken from 160 tomato plants showing symptoms similar to virus disease symptoms such as mosaic, deformations, yellowing, blight on the leaves and stunted plants. Possible infections of *Cucumber mosaic virus* (CMV), *Tomato spotted-wilt virus* (TSWV) and *Tomato mosaic virus* (ToMV) on these leaves were tested by serological-based DAS-ELISA (Double Antibody Sandwich-Enzyme Linked Immuno Sorbent Assay) method. According to DAS-ELISA results, it was determined that 66,25% of the samples were infected with at least one of these three viruses. In addition, TSWV was detected as the most common virus with a 48,75 % relative infection rate in the samples, followed by ToMV (28,75 %) and CMV (26,25 %). Mixed infections of the viruses were also detected in the leaf samples tested. CMV + TSWV double infection was detected in 22 samples, ToMV + TSWV double infection was detected in 14 samples, and CMV + ToMV + TSWV triple infection was detected in 12 plant samples.

Key Words: *CMV, DAS-ELISA, Tomato, ToMV, TSWV*

Konya İli Ereğli İlçesi Domates Ekim Alanlarında Domateste Yaygın Olarak Bulunan Üç Virüsün Serolojik Tespiti

Özet

Solanaceae familyasının bir üyesi olan domates (*Lycopersicon esculentum* Mill.), dünyada ve Türkiye'de de yaygın olarak yetiştirilen bitki türlerinden biridir. Domates bitkisinin meyveleri hem çiğ hem de pişmiş olarak tüketilmektedir. Ayrıca salçanın hammaddesi olması da tüketim miktarının artmasına neden olmaktadır. Domates meyvelerinden salça üretilmesinin yanında, kuru meyve olarak ta önemli bir ihraç kalemini oluşturmaktadır. Domates yetiştiriciliğinde verim ve kalite üzerinde olumsuzluklara sebep olabilen birçok biyotik ve abiyotik etken bulunmaktadır. Virüs hastalıkları da bu etkenler arasında önemli bir yere sahiptir. Bu çalışmada, yoğun olarak domates üretimi yapılan Konya ilinin Ereğli ilçesindeki domates üretim alanlarında sorun olan bazı virüslerin ortaya konulması amaçlanmıştır. Bu sebeple, 2019 üretim sezonunda sürveyler gerçekleştirilerek yapraklarda mozaik, şekil bozuklukları, sararmalar, yanıklıklar, bitkilerde bodurluk gibi virus hastalık belirtilerine benzer belirtiler gösteren 160 domates bitkilerinden yaprak örnekleri alınmıştır. Bu yapraklardaki olası Hıyar mozaik virüsü (*Cucumber mosaic virus*, CMV), Domates lekeli solgunluk virüsü (*Tomato spotted-wilt virus*, TSWV) ve Domates mozaik virüsü (*Tomato mosaic virus*, ToMV) enfeksiyonları serolojik test yöntemlerinde DAS-ELISA (Double Antibody Sandwich-Enzyme Linked Immuno Sorbent Assay) testi ile araştırılmıştır. DAS-ELISA sonuçlarına göre örneklerin % 66,25'inin bu üç virüsten en az bir tanesi ile bulaşık olduğu belirlenmiştir. Ayrıca, TSWV örneklerde % 48,75'lik bulaşıklık oranı ile en yaygın virus olarak tespit edilirken, bu virüsü ToMV (% 28,75) ve CMV (% 26,25) takip etmiştir. Testlenen yaprak örneklerinde söz konusu virüslerin karışık enfeksiyonları da belirlenmiştir. CMV + TSWV ikili enfeksiyonu 22 örnekte, ToMV + TSWV ikili enfeksiyonu 14 örnekte ve CMV + ToMV + TSWV üçlü enfeksiyonu ise 12 bitki örneğinde tespit edilmiştir.

Anahtar Kelimeler: *CMV, DAS-ELISA, Domates, ToMV, TSWV*

ID: 798

Development of Electronic Data Collection Hive System for Use in Precision Beekeeping

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Abstract
Beekeeping is one of the important branches of livestock. Although Turkey is second in the world in the number of colonies, honey production is not in the same order. This is because of the inefficient production. In order to overcome this inefficiency, it is necessary to develop and implement the scientific and modern activities in beekeeping as well as in other animal husbandry branches. Sensitive livestock has become an important issue in animal production. The basic goal in sensitive livestock production is to produce the most efficiently by meeting the needs of the animals adequately and economically. The vital activities of animals must be controlled to determine their needs. This is accomplished by ensuring continuous traceability by using electronic systems and information systems. It is considered that the application of sensitive livestock for beekeeping will reduce workload and increase honey yield. The purpose of Precision beekeeping is to be able to reach all the information needed about the bee colonies grown quickly and to plan the most economical and effective maintenance work by using this information. In order to achieve this, the beekeepers must constantly collect and record data. The reasonable thing about beekeeping is that it does not disturb the colony by opening the beehives as little as possible while performing the examinations and care of the colonies. Frequent opening of the hives and data collection do not give good results in terms of beekeeping. For this reason, there is a need for electronic systems to collect the necessary data for bee colonies. In this project, an electronic hive system was designed to collect data for sensitive beekeeping.
Keywords: *Beekeeping; Electronic; Beehive; Sensor*

Hassas Arıcılıkta Kullanılması Amacıyla Elektronik Veri Toplama Özellikli Kovan Sisteminin Geliştirilmesi

Özet
Arıcılık hayvancılığın önemli dallarından biridir. Türkiye koloni sayısında dünyada ikinci sırada olmasına rağmen, bal üretiminde aynı sırada değildir. Bunun nedeni verimsiz üretimdir. Bu verimsizliğin giderilmesi için diğer hayvancılık dallarında olduğu gibi arıcılıkta da bilimsel ve modern faaliyetlerinin geliştirilmesi ve en doğru şekilde uygulanması gerekmektedir. Hassas hayvancılık hayvansal üretimde önemli bir konu haline gelmiştir. Hassas hayvancılıkta temel hedef, hayvanların ihtiyaçlarının yeter ve ekonomik şekilde karşılanmasıyla üretimin en verimli şekilde sağlamasıdır. İhtiyaçların belirlenmesi için hayvanların yaşamsal faaliyetlerini kontrol altında tutulması gerekir. Bu da elektroniğin ve bilişim sistemlerinin kullanılarak sürekli izlenebilirliğin sağlanmasıyla gerçekleştirilmektedir. Hassas hayvancılığın arıcılık için uygulanmasının iş yükünü azaltacağı ve bal verimini arttıracağı düşünülmektedir. Hassas arıcılıkta amaç yetiştirilen arı kolonileriyle ilgili ihtiyaç duyulan tüm bilgiye hızlı bir şekilde ulaşılması ve bu bilgi kullanılarak en ekonomik ve etkili bakım çalışmasının planlanabilmesidir. Bunun sağlanabilmesi için arıcıların muayenelerle sürekli veri toplaması ve kaydetmesi gerekmektedir. Arıcılıkta makul olan, kolonilerin muayene ve bakımlarını yaparken arı kovanlarını olabildiğince az açarak koloniyi rahatsız etmemektir. Kovanların sık sık açılarak veri toplanması arıcılık açısından iyi sonuçlar vermez. Bu nedenle arı kolonilerine ait gerekli verileri toplayacak elektronik sistemlere ihtiyaç vardır. Bu projede hassas arıcılığın veri toplama ihtiyacını gidermeye yönelik elektronik bir kovan sistemi tasarlanmıştır.
Anahtar Kelimeler: *Arıcılık; Elektronik; Arı Kovanı; Sensör*

ID: 799

Assessment of Durum wheat behavior according to phenology and climatic patterns in the semi-arid region of Setif-Algeria

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Abstract

The study aims to assess the behavior of a set of three durum wheat (Triticum durum. Desf) with diverse developmental phenologies: i) *Waha* as an early heading genotype, ii) *Bousselam* as a mid-early genotype and iii) *Mohamed Ben Bachir* (MBB) as a late heading land race. Indeed, the national breeding programs of durum wheat opt for breeding more early heading lines with short vegetative cycles, aiming to escape the thermal stress that often occurred at the end of the season, but this strategy is not often successful given the controverse of the local climate. The experiment was carried out for three seasons: from 2019-20 to 2021-22. The statistical treatment was built on ranking genotypes, based on yield components and the analysis of covariance over the three seasons. Results of the climatic analysis showed three different patterns of the decadal rainfall for the period of March-April-May which is the most effective and sensitive period for cereal crops in Setif region, in addition to some differences for the temperatures (Tmax and Tmin) and evapotranspiration. Results showed that MBB the late heading genotype performed in two seasons (2019-2020 and 2020-2021), by recording the best grain yields of 588.18g/m² and 169.83g/m² in the two seasons respectively. This superiority is supported in both seasons by average biomass of 1361.9g/m², TKW (42.4g) and fertility (29.88). However, Waha the earliest heading genotype performed in one year (2021-22) by recording a grain yield of 522.99g/m², supported by a superiority of the density of spikes per squared meter (445 spikes/m²). Bousselam genotype has the lowest interannual variability for grain yield (267.3 g/m²±55.01) while Waha has the highest variability one (405.2 g/m²±145.51). This findings suggest at least for the study period to review the strategy-based early heading genotypes, by focusing more on genetic stability and land races performances.

Keywords: *Phenology, Durum wheat, Variability, Yield components*

ID: 800

The Importance of Animal Products for Nutrition and Health

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Abstract

The ability of a person to live physically and productively is closely related to nutrition. For an adult to have a balanced diet; It is necessary to consume 2800-3000 calories and at least 75-80 g of protein in a day, and at least 30-35 g of this protein must be of animal origin.

A balanced intake of nutrients is necessary for a person to survive. Nutrients consist of carbohydrates, proteins, vitamins and minerals. All nutrients contain these compounds to a greater or lesser extent. Although there are these compounds in plant-based foods, animal-based foods such as meat, milk, eggs and honey are rich in protein, as well as the biological value of the protein they contain.

When it comes to the use of animal products as a support for the treatment of diseases, the importance of goat's milk should be emphasized. It is known that goat milk is used in the treatment of many diseases. It has been determined by the positive results obtained from the applications that the regular consumption of goat milk and goat milk products is beneficial in the treatment of eczema, asthma, digestive disorders, some diseases related to varicose veins, virus abscesses and some allergic conditions.

"Apitherapy" is a treatment method with bee products and it shows a rapid development in our country. Products obtained from beekeeping activities; products such as honey, pollen, propolis, royal jelly, bee venom. These products are used in many diseases (insomnia, digestive system diseases, upper respiratory tract infections, rheumatic, influenza, orthopedic diseases, skin cancer, eczema, asthma, arteriosclerosis, gastrointestinal diseases, rheumatic diseases, kidney, urinary tract infections, etc.) used as a supplement to treatments. Honey, propolis, royal jelly have excellent antibacterial properties. Bee venom has antirheumatic properties and pollen is used in the treatment of immunological diseases.

The importance of animal products in terms of health should not be ignored and more studies on the subject are needed.

***Keywords*:** Animal product, nutrition, health, treatment.

Hayvansal Ürünlerin Beslenme ve Sağlık Açısından Önemi

Özet

İnsanın bedenen sağlıklı ve üretken olarak yaşayabilmesi beslenme ile yakından ilgilidir. Yetişkin bir insanın dengeli olarak beslenebilmesi için; bir günde 2800-3000 kalori ve en az 75-80 g protein alması ve alınan bu proteinin de en az 30-35 g'ının hayvansal kökenli olması gerekmektedir.

Bir insanın hayatını sürdürebilmesi için besin maddelerinin dengeli bir şekilde alınması gerekir. Besin maddeleri karbonhidratlar, proteinler, vitaminler ve minerallerden oluşurlar. Bütün besin maddeleri az veya çok bu bileşikleri içerir. Bitkisel kökenli besinlerde bu bileşikler olsa da et, süt, yumurta, bal gibi hayvansal kökenli besinlerde proteince zengin olmasının yanında içerdiği proteinin biyolojik değerliliği de yüksektir.

Hayvansal ürünlerin hastalıkların tedavilerine destek olarak kullanılması üzerinde durulduğunda da keçi sütünün öneminin belirtilmesi gerekmektedir. Keçi sütlerinden birçok hastalıkların tedavisinde yararlanıldığı bilinmektedir. Keçi sütü ve keçi sütü ürünlerinin düzenli olarak tüketilmesinin egzema, astım, sindirim rahatsızlıkları, varisle ilgili bazı rahatsızlıklar, virus apseleri ve bazı alerjik durumların tedavisinde yararlı olduğu uygulamalardan alınan olumlu sonuçlarla belirlenmiştir.

"Apiterapi " arı ürünleri ile tedavi yöntemidir ve ülkemizde hızlı bir gelişme göstermektedir. Arıcılık aktivitelerinden elde edilen ürünler; bal, polen, propolis, arı sütü, arı zehiri gibi ürünlerdir. Bu ürünler halk arasında birçok hastalıklarda (uykusuzluk, sindirim sistemi hastalıkları, üst solunum yolu enfeksiyonları, romatizmal, gripal, ortopedik hastalıklar, deri kanseri, ekzema, astım, damar sertliği, mide barsak hastalıkları, romatizmal hastalıklar, böbrek, idrar yolu enfeksiyonları vb.) tedavilere takviye olarak kullanılmaktadır. Bal, propolis, arı sütü mükemmel bir antibakteriyel özelliğe sahiptir. Arı zehirinin antiromatizmal özelliği bulunmakta, polende immünolojik hastalıkların tedavisinde kullanılmaktadır.

Hayvansal ürünlerin sağlık açısından önemi de göz ardı edilmemeli ve konuyla ilgili daha fazla çalışmanın yapılması gerekmektedir.

Anahtar Kelimeler: Hayvansal ürün, beslenme, sağlık, tedavi.

ID: 801

Green synthesis, Characterization and Antimicrobial potential of Selenium Nanoparticles from *Ocimum gratissimum*

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Abstract
Ocimum gratissimum is a perennial herbaceous plant used in the treatment of fungal and bacterial infections. Green synthesis has provided cost effective, environment friendly procedure and raising safe strategies for the synthesis of nanoparticles. This study was aimed at investigating the potential of *O. gratissimum* for the synthesis of selenium nanoparticles (SeNPs) and their antimicrobial activities. Phytochemical screening on aqueous extract was carried out using standard procedures. Selenium nanoparticles was biosynthesized by *O. gratissimum* and characterized using Visual detection, UV-Visible spectroscopy, Scanning Electron Microscope, Transmission Electron Microscope, Energy dispersive X-ray, Fourier Transform Infra-red spectroscopy and X-ray diffraction spectroscopy. Antimicrobial activity of the biosynthesized selenium nanoparticles by *O. gratissimum* was done using agar well diffusion method. Saponins, tannins, cardiac glycosides, terpenoids and phenols were present. The biosynthesized SeNPs had a strong plasmon resonance band at 300 nm, changes in colour from dark brown to ruby red. The SeNPs were spherical and aggregated with varying shapes and size ranged from 20 – 50 nm.Strong signal of selenium element was observed. Hydroxyl, esters, aldehyde, alkane and amine are present and responsible for the efficient stabilization and bioreduction of Selenium nanoparticle. Furthermore, biosynthesized SeNPs by *O. gratissimum* (OGSeNPs) exhibited higher antimicrobial activity against both Gram positive and Gram negative bacteria. Green synthesis of nanoparticles is a promising method in the biomedical field, due to its high bioactive components.

Keywords:*Ocimum gratissimum*, Selenium nanoparticles, phytochemical screening, Inhibitory effect, Green synthesis

Introduction

Nanotechnology is an all-round disciplinary field in science that involves materials at the atomic level or nanoscale level.Nanoparticles are the fundamental components of nanotechnologythat differs from various dimensions, to shapes and sizes apart from their material (Minakshiet al., 2020). They are nanometer-sized (<100 nm) atomic or molecular scale solid particles having some excellent physical properties on their size and morphology (Stadler et al., 2019).Metal and metal oxide nanoparticles have been thoroughly examined using science and technology due to their excellent properties such as high surface to volume ratio, high dispersion in solution, etc. Metal and metal oxide nanoparticles displays enhanced antimicrobial properties (Ingle et al., 2020). Among all the metal nanoparticles, Selenium nanoparticles (SeNPs) have attracted numerous research interests due to its nutritional supplementation value and low toxicity (Bhattacharjee et al., 2019). Selenium can be present in nature showing various polymorphic structures, either amorphous or crystalline. It is a trace element present in both plants and mammals (Skalickova et al., 2017). It is effective against different types of cancer and neurodegenerative diseases (Santos et al., 2019) and its deficiency is associated with disease in man (Rajeshkumar et al., 2019).Selenium nanoparticles have been studied for the treatment of several diseases, such as diabetes, Alzheimer's disease (AD) and inflammation-related diseases such as rheumatoid arthritis (Gupta et al., 2019).Also, they are being explored as a protector against potential toxic agents, such as chromium, cadmium, and chemotherapeutics agents, which side effects can be very harmful (Khurana et al., 2019).

Three main methods have been applied for the synthesis of selenium nanoparticles: physical, chemical, and biological methods. In the physical approach for SeNPs synthesis, pulsed laser ablation, vapour deposition, hydrothermal and solvent thermal methods were used. The pulsed laser ablation method has the advantage over other methods due to the lack of contamination with chemical reagents, easy collection of nanoparticles by centrifugation, and their high stability (Tzeng et al., 2020). In chemical approach, chemical reductionof inorganic selenium forms as the precursors is the most commonly used method for the preparation of SeNPs. Ascorbic acid, glucose, fructose, cysteine, glutathione, sodium metasulfite and ionic liquid 1-ethyl-3-methylimidazolium thiocyanate have been used as reducing agents, usually in the presence of stabilizing agent to prevent aggregation of nanoparticles (Guleria, et al., 2020). Water-soluble polymers, natural polysaccharides, carboxymethyl cellulose or bovine serum albumin have been used for this purpose (Chung et al., 2020). However, some residuals of these chemicals limit the applications of the formed SeNPs in the pharmaceutical and medicinal areas.

The biological approach involves the use of microorganisms and plants for the synthesis of nanoparticles. Different groups of bacterial strains and fungi have the ability to reduce selenite or selenate to nano selenium as a method of detoxification. SeNPs may be formed both within the bacterial cells and/or extracellularly. The utilization of water plant extracts is also a better alternative to chemical methods for the synthesis of selenium nanoparticles. This approach requires non-toxic solvents, mild temperatures, and application of the reducing agents that are easily accessible, cheap, biodegradable, and not harmful to the environment. It also reduces the high cost of microorganism's isolation and a final SeNPs purification, when applied in biomedical sectors. Such greenly synthesized methods of SeNPs are becoming preferred over the conventional chemical and physical methods due to their reduced toxicity towards the environment which uses living organisms such as plants, microalgae, and other microorganisms. Selenium nanoparticles produced via the green synthesis method can be an alternative to antibiotics (Ingle et al., 2020).Plants are considered to be more suitable compared to microbes for green synthesis of nanoparticles as they are non-pathogenic and various pathways are thoroughly researched. A wide spectrum of metal nanoparticles has been produced using components (including leaves, fruits, roots, stems, and seeds) of different plants (Das et al., 2017). Plant extracts have the ability to produce nanoparticles with defined size, shape, and composition. Furthermore, the presence of a wide array of phytochemicals in their extract may function as natural stabilizing and/or reducing agents for nanoparticles production. It is accepted that plant-derived nanoparticles are less likely to cause harmful side effects in humans when compared to chemically synthesized nanoparticles, and exhibit a high biological potential with applications in agriculture, food science and technology, bioengineering, cosmetic or nanomedicine, and human health protection (Geoffrion et al., 2020).

Ocimum gratissimum is a herbaceous plant popularly known as scent leaf.It is highly cultivated due to its culinary and medicinal importance (Shittu et al., 2016). It belongs to the family of Lamiaceae and is found in Africa, Asia, and South America. It is used as a natural flavouring agent, condiment, or vegetable in the preparation of fish, meat, soup, and stew. It is also used in traditional medicine for the treatment of several ailments such as cough, pneumonia, fever, inflammation, anaemia, diarrhoea, pains, and fungal and bacterial infections (Akara et al., 2021). Scientific reports have shown that *O. gratissimum* has a wide range of bioactive compounds such as flavonoids and polyphenol and essential oils with several beneficial effects (Melo et al., 2019). Furthermore, several studies have also shown that this plant possesses numerous pharmacological properties such as antioxidant, antimicrobial, anti-inflammatory, anthelmintic, cardiovascular, anti-mutagenic and antidiarrheal. However, there have been numerous reports on the use of several members of the *Ocimum* family in the synthesis of Selenium nanoparticles with *Ocimum sanctum* being the most used. (Aderibigbe and Idowu, 2020). The rise in antimicrobial resistance has emerged as a big crisis and a serious threat in every region of the world. It is becoming a worsening problem in recent decades not only in public health, but also in economic and social impacts, which requires the development of new drugs for more effective treatments. Selenium nanoparticles produced via the green synthesis method can be an alternative to antibiotics. SeNPs showed an antibacterial effect toward standard and antibiotic-resistant phenotypes of Gram-negative and Gram-positive bacteria in a dose-dependent manner (Geoffrion et al., 2020). This study is aimed at phytochemical screening, synthesis, characterization, and antimicrobial activity of selenium nanoparticles synthesized from *O. gratissimum*.

Materials and Method

Collection of Plant

Fresh*O. gratissimum* leaves were obtained from Bodija market in Ibadan, Oyo state, South-west, Nigeria. The leaves were identified at the Department of Botany, University of Ibadan, Nigeria. The leaves were labeled and transported to the laboratory for immediate microbiological analysis.

Culture collection

The test organisms used to determine the antimicrobial activity were collected from the department of medical microbiology University College Hospital (UCH), Ibadan. The test organisms were *Escherichia coli*, *Paenibacillus alvei, Staphylococcus aureus, Streptococcus pneumoniae, Klebsiella pneumoniae, Pseudomonas aeruginosa* and *Candida albicans*. They were revived on nutrient agar (LabM, UK) before subsequently used.

Preparation of *O. gratissimum* extract

O. gratissimum leaves were washed with sterile distilled water to remove the particles and later air dried. 20 g of the leaf was finely cut, put in 250 ml glass beaker along with 100 ml distilled water, crushed and boiled for 5 mins at 90°C. The extract was cooled at room temperature and filtered with Whatman No.1 filter paper. The filtrate was centrifuged for 10 minutes at 10000 rpm. The supernatant was collected and stored at 4°C (Radha et al., 2014).

Phytochemical screening of *O. gratissimum* leaf extract

The phytochemical tests to detect the presence of saponins, tannins, flavonoids, cardiac glycosides, anthraquinones, steroids, terpenoids, alkaloids and phenols was performed according to the procedure described by Harbourne, (1998) and the quantitative analysis was determined according to the method of Dohou et al.(2003).

Green synthesis of Selenium Nanoparticles using *O. gratissimum*leaf extract

The synthesis of Selenium nanoparticles (SeNPs) using *O. gratissimum* was done using the modified method of Alagesan and Venugopal, (2019). 10 mls of*O. gratissimum* leaf extract was added to 90 mls of 5 mM sodium selenite solution and heated up to 90°C for 5 minutes, the immediate colour change indicate the formation of Selenium nanoparticles. The Selenium nanoparticles solution thus obtained were purified by repeated centrifugation at 10000 rpm for 15 minutes. The supernatant was transferred to a clean dry beaker for further settlement of particles and repeated centrifugation was carried out. The particles obtained were used for further characterization.

Characterization of Greenly synthesized SeNPs

Visual Detection and UV –Visible spectrophotometric analysis of SeNPs

The SeNPs synthesized using *O. gratissimum* was observed visually for the change in colour from the initial colour (brown) of the sample to ruby red colour indicating the formation of selenium nanoparticles.

The bioreduction of Sodium selenite to selenium nanoparticles was monitored using UV-visible spectrophotometer (752 UV - Vis Spectrophotometer) with a resolution of 0.5 nm. 1 ml of each sample was taken and the absorbance was read at the wavelength ranging from 200 – 700 nm (Alagesan and Venugopal, 2019).

Scanning Electron Microscopic (SEM) and Transmission Electron Microscopic (TEM) analysis of SeNPs

The shape and morphology of the synthesized SeNPs was determined using Scanning Electron Microscopic (SEM) machine. The biosynthesized samples were freeze dried and mounted on a cover slip, coated with gold using a coater. Images of the selenium nanoparticles were taken in a SEM (JEOL - JSM - 7600F US). The details of the applied voltage and magnification used were also implanted on the images. (Wadhwani et al., 2017).

A thin film of the sample was prepared on a carbon coated copper grid by dropping a very small amount of the sample on the grid. The biosynthesized SeNPs were subjected to centrifugation at 13000 rpm for 10 min. The pellet thus recovered was subjected to washing by its re-suspension in de-ionized water followed by centrifugation at 13000 rpm for 10 min, to remove possible organic contamination present in nanoparticles. Finally, the pellets were freeze dried using a lyophilizer. Transmission electron micrographs and recorded was done using TEM-ARM200F-G Verios 460L, USA instrument operated at an accelerating voltage of 15kV with a resolution of 0.23 nm(Kumar et al., 2014).

Energy Dispersive X-ray (EDX) and X-Ray Diffraction analysis of SeNPs

The elemental composition of the sample was determined using Energy Dispersive X-ray (EDX) (JEOL - JSM - 7600F, US). The centrifuged sample was drop coated on a carbon film and a spot-profile mode was done by focusing the electron beam onto a region on the surface of the biosynthesized selenium nanoparticles sample. It was done at a voltage of 40.0Kv and current of 350μA (Kumar *et al*., 2014).

The crystalline size and purity were characterized by an X-ray diffractometer (Rigaku D/ Max111c, pw1800, China) using Cu K α radiation of wavelength $\lambda = 1.541$Å. The crystalline size of the prepared SeNPs nanoparticles was determined by using Scherrer's equation as follows $D \approx 0.9\lambda/\beta\cos\theta$, where D is the crystal size, λ is the wavelength of X-ray, θ is the Bragg angle in degree, and β is the full width at half maximum of the peak in radians (Alagesan and Venugopal, 2019).

Fourier Transform Infra-red (FTIR) analysis of SeNPs

FTIR was used to determine the functional groups in the synthesized SeNPs.2 mg of the nanoparticles were encapsulated in 100mg of KBr pellet in order to prepare translucent sample discs. The pelleted samples were subjected to Fourier transform infrared (FT-IR) spectroscopy in the range of wavelength 350 to 4400cm^{-1}. The FT-IR spectrum was recorded using Nicolet iS10 FT-IR Spectrophotometer, China (Alagesan and Venugopal, 2019).

Effects of Physicochemical Parameters on the greenly synthesized SeNPs

Effect of incubation time, temperature, sodium selenite concentration and pH on the biosynthesis of SeNPs was investigated. The effect of temperature(27°C, 37°C and 45°C), incubation time(24, 48 and 72 hrs), different concentrations of Na_2SeO_3 (2 mM, 4 mM, 6 mM, and 8 mM) and pH (2, 5, 7, 9 and 11) on SeNPs synthesis was evaluated and characterized using UV-visible spectrophotometer at wavelengths ranging from 200 - 700 nm.

Antimicrobial Potential of the synthesized SeNPs using*O. gratissimum* leaf extract

The antimicrobial activity of the synthesized SeNPs was tested against selected pathogenic organisms using agar well diffusion method. Mueller Hinton agar was used as the growth media and was prepared and sterilized at 121°C for 15 minutes. The sterile media was allowed to cool to about 45°C, poured into sterile Petri dishes. Standardized inoculum of the test organisms were swabbed onto the surface of the sterile and solidified Mueller Hinton agar in separate Petri dishes. The plates were then allowed to dry. A 5 mm standard cork borer was used to bore uniform wells in the agar. SeNPs wereintroduced into each well on the agar. The plates were incubated at 37°C for 24 hrs after which the plates were observed for zone of inhibition of growth. The zones of inhibition were measured and recorded excluding the wells (Yusuf et al., 2021).

Results and Discussion

O. gratissimum is one of the discovered medicinal plants with the potential to serve as an alternative therapy for the treatment of various ailments. Scientific reports have shown that *O. gratissimum* has a wide range of bioactive compounds which possess unique antibacterial activities against the plant and human bacterial pathogens. The

qualitative and quantitative phytochemical analysis of *O. gratissimum*leaf extract is shown in Table 1.The result revealed that Saponins, Tannins, Cardiac glycosides, Terpenoids and Phenols are present in the leaf extract. Flavonoids and Alkaloidsare abundantly present while Anthraquinones and Steroids were absent. These phytochemicals rich in polysaccharide galactomannan, act as good reducing and capping agents for the stability of selenium nanoparticles and may have played a role in reducing sodium selenite to SeNPs. Similar studies have also been reported by Olamilosoye *et al*. (2018) that the aqueous extract of *O. gratissimum* leaves contains alkaloids, flavonoid, tannins, saponins, cardiac glycoside and terpenoid.Melo *et al*. (2019) reported thataqueous extract of *O. gratissimum* is a rich source of flavonoids and phenolics. This is in line with the work of Usunomena and Eseosa, (2016) who reported the presence of tannins, saponins, flavonoids and alkaloids in *O. gratissimum* leaves.

Table 1: Qualitative and quantitative phytochemical composition of *O. gratissimum*

S/N	Phytochemical parameters	Qualitative	Quantitative (mg/100g)
1	Alkaloids	++	875
2	Flavonoids	++	615
3	Saponins	+	65
4	Tannins	+	122
5	Phenols	+	70
6	Cardiac glycosides	+	-
7	Terpenoids	+	90
8	Anthraquinones	-	-
9	Steroids	-	-

Key: ++: Abundantly present, +: Present, -: Absent

Green synthesis and Characterization of SeNPs

O. gratissimum leaf extract used for the synthesis of selenium nanoparticles produced nanoparticles which were evident in the change of colour from dark brown to ruby red indicating the formation of SeNPs in the reaction mixture. Plate1 shows the visual characterization of SeNPs produced. The changes in colour from dark brown to ruby red may be due to the excitation of surface plasmon vibrations of selenium nanoparticles. This is in accordance with the work of Alagesan and Venugopal, (2019) who reported that the color change observed after adding *Withania somnifera* leaf extract to selenious acid solution is ruby red. Similarly, coloration changes from the colourless solution of sodium selenite to brick red have also been reported in the phytofabrication of Selenium nanoparticles using *Emblica officinalis* fruit extract (Gunti *et al*., 2019).

The greenly synthesized SeNPs was further characterized using the UV-Visible spectrophotometer. The spectra obtained from the synthesized SeNPs using *O. gratissimum* is shown in Figure 1. A strong surface plasma resonance peak (SPR) was obtained at 300 nm for the synthesized SeNPs which indicated the formation of the nanoparticles with a broad band at 200 - 400 nm while *O. gratissimum* extract did not show any characteristic SPR peak. Similar studies have been reported by Ramamurthy et al. (2013) who stated that the UV-Visible spectra of their SeNPs showed absorption maximum at 200 nm – 400 nm with small peak observed at 300 nm in the UV region which may be due to the small organic molecules present in the reaction mixture.



Plate 1: Visual characterization of the synthesized SeNPs using *O. gratissimum* leaf extract
Key: Na_2SeO_3: Sodium selenite
SeNPs: Biosynthesized SeNPs using *O. gratissimum*
Extract*: O. gratissimum* leaf extract

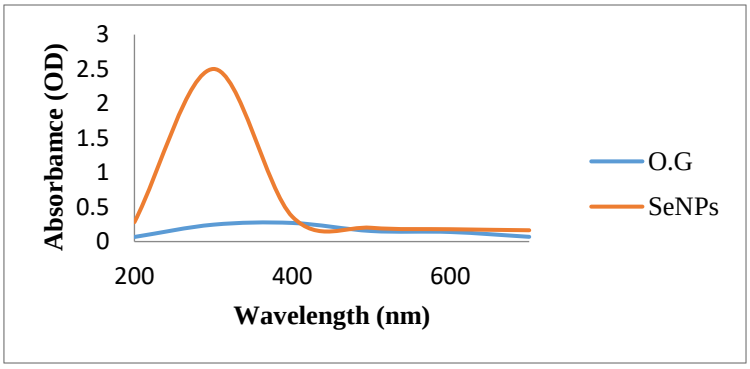


Figure 1: UV-Visible absorption spectrum of synthesized SeNPs using *O. gratissimum*
Key: O.G: *O. gratissimum* extract
SeNPs: Greenly synthesized SeNPs using *O. gratissimum*

The scanning electron microscopic analysis was carried out to determine the morphology of the synthesized SeNPs. Plate 2 shows the SEM micrograph of the synthesized SeNPs using *O. gratissimum* extract. The SeNPs in this study presented a monodispersed spherical morphology without forming aggregates. This result may be due to the presence of capping agents in the extract that act as stabilizers or binding molecules to provide colloidal stability along with preventing agglomeration and inhibit uncontrolled growth of nanoparticles. Similar sizes and morphologies of SeNPs have been reported by Fardsadegh *et al*. (2019) using *Pelargonium zonale* extract. Ojeda et al. (2020) also obtained spherical shaped particles with the synthesis of selenium using *Juglans regia* On the contrary, Alagesan and Venugopa (2019) reported that the SEM image of SeNPs showed greater numbers of agglomerated spherical particles.

The TEM analysis was further used to characterize the SeNPs produced by determining the size of the nanoparticle. The TEM analysis of synthesized SeNPs using *O. gratissimum* extract is shown in Plate 3. The particles size ranged from 20 nm - 100 nm. Changes in the size of SeNPs may be due to different nucleation and growth mechanisms related to factors such as temperature and reaction. This is in accordance with the work of Alagesan and Venugopa (2019) who reported that the nanoparticles produced were spherical particles within the diameter range 45 – 90 nm. Gunti et al. (2019) reported that the size of the biosynthesized SeNPs ranged from 15 – 40 nm.

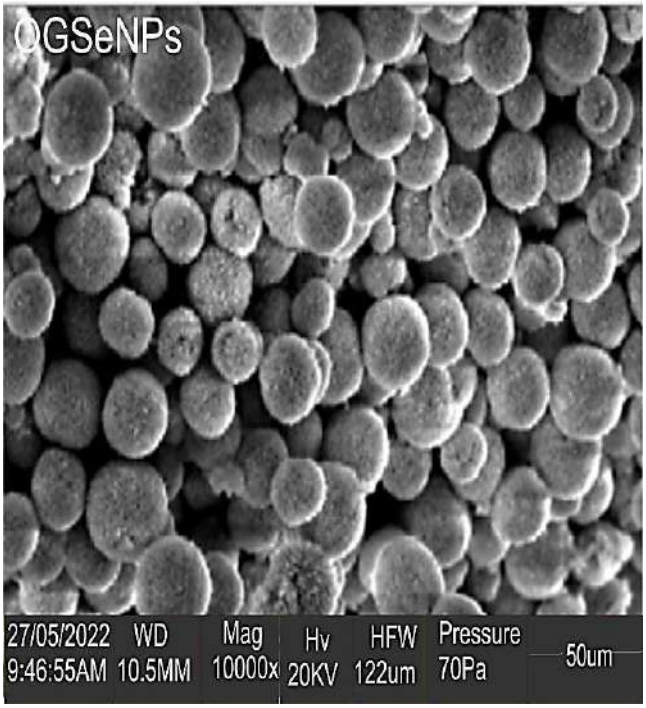


Plate 2: SEM micrograph of synthesized SeNPs using *O. gratissimum* extract

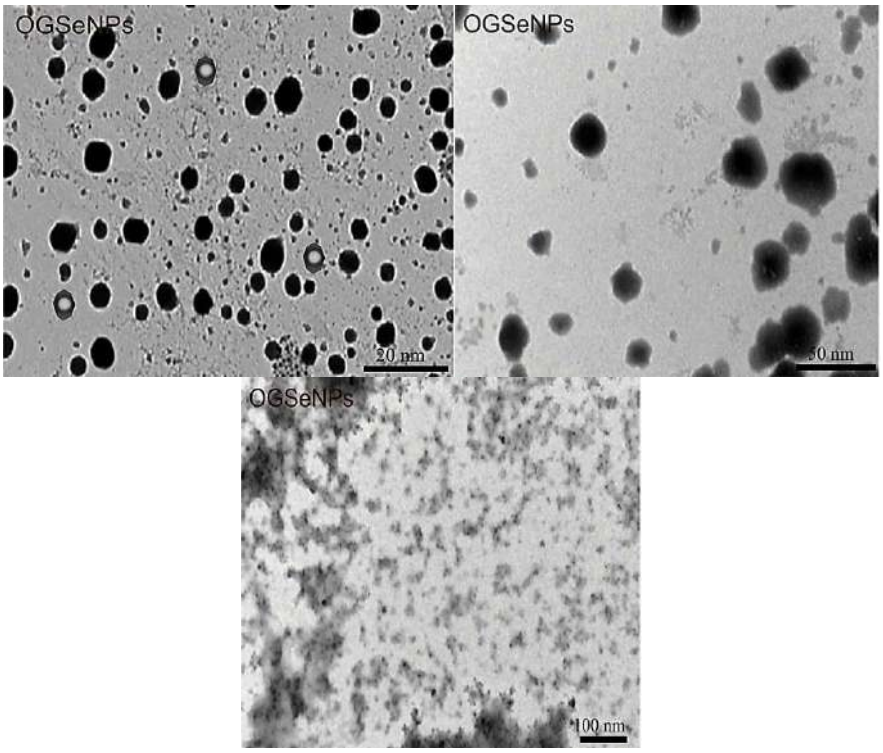


Plate 3: TEM micrograph of synthesized SeNPs using *O. gratissimum* extract

The SeNPs was characterized by EDX to determine the elemental composition of the sample. The EDX analysis of synthesized SeNPs using *O. gratissimum* extract is shown in Figure 2. The presence of a strong selenium signal was observed and it was as a result of the surface plasmon resonance indicating that the SeNPs obtained were of high purity. The weak signal from Silicon, Carbon, and Oxygen may be due to mixed precipitate present in the extract. This is similar to the work of Miglnai and Tani-ishii (2021) who reported that there were strong signals from selenium atoms in the selenium nanoparticles. Vyas and Rana, (2017) reported that Selenium had the highest proportion in nanoparticles followed by Oxygen, Carbon, Sodium, Phosphorus and Chlorine.

To evaluate the crystalline nature of the synthesized SeNPs, it was characterized by the XRD technique.Figure 3 shows the X-ray diffraction analysis for the synthesized SeNPs using *O. gratissimum*. The XRD analysis for the biosynthesized SeNPs indicated five diffraction peaks in the whole spectrum of 2θ values ranging from 35 to 80. All diffraction peaks corresponded to the characteristic crystalline face-centered cubic (FCC). Sharp peaks were observed indicating the formation of crystalline SeNPs.All the peaks could be indexed according to the trigonal phase of elemental selenium. This corresponds to the work of El-Deeba *et al.,* (2018) who reported the pure crystalline form of selenium.This result contradicts the work of Filipovic *et al*., (2021) who reported that thediffraction peaks which indicate the crystalline phase of selenium were not observed.

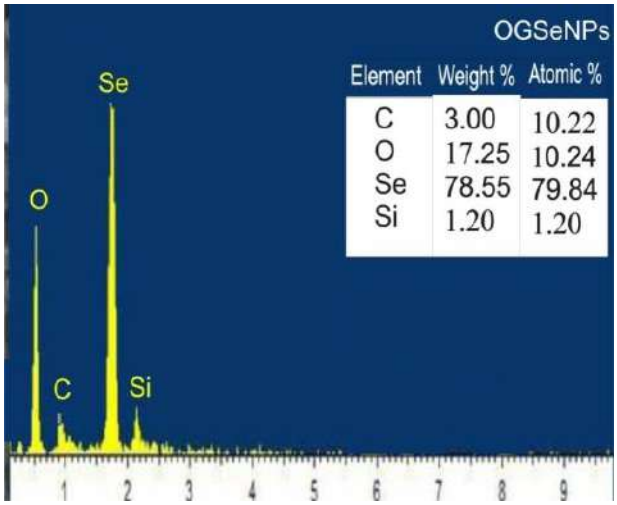


Figure 2: EDX analysis of synthesized SeNPs using *O. gratissimum* extract

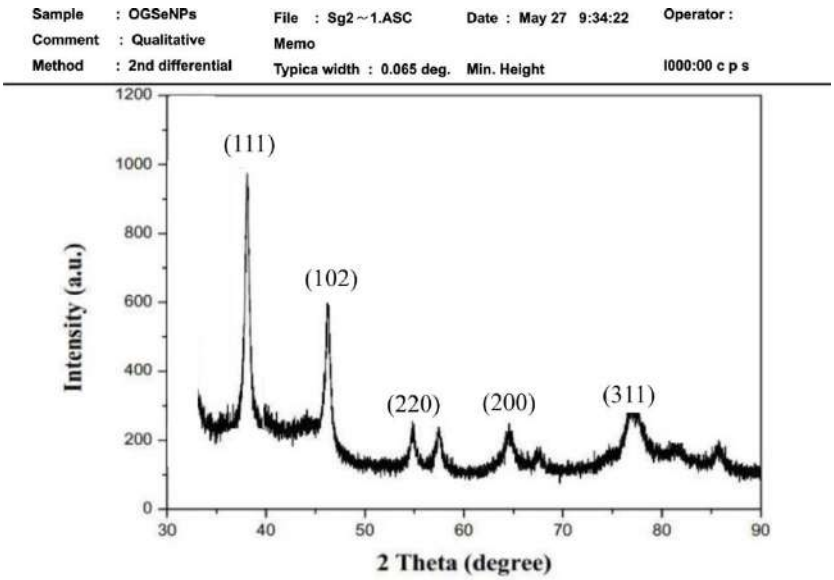


Figure 3: XRD analysis of synthesized SeNPs using *O. gratissimum*

FTIR was used to determine the functional groups present in the sample. The FTIR spectrum of *O. gratissimum* extract is shown in Figure 4a. Peaks were present at 3778.31, 3376.00, 2918.00, 2853.01, 2360.17, 1595.00, 1369.00, 1032.00 and 367.33 cm^{-1}. The peaks at 3376.00 cm^{-1} and 3778.31 cm^{-1} were observed to have the strongest and broadest absorption peak indicating a stretching vibration of hydroxyl group (OH). The characteristic peaks appearing at 2918.00 cm^{-1} corresponds to C – H asymmetrical stretching of alkanes. The peak at 2853.01 cm^{-1} indicated the O-H stretching of carboxylic acid. The peak at 1595.00 cm-1 corresponds to C=C stretching of cyclic alkene. The peak at 1369.00 cm^{-1} attributed to O-H bending of alcohol. The peak observed at 1032.53 cm^{-1} and 1032.00 cm^{-1} was due to C-N stretching of amine. These characteristics absorption peak indicated that hydroxyl, aldehyde, amine and ester may be responsible for the ability of *O. gratissimum* extracts to adhere to the surface of nanoparticles as a form of stabilization.

The FTIR spectrum of biosynthesized SeNPs is shown in Figure 4b. Peaks appeared at 3458.00, 2929.45, 2355.16, 1737.50, 1637.33, 1449.00, 1387.40, 1111.33, 1032.53, 540.00 and 458.73 cm^{-1}. The peak at 3458.00 cm^{-1} was observed to have the strongest and broadest absorption peak indicating a stretching vibration of hydroxyl group (OH). The characteristic peaks appearing at 2929.45 cm^{-1} corresponds to C – H asymmetrical stretching of alkanes. The peak at 1737.50 cm^{-1} attributed to C=O stretching of esters. The peak at 1595.00 cm-1 corresponds to C=C stretching of cyclic alkene. The peak at 1387.40 cm^{-1} was assigned to C-H bending of aldehyde. The peak at 1111.33 cm^{-1} corresponds to C-O stretch of secondary alcohol and aliphatic ether. The peak observed at 1032.53 cm^{-1} was due to C-N stretching of amine while the peak at 540.00 cm^{-1} represents the C-I and C-Br stretching of halo compounds. These characteristics absorption peak indicated that hydroxyl, aldehyde, amine and ester may be responsible for the efficient stabilization and bioreduction of Sodium selenite (Na_2SeO_3) into Selenium nanoparticles (SeNPs). These functional groups are present as a result of the presence of biomolecules in the extract which was involved in the synthesis process. This is in accordance with the work of Alagesan and Venugopa, (2019) who reported that the presence of various functional groups as biomolecules may be responsible for both reduction and stabilization of the SeNPs.These functional groups are present as a result of the presence of biomolecules in the extract which was involved in the biosynthesis process. Previous reports have also suggested the role of phytochemicals as a stabilizing agent for the synthesis of metal nanoparticles (Coccia *et al*., 2012).

Temperature is one of the most important physical parameter on the synthesis of SeNPs. Effect of temperature on the synthesis of SeNPs was evaluated. The UV-Visible absorption spectrum of the effect of temperature on the synthesis of SeNPs is shown in Figure 5a. Strong SPR peak was observed at 300 nm for all the temperatures and broad bands ranging from 200 nm – 400 nm. The result showed that the nanoparticles biosynthesis increased by enhancing temperature to 37°C and no appreciable production of nanoparticles was attained at 45°C. The ability of 37°C to be the best temperature for the synthesis of SeNPs may be due to the fact that the biomolecules or proteins responsible for the reduction of sodium selenite are only active around 30°C and at 37°C. So, 37°C was considered as the optimum temperature. Also, at higher temperature denaturation of proteins capping may occur and this leads to higher rate of agglomeration. This result is in agreement with the work of Lortie et al. (1992) who reported that there was no synthesis of SeNPs at higher temperature. Correa-Llantenet al. (2014), reported that synthesis of SeNPs by *Citrus reticulata* peel extract was found to be efficient at 40°C

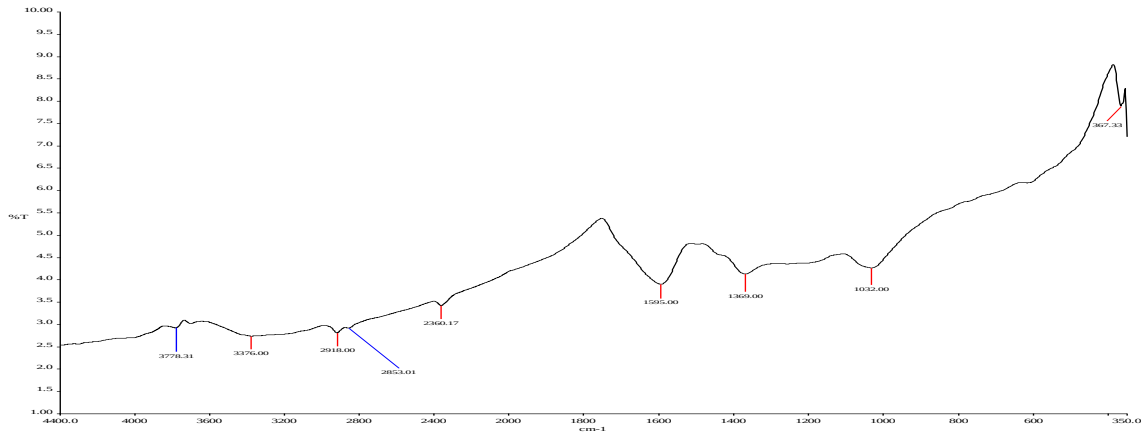
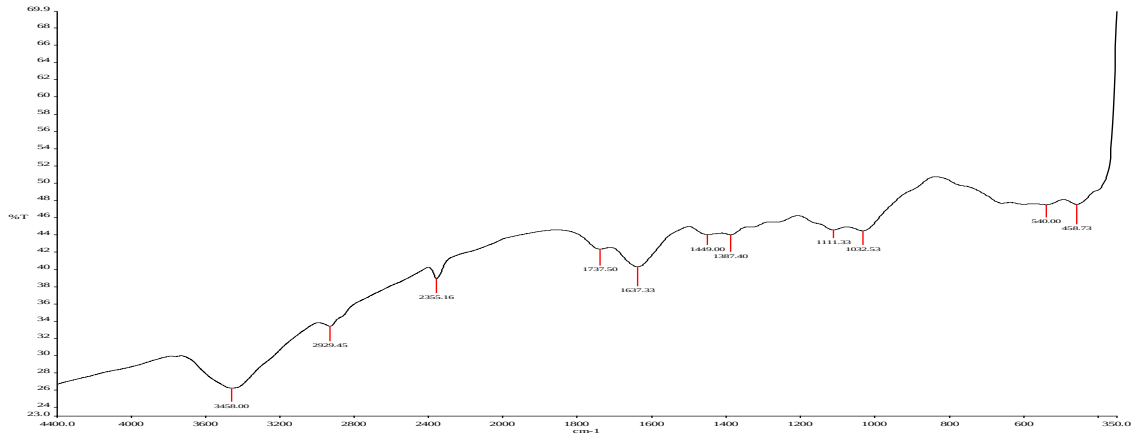


Figure 4a: FTIR spectrum of *O. gratissimum* extract

Figure 4b: FTIR spectrum of synthesized SeNPs using *O. gratissimum* extract



The effect of physicochemical parameters on the synthesis of SeNPs

The effect of incubation time on the biosynthesis of SeNPs using *O. gratissimum* extract was studied and the UV-Visible spectrum was recorded after time intervals of 24 hrs, 48 hrs and 72 hrs. Figure 5b shows the UV-Visible absorption spectrum of the effect of incubation time on the biosynthesis of SeNPs. SPR peak was observed at 300 nm and a broad band ranging from 200 nm – 400 nm for all the incubation time. Maximum absorbance was recorded at 72 hrs while the least absorbance was recorded at 24 hrs for the biosynthesis of SeNPs. The ability of the biosynthesized SeNPs to increase in absorbance with time may be as a result of continued reduction of the selenium ions and the collision frequency between the particles. This is in accordance with the work of Sani-e-Zahra et al. (2022) who reported that after 96 hr maximum absorbance was observed.Sarkar *et al*. (2022), who reported that the synthesis of SeNPs depends on time.

The effect of different concentration (2 mM, 4 mM, 6 mM, 8 mM) of Na_2SeO_3 on the biosynthesis of SeNPs was evaluated and is shown in Figure 5c. The SeNPs showed strong SPR peak at 300 nm with broad band at 200 nm - 400 nm for all concentrations. The highest absorbance was recorded at 8 mM while the least absorbance was recorded at 2 mM. It was observed that the best concentration for SeNPs synthesis was 8 mM. The ability of 8 mM Na_2SeO_3concentration to produce the highest SeNPs biosynthesis may be due to the fast rate of bio-reduction with increase in concentration of the salt. This result is in agreement with the work of Sani-e-Zahra et al. (2022) who reported maximum amount of SeNPs as the concentration of sodium selenite increased.

The effect of pH on the biosynthesis of SeNPs using *O. gratissimum* extract was evaluated at different range (2, 5, 7, 9 and 11) and monitored with the UV-Visible spectrophotometer. The UV-Visible absorption spectrum of the effect of different pH levels on the biosynthesis of SeNPs is shown in Figure 5d. SPR peak was observed at 300 nm and broad bands ranging from 200 nm – 400 nm for the pH levels with pH 9 and 11. The highest absorbance was recorded against pH 11 indicating the increased synthesis of selenium nanoparticles under alkaline conditions which may be as a result of more availability of bio-reductions while the lowest absorbance was recorded att pH 2. The decreased reduction rate in acidic medium could be ascribed to the denaturation and /or degradation of bioactive compounds present in the *O. gratissiumum*. This report is in agreement with the work of Sani-e-Zahra *et al*. (2022) who reported that a maximum absorption was observed at pH 7 and no reaction occurred at pH 5. Similarly, Roopan *et al*. (2011) also reported the formation of highly dispersed nanoparticles at pH 11 whereas, no reaction occurred at pH 2.

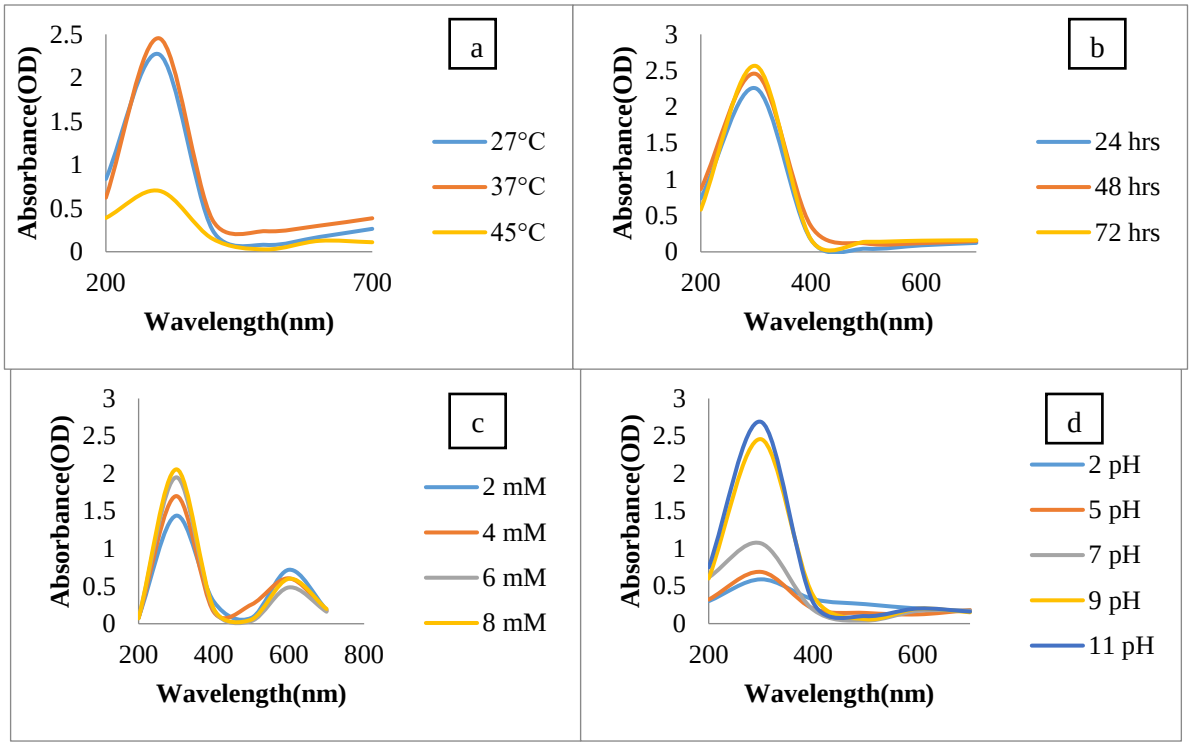


Figure 5: UV-visible absorption spectra of synthesized SeNPs; (**a)** at different incubation temperature;(**b)** at different incubation time; (**c)** at different pH of reaction mixture; (**d)**; at different Na_2SeO_3 concentration.

Antimicrobial activity of greenly SeNPs using *O. gratissimum* (OGSeNPs)

One of the most remarkable and peculiar properties of selenium nanoparticles is their antimicrobial activities. The ability of the biosynthesized SeNPs to inhibit the growth of selected pathogens was investigated and the biosynthesized SeNPs exhibited an excellent antimicrobial activity against the selected pathogens. They were also found to have a broad spectrum of activity against the pathogens. The gram negative bacteria were more susceptible to the SeNPs than the gram positive bacteria which may be due to the composition of bacterial cell wall. Gram negative bacteria are significantly protected with a cytoplasmic membrane and outer cell membrane, containing a thin layer of the peptidoglycan between them with periplasmic compartment, while all gram positive bacteria are bound by only a single unit lipid membrane and thick layer of peptidoglycan. The result is similar to the work of Hidayat *et al*. (2020), who reported that the inhibitory effects of SeNPs were more pronounced on gram negative compared to gram positive bacteria due to the thickness of the cell wall and cell components.Eswarapriya and Jegatheesan (2015) reported that there was an antifungal activity of biosynthesized SeNPs against *Candida albicans* and *Aspergillus niger*. Also, Zonaro *et al*. (2015) reported that SeNPs exhibit more inhibitory actions against gram positive bacteria species as a result of the lesser surface charges of nanoparticles that effectively enable them to bind to the bacterial cell membrane.This study is in accordance with the work of Hernández-Díaz *et al*. (2021) which reported that selenium nanoparticles had a wide range of activities against *B. subtilis*, *E. coli*, and *S. aureus*.

Table 2: Antimicrobial activity of greenly SeNPs using *O. gratissimum*(OGSeNPs) on some pathogens

Zone of inhibition (mm)				
Test organisms	**Na_2SeO_3**	**OGE**	**OGSeNPs**	**CPR**
S. pneumoniae	-	18	26	28
E. coli	-	19	28	26
K.pneumoniae	-	15	27	24
P. aeruginosa	-	-	22	24
S. aureus	-	20	27	28
C. albicans	-	14	24	24
P. alvei	-	16	20	24

Key: Na_2SeO_3: Sodium selenite, OGE: *O. gratissimum* extract OGSeNPs: Biosynthesized selenium nanoparticles using *O. gratissimum* CPR: Ciprofloxacin

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ID: 804

Differential antimicrobial potential of *Ajuga bracteosa* Wall ex. Benth based on extraction solvents

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Abstract

The current study aimed to evaluate the effect of extraction solvents on the anti-bacterial and anti-fungal efficacy of the stem and roots of *Ajuga bracteosa* Wall ex. Benth. Extracts were prepared in different solvents and tested against fungi and bacteria species including, *Agrobacterium tumefaciens, Xanthomonos oryzae, Citrobacter freundi, Alternaria alternata, Alternaria solani* and *Aspergillus niger*. Antibacterial efficacy of the *Ajuga bracteosa* was carried out by disc diffusion susceptibility method and antifungal efficacy by well diffusion susceptibility method. Methanol stem extract revealed efficacy against *Citrobacter freundi* by producing a 63% zone of inhibition at 3mg/disc while methanol roots extract produced 77% ZI against *Agrobacterium tumifaciens*. Methanol root and stem extracts produced an equal zone of inhibition (97%) at 100µl/well concentration against *Alternaria alternata* and *Alternaria solani.* The results of the study clearly stated that the polarity of the solvents used in the extraction procedure affects the bioactivities of the extracts.

Keywords; *Extraction solvent, antibacterial efficacy, antifungal activity, Disc diffusion Assay, Crude extract*

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Eggplant (Solanum melongena L.) Drying Kinetics and Color Change

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Abstract

Eggplant is used intensively in addition to its fresh consumption, as well as dried. With the drying process, it can be stored for a longer time and can be consumed in four seasons. In this study, the color criteria and drying kinetics, which are important quality parameters, were determined by drying the eggplant oven in a laboratory type convective dryer at 40, 50, 60, 70 ºC and in the shade environment. Before the drying process, the products were sliced in equal sizes and dried in a thin layer drying model and color measurements were made. When the drying data were examined, the longest drying time was 124 hours in the shade environment, while the shortest drying process was 3 hours 45 minutes in the laboratory type convective dryer at 70 ºC. Page, Midilli Küçük, Lewis and Jenedas models were used for drying modeling. The reliability level in modeling was found to be $p<0.001$ for all models. The highest R2 value was found to be 0.9998 in the drying models, at 40 ºC in the laboratory type convective dryer in the Page model, and at 60 ºC in the laboratory type convective dryer in the Midilli Küçük model. The Croma value, which is closest to fresh in color properties calculated in terms of color values, was found at 60 ºC in the oven dryer, the Hue angle at 60 ºC in the laboratory type convective dryer, and the total color change and browning index at 70 ºC in the laboratory type convective dryer.,

Key Words: *Eggplant, Drying, Color Change*

Patlıcan (Solanum melongena L.) Kuruma Kinetiği ve Renk Değişimi

Özet

Patlıcan taze tüketiminin yanı sıra kurutularak da yoğun bir şekilde kullanılmaktadır. Kurutma işlemi ile daha uzun süre muhafaza edilerek dört mevsim tüketim imkânı sağlanabilmektedir. Bu çalışmada patlıcan etüvde, laboratuvar tipi konvektif kurutucuda 40, 50, 60, 70 ºC sıcaklıklarda ve gölge ortamında kurutularak önemli kalite parametrelerinden olan renk kriterleri ve kuruma kinetiği belirlenmiştir. Kurutma işlemi öncesi ürünler eşit boyutlarda dilimlenerek ince tabaka kurutma modelinde kurutularak renk ölçümleri yapılmıştır. Kurutma verileri incelendiğinde en uzun kuruma süresi 124 saat süren gölge ortamında kurutmayken en kısa süren kurutma işlemi 3 saat 45 dakika ile laboratuvar tipi konvektif kurutucuda 70 ºC sıcaklıkta bulunmuştur. Kurutma modellemesinde Page, Midilli Küçük, Lewıs ve Jenedas modelleri kullanılmıştır. Modellemede güvenilirlik seviyesi tüm modeller için $p<0.001$ olarak bulunmuştur. Kurutma modellerinde en yüksek R^2 değeri 0.9998 olarak Page modelinde laboratuvar tipi konvektif kurutucuda 40 ºC sıcaklıkta, Midilli Küçük modelinde ise laboratuvar tipi konvektif kurutucuda 60 ºC sıcaklıkta tespit edilmiştir. Renk değerleri açısından hesaplanan renk özelliklerinde tazeye en yakın olan Croma değeri etüv kurutucuda 60 ºC sıcaklıkta, Hue açısı laboratuvar tipi konvektif kurutucuda 60 ºC sıcaklıkta, toplam renk değişimi ve kahverengileşme indeksi ise laboratuvar tipi konvektif kurutucuda 70 ºC sıcaklıkta bulunmuştur.

Anahtar Kelimeler: *Patlıcan, Kurutma, Renk Değişimi*

ID: 808

Association Study for GJA8 Variants with Age-Related Cataract in Population of Pakistan

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Abstract

Cataract is a major cause of blindness due to the cloudiness of the lens. Approximately 37 million people are suffering from cataracts worldwide and about 50% of people are blind worldwide due to cataracts. We investigated the association of single nucleotide polymorphism in Gap Junction Alpha 8 Gene and the effects of different demographic factors like age, sex, diabetes, smoking, radiation, vitamins, and use of steroids medication with age-related cataract in 200 individuals suffering from of any type of age-related cataract and 159 healthy individuals. The polymerase chain reaction technique was used with TETRA-ARMS primers to investigate the single nucleotide polymorphism, and genotypes of individuals in the GJA8 gene. There is a significant difference in the genotypic frequency of SNP G/A (rs9437983) and SNP T/G (rs1495960) in patients and normal individuals ($P < 0.05$). These results indicated that the GJA8 gene is significantly associated with the disease

Key Words: *Cataract, Single nucleotide polymorphisms (SNPs), Age-Related Ctaract, GJA8*

ID: 810

Non-Thermal Technologies In Fruit Juice Processing

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Abstract
In parallel with the changing consumer demands in the food industry, new techniques have emerged in food processing, especially as an alternative to heat treatment, in recent years. These processes, which are used as an alternative to heat treatment in the food industry, are applied to prevent microbiological development, reduce enzyme activity and increase food quality, as well as to preserve physical, nutritional bioactive compounds and organoleptic properties. Current food processing techniques, which are seen as a good alternative to heat treatment, can be adapted to all foods and types to be applied, and even in combination with traditional thermal techniques, the operable effect can be increased (improved). In the researches, microbial inactivation, decrease in enzyme activity and losses in nutritional values are evaluated and it is tried to determine the appropriate process parameters. The main purpose of all non-thermal techniques applied is to produce products that have a long shelf life and preserve their nutritive and sensory qualities until the expiry date. In this study, the effects of ultrasound, pulsed electric field (PEF), high hydrostatic pressure, ultraviolet radiation (UV), gamma and X-Ray, pulsed electric field (PEF) and ohmic heating technologies on juice production will be discussed.
Key Words: *Fruit Juices, Enzyme Inactivation, Microbial Inactivation, Non-Thermal Technologies, Nutritional Value*

Meyve Suyu İşlemede Isıl Olmayan Teknolojiler

Özet
Gıda endüstrisindeki tüketici taleplerinin değişmesine paralel olarak son yıllarda gıdaların işlenmesinde, özellikle ısıl işleme alternatif olarak yeni teknikler ortaya çıkmıştır. Gıda endüstrisinde ısıl işleme alternatif olarak kullanılan bu işlemler, mikrobiyolojik gelişimi önlemenin, enzim aktivitesini azaltmanın ve gıda kalitesini artırmanın yanı sıra fiziksel, besinsel biyoaktif bileşiklerin ve organoleptik özelliklerin de korunması amacıyla uygulanmaktadır. Isıl işleme iyi bir alternatif olarak görülen, güncel gıda işleme teknikleri uygulanacak olan tüm gıdalar ve tiplerine göre uyarlanabilir hatta geleneksel termal tekniklerle kombine olarak çalıştırılabilir etkisi yükseltilebilir (iyileştirilebilir). Yapılan araştırmalarda mikrobiyal inaktivasyon, enzim aktivitesindeki azalma ve besin değerlerindeki kayıplar değerlendirilerek uygun işlem parametrelerinin belirlenmesine çalışılmaktadır. Uygulanan termal kaynaklı olmayan tüm tekniklerin temeldeki amacı raf ömrü uzun ve son tüketim tarihine kadar besleyici ve duyusal niteliklerini koruyan ürünler üretimektir. Bu çalışmada ultrason, vurgulu elektrik alan (PEF), yüksek hidrostatik basınç, ultraviyole ışın (UV), gamma ve X Işını, vurgulu (atımlı) ışık ve ohmik ısıtma teknolojilerinin meyve suyu üretimindeki etkisinden bahsedilecektir.
Anahtar Kelimeler: *Besleyici, değer, Enzim İnaktivasyonu, Isıl Olmayan Teknolojiler, Meyve suyu, Mikrobiyal İnaktivasyon*

1. Giriş

➢ Isıl Olmayan Yeni Teknikler

Gıda güvenliği ve kalitesi açısından biyolojik ve kimyasal aktivitelerin kontrol altına alınması gerekmektedir. Gıdanın üretilmesi sırasında bu durum genellikle geleneksel ısıtma teknikleri kullanılarak (sterilizasyon, pastörizasyon, haşlama, evaporasyon, pişirme ve kurutma gibi) sağlanmaktadır. Ancak bu geleneksel ısısal yöntemlerin uygulanmasıyla enzim ve mikroorganizma inaktivasyonu yanında, vitaminler ve mineraller gibi besin öğeleri ile renk, doku ve lezzet gibi duyusal unsurlarda kayıplar görülebilmektedir. Bu nedenle günümüzde gıda üreticileri gerek gıdanın raf ömrünü uzatabilmek gerekse gıdanın besin değerini koruyabilmek için yeni teknoloji ve yöntem arayışı içine girmişlerdir. Bu tip olumsuzlukları engellemek amacıyla üzerinde yoğunlukla çalışılmaya başlanan bu tekniklerin bir kısmını da termal olmayan yöntemler (ultrason, PEF, yüksek basınç, radyasyon vb.) ve elektriksel ısıtma (mikrodalga, ışınlama, ohmik ısıtma ve radyo dalgalarıyla ısıtma gibi) yöntemleri oluşturmaktadır (Demirdöven ve Baysal, 2008).

2. Ultrases (Ultrason) Teknolojisi

Ultrason mekaniksel nitelikte olan insanların işitebildiği 20 kHz'nin üzerindeki frekanslara sahip bir enerji biçimidir ve ısısal olmayan, emniyetli, etkili, ekstrakt üretimi ve hücre parçalanması için kullanılabilen bir gıda işleme metodudur (Piyasena vd., 2003). Ultrason tekniğinin geleneksel tekniklerle kombinasyonlarının uygulama etkinliğini arttırdığı bilinmektedir. Termosonikasyon tekniği sıcaklık ve ultrason tekniklerinin kombinasyonu

sonucu proses sıcaklığı ve süresini azaltarak pastörizasyon ve sterilizasyon amacıyla kullanılabilmektedir. Manosonikasyon ise basınç uygulaması (600 kPa'a kadar) ve ultrason tekniklerinin bir arada kullanıldığı ve mikroorganizmalar üzerine geleneksel uygulamadan daha yüksek letal etki sağlayan bir yöntemdir. Manotermosonikasyon; basınç, sıcaklık ve ultrason uygulamalarının kombinasyonu olarak ifade edilmekte ve daha etkin enzim ve mikroorganizma inaktivasyonu sağlamaktadır (Knorr vd., 2004). Ultrases sıvı içerisinde uygulandığında sonikasyon olarak adlandırılabilmekte (Tiwari ve Mason, 2011) ve sonikasyonun temel etki mekanizması kavitasyon ile açıklanmaktadır: Ses dalgası sıvının içerisinden geçerken boyuna dalgalar oluşturur ve ardışık olarak kasılıp gevşeme olayları gerçekleşir. Ses dalgası gevşeme pozisyonuna geçerken negatif basınç sıvının noktasal çekme kuvvetini aştığı zamanlarda mikro kabarcıklar ve boşluklar oluşur. Sıvı içindeki küçük kabarcıklar ultrases dalgalarının gevşeme-sıkışma hareketleri ile hızlı bir şekilde gelişir ve kritik bir değere ulaştığında patlamaktadır ki buna kavitasyon denir. Bu olayda meyve suyu işlemede ultrases kullanımı noktasal olarak çok yüksek sıcaklık (5000 °C) ve basınç (100 MPa) oluşur (Piyasena vd., 2003; Tiwari ve Mason, 2011).
Meyve sebze işleme alanında enzim ve mikroorganizma inaktivasyonu, renk maddelerinin ekstraksiyonu, karıştırma, homojenizasyon, partikül küçültme, köpük kırma, temizleme yüzey dekontaminasyonu, şeker kristalizasyonu ve kabuk soyma amacıyla kullanılabilmektedir (Betts vd., 1999). Ultrasonun gıdalardaki bazı uygulamaları Tablo 1' de gösterilmektedir. Ultrases işleminin temel etki mekanizması kavitasyondur. Kavitasyon; sıvılarda bulunan mikro kabarcıkların kritik büyüklüğe ulaşması sonucunda patlamalarıyla meydana gelen önemli bir etkidir (Ashokkumar vd., 2010). Diğer taraftan ultrasesin etkileri, uygulanan ultrases gücü, hedef alınan mikroorganizma cinsi ve gıda matrisine göre oldukça farklılık göstermektedir. Bu nedenle ultrases işlemi her gıda matrisi için ayrı ayrı incelenmeli ve endüstriyel tasarımlar için şartlar ürün bazında optimize edilmelidir. Ultrases uygulaması meyve sularında askorbik asit, karotenoidler ve fenolik bileşikler gibi biyoaktif bileşiklerin; elektriksel iletkenlik, bulanıklık, renk, pH, asitlik, briks ve viskozite gibi özelliklerde değişime neden olabilmektedir. Söz konusu özelliklerdeki değişimlerin uygulanan ultrases gücü, uygulama süresi ve sıcaklığının yanında meyve suyu çeşidi ve içeriğine göre farklılıklar gösterebilmesi kaçınılmazdır (Dinçer ve Topuz, 2018). Baltacıoğlu (2022) şeftali suyunda farklı sıcaklık (40, 50 ve 60 °C) ve sürelerde (10, 20 ve 30 dk) termosonikasyon işleminin (125, 170 ve 210 µm genlik) PPO ve POD inaktivasyonuna etkisini araştırmıştır. Enzim inaktivasyonunun artan güç, sıcaklık ve süreye bağlı olarak artış gösterdiği bildirilmiştir.170 µm genlikte, 60 °C'de 10 dakikalık işlemden sonra PPO enziminde %97,14'lük bir inaktivasyon sağlanırken, POD enziminde %92,16'lık bir inaktivasyon sağladığını belirlenmiştir. Sonuçlar ısıl işlemle karşılaştırdığında (70 °C 10 dk), şeftali suyunda termosonikasyonla daha düşük sıcaklıkta enzim inaktivasyonunun sağlandığı belirlenmiştir. Baltacıoğlu ve Doğanay (2021) farklı sıcaklık (40, 50, 60, 70 ve 80 °C) ve sürelerde (5, 10, 15, 20, 25, 30 dakika) uygulanan ısıl işlemin elma suyunda PPO ve POD enzim aktivitesi üzerine etkisini incelemişlerdir. Enzim inaktivasyonunun genellikle artan sıcaklık ve zamanla arttığı belirlenmiştir. PPO enziminde 80 °C'de 20 dakika sonunda % 99 inaktivasyon sağlanırken, aynı koşullarda POD enziminde % 93,29'luk bir inaktivasyon sağlandığı bildirilmiştir. Bir başka çalışmada termosonikasyon (TS) uygulamasının farklı genlik (%60, 80, 100), sıcaklık (40, 50, 60 ve 70 °C) ve sürelerde (5, 10, 15, 20, 25 ve 30 dakika) elma suyunda bulunan PPO ile POD enzimlerine etkisi incelenmiştir. Genel olarak artan güç, sıcaklık ve süre ile enzim inaktivasyonunun arttığı belirlenmiştir. Termosonikasyon uygulama sonucunda PPO enzimi için %100 genlik 70 °C sıcaklıkta 15 dakika sonunda %99 inaktivasyon sağlanırken, aynı koşullarda POD enzimi için %94,5 oranında inaktivasyon sağlandığı belirlenmiştir. Elma POD enziminin PPO' a göre ısıya daha dirençli olduğu bildirilmiştir (Şahin 2019).

3. Vurgulu Elektrik Alan (PEF)

PEF iki elektrot arasında bulunan gıda maddesinin çok kısa süreyle (1-100 µs) yüksek voltaj elektriksel alan (80-100 kV/cm) etkisi altında bırakıldığı bir işlemdir. Mikrobiyolojik ve enzimatik inaktivasyon ile bitkisel dokunun parçalanması amacıyla kullanılır. Ayrıca düşük sıcaklıklarda çalışılması ürünün fiziksel ve besinsel özellikleri ile renk tat ve koku korunumu açısından da diğer tekniklere göre üstünlük sağlamaktadır (Heinz vd., 2003). PEF tekniğinde mikroorganizma inaktivasyonunun hücre zarının elektromekanik stabilitesinin bozulmasıyla gerçekleştiği belirtilmektedir (Ramaswamy ve Chen, 2002). Bu teknolojide özellikle sıvı ve yarı sıvı gıdalar düşük sıcaklıkta ve kısa sürede işlenerek raf ömürleri uzatılabilmekte, meyve-sebzelerde ekstraksiyon verimi ve kurutmada kütle transfer hızı arttırılabilmektedir. Hücre zarı parçalanmasının amaçlandığı bu ön işlem uygulaması sonrasında elde edilen ekstraktların kalite açısından ısısal ve enzimatik olarak ön işleme tabi tutulmuş ürünlere göre daha iyi özelliklere sahip olduğu belirlenmiştir (Toepfl, 2015). Ekstraktların daha saf ve berrak olması gıda üretiminde gereksinim duyulabilecek fazladan işlem basamaklarının gereksinimi azaltmaktadır. Meyve ve sebzelerde hücre zarının parçalanması için gereken elektrik alan şiddetinin 0,5-1 kV/cm olmasının yeterli olduğu bilinmektedir (Bouzrara, 2001).
Gıda sanayinde PEF uygulamalarında kritik elektrik alan parametreleri doğru olarak seçilmelidir. Sularda ve sıvı gıdalarda mikrobiyal inaktivasyonu için kullanılan elektrik alan şiddeti genellikle 10-60 kV/cm, vurgu süresi ise mikro ile milisaniye arasında değişim göstermektedir (Lebovka vd., 2004). Elektrik alan şiddetine göre PEF Düşük (E≤100-200 V/cm), Orta (E=300-1500 V/cm) ve Yüksek (E>1500 V/cm) olarak sınıflandırılmıştır. (Bazhal ve Vorobiev, 2000). Ekstrakt veriminin belirlendiği çalışmalarda havuç suyu üretiminde ekstrakt verimi hiç ön işleme

tabi tutulmadan preslenen hammaddeye göre %60,1 ile 66,4 artış gösterirken üzümlerle yapılan çalışmada üzüm suyu verimi enzimatik maserasyon sonrası elde edilen verimle (%87) aynı bulunurken PEF ile gerçekleşen hücre parçalanmasından dolayı çözünen madde ve pigment miktarının arttığı belirlenmiştir (Eshtiaghi ve Knorr, 2000).

Tablo 1. Ultrasonun gıdalardaki bazı uygulamaları (Tavman vd., 2009)

Uygulama	**Etki**
Mikrobiyal İnaktivasyon	Sıcaklık ve basınçla kombine edildiğinde daha düşük sıcaklıklarda ve daha kısa sürede inaktivasyon sağlar.
Enzim İnaktivasyonu	Daha düşük sıcaklıklarda enzim inaktivasyonu sağlar.
Ekstraksiyon	Ekstraksiyon hızı ve etkinliğini artırır
Canlı hücrelerin uyarılması	Hücreye zarar vermeden hücre etkinliğinin arttırılması (yoğurt, balık yumurtası oluşumu, tohum çimlenmesi)
Dondurma	Buz kristallerinin oluşumu için geçen sürede kısalma
Kurutma	Düşük sıcaklık ve düşük hava hızında kurutma sağlar.
Filtrasyon, Seperasyon	Akış hızında ve ayırma etkinliğinde artış
Kristalizasyon	Katı yağ ve şekerlerin kristalizasyon akısını arttırır.
Gaz uzaklaştırma	Fermentasyon sonrası CO2 gazını giderir.
Köpük kırma	Sıvıların doldurulması sırasında oluşan köpüğün giderilmesini sağlar.
Kesme	Yumuşak/ kırılgan ürünlerin kesilmesinde kayıpları azaltır.
Viskozite değiştirme	Katkı maddelerinin kullanımını azaltarak proses özelliklerini geliştirir
Emülsiye etme ve homojenizasyon	Geleneksel uygulamalara göre maliyeti azaltır.
Temizleme ve yüzey dekontaminasyonu	Boru iç yüzeyi ve kesimhanelerde kullanılan sistemlerin temizliğinde kolaylık sağlar.

Min vd. (2003a) ticari ölçekte yaptıkları çalışmada vurgulu elektrik alan teknolojisi ile işlenen portakal suyunun ısıl işleme göre doku, aroma ve toplam kabul edilebilirlik bakımından üstün olduğunu bildirmişlerdir (Min vd., 2003). Min ve Zhang (2003) ticari ölçekte yaptıkları çalışmada vurgulu elektrik alan teknolojisi ile işlenen domates suyunda ısıl işleme göre aroma bileşenlerinin daha zengin, enzimatik kararmanın daha az ve kırmızı rengin daha iyi nitelikte olduğunu belirtmişlerdir (Min ve Zhang, 2003). Min vd. (2003) ticari ölçekte yaptıkları çalışmada vurgulu elektrik alan teknolojisi ile işlenen domates suyunun ısıl işleme göre duyusal kalite bakımından daha iyi olduğunu fakat likopen konsantrasyonu, briks, pH ve vizkozite bakımından aralarında istatistiksel olarak anlamlı bir fark bulunmadığını bildirmişlerdir (Min vd., 2003b).

4. Yüksek Hidrostatik Basınç Uygulaması

Bu yöntem, ısıl işlemlerin tersine ürünün büyüklüğünden ve şeklinden bağımsız ve gecikmesiz olarak etki göstermektedir. Yüksek basınç uygulaması oda sıcaklığında gerçekleştirildiğinden, konvansiyonel yöntemlerdeki gibi termal enerjiye ihtiyaç duyulmamakta ve ürün yapısında yüksek sıcaklığın neden olduğu olumsuz durumlar gerçekleşmemektedir. (Gökmen ve Acar 1995).

Yüksek hidrostatik basınç elde etme yöntemleri, ikiye ayrılmaktadır. Bunlar; dolaylı sıkıştırma yöntemi ve doğrudan sıkıştırma yöntemidir. Dolaylı sıkıştırma yönteminde; bir piston vasıtasıyla içinde basınç iletici sıvı bulunan kapta basınç oluşturulur. Ürün bu sıvı içinde ambalajlı olarak bulunur. Endüstriyel olarak ambalajlı ürünlerde bu yöntem kullanılır. Doğrudan sıkıştırma yönteminde ise, bir piston yardımıyla sıkıştırma uygulanır. Kap içindeki basınç bu piston tarafından oluşturulur. Meyve suyu gibi sıvı ürünlerde bu yöntem uygulanır. (Mertens ve Deplace, 1993).

Yüksek hidrostatik basınç sistemlerinin temel prensibi gıdayı çevreleyen suyu sıkıştırmaktır. Basınçlı kaba konan paketlenmiş haldeki gıda maddesi, çevresindeki suya uygulanan basınç ile her noktadan eşit olarak etkilenmektedir. Suyun basınç ileten ortam olarak kullanılmasının nedenleri; yüksek basınçlara çıkıldığında bile hacim azalmasının ihmal edilebilir olması, gıdalar için güvenilir, saf ve ucuz olmasıdır (Tülek ve Filizay 2006).

Yüksek basınç yöntemi oda sıcaklığında gıdaların renk, lezzet ve besin öğeleri gibi kalite özelliklerini değiştirmez veya çok az değiştirir. İşlemin etkinliği üzerine ürünün boyut ve geometrisinin hiçbir etkisi yoktur. Gıdalarda bozulmaya neden olan saprofit mikroorganizmaları yok ederek gıdaların raf ömürlerini arttırır. Genellikle 250-300MPa'da 10dk.'lık bir uygulama birçok gıdadaki vejetatif hücreleri tamamen inaktive edebilir. Bu işleme soğuk pastörizasyon da denir (Yemencioğlu ve Özkan, 2004).

Préstamo vd., (2000) kivi ve elma suyuna 400 MPa, 30 dk, -7°C/5°C/20°C'de yüksek basınç uygulamasının polifenol oksidaz aktivitesi üzerine pozitif etkiye sahip olduğunu tespit etmiştir (Préstamo vd., 2000). 300- 400 MPa 10 dakika portakal suyunu Bacillus sp sporu öldürülmemesine rağmen, vegatative mikroorganzimaların sterilizasyonu için yeterlidir. Meyve suyunun güzel tadını ve lezzetini 5 ay oda sıcaklığında muhafazasını sağlar. Basınç 45°C de uygulandığında, sonuçlar oda sıcaklığından çok daha iyidir (Hayashi, 1989).

Basınçlanmış meyve suyu taze aromasını ve tadını muhafaza için soğuk ortamda korunmalıdır. Düşük sıcaklık pektin esteraz aktivitesini düşük tuttuğu için, düşük sıcaklık tortu gelişimini azaltmaya yardımcı olur; böylece, pektin esteraz tortu oluşumuna katkıda bulunmaz. Düşük sıcaklıkta depolamada diğer basınç uygulanmış gıdalarda da önemlidir; örneğin, basınç uygulanmış reçeller soğukta muhafaza edildiğinde taze tadı ve lezzeti uzun süre muhafaza ederler (Gould, 2000).

5. Ultraviyole Işın (UV) Teknolojisi

UV uygulaması, zararlı mikroorganizmaları inaktive etmek amacıyla uygulanan bir dezenfeksiyon metodudur. (Tran ve Farid, 2004).

UV ışınlarının kullanımı hava, su ve yüzey dezenfeksiyonunda iyi tanımlanmış olmasına rağmen, sıvı gıdalara uygulanmasındaki kullanımı hala sınırlıdır. Su ile karşılaştırıldığında, sıvı gıdaların çeşitli optik ve fiziksel özellikleri ve farklı kimyasal kompozisyonları UV ışının geçirgenliğini, doz aktarımını ve sonuç olarak mikrobiyal inaktivasyonu etkilemektedir. Bununla birlikte, fiziksel bir muhafaza metodu olarak UV ışınlama üzerine yapılan araştırmalar, bu teknolojinin çeşitli sıvı gıdaların ve ingredientlerin (meyve suları, içecekler, süt, sıvı yumurta, şeker şurupları vs.) pastörizasyonu için geçerli bir alternatif olarak oldukça ümit verici olduğunu göstermektedir (Koutchma, 2008).

Ultraviyole ışınları, elektromanyetik spektrumun 100-400 nm aralığında yer alan küçük bir kısmını kapsamaktadır. Ultraviyole ışınları, insan vücudunun bronzlaşmasından sorumlu UV-A (320-400 nm), cilt yanıkları ve cilt kanserine neden olan UV-B (280-320 nm), germisidal etkili UV-C (200-280 nm) ve tüm maddeler tarafından absorbe edilebildiğinden sadece vakum altında yayılabilen Vakum UV (100-200 nm) olarak alt sınıflara ayrılmaktadır. Bu sınıflar arasından UV-C bakteri, virüs, protozoa, maya, küf ve alg gibi mikroorganizmalara karşı öldürücü etkiye sahiptir. En yüksek öldürücü etki 250-270 nm arasında gözlenmekte olup, yüzey dezenfeksiyonu ve meyve suyu, gibi çeşitli akışkan gıda ürünlerinin dezenfeksiyonunda 254 nm dalga boyu kullanılmaktadır. (Keyser vd., 2008).

Bir UV reaktörünün dizayn edilmesinde ve performansının optimizasyonunda, meyve suları gibi sıvı gıda ürünlerinin fiziksel, kimyasal ve optik özellikleri büyük önem taşımaktadır. Fiziksel özelliklerden viskozite ve yoğunluk, sistemde sıvının transferi ve akış modelinin etkinliğini belirlemektedir. Optik özellikler ise, UV ışınının geçirgenliğini ve bunun sonucu olarak sıvı gıdalardaki mikrobiyal inaktivasyonu etkileyen başlıca faktördür. Diğer yandan, kimyasal kompozisyon, briks ve su aktivitesi gibi özellikler de UV ışınlarının inaktivasyon etkinliğini değiştirebilmektedirler (Koutchma, 2008).

Taze meyve suları ve içecekler gibi sıvı gıdalarda bulunan renk bileşenleri ve organik bileşenler ve süspanse maddeler de bu ürünlerin suya göre daha az UV ışını geçirmesine neden olmaktadırlar. Dolayısıyla bu düşük geçirgenlik, UV pastörizasyonun etkinliğini azaltmaktadır (Koutchma, 2009).

Keyser vd., (2008) çeşitli meyve sularının (portakal suyu, elma suyu, guava ve ananas suyu, mango nektarı ve tropikal meyve suyu) mikroorganizma yüklerinin azaltılması amacıyla 10 lambalı türbülent akışlı bir UV sistemi kullanmışlar ve UV ışınlarının, incelenen meyve suyu ve nektarlarında mikrobiyal yükü azaltmada etkili olduğunu, ancak her meyve suyu için optimizasyonun gerekli olduğunu bildirmişlerdir.

Walkling-Ribeiro vd. (2008) elma suyunda UV uygulaması (20ºC'de 30 dakika) sonucunda, elma suyunun pH ve briks değerlerinin çok az düzeyde etkilendiğini, buna karşın askorbik asit içeriğinin 5,4 mg/100mL'den 4,0 mg/100mL'ye düştüğünü saptamışlardır. Uysal Pala ve Kırca Toklucu (2009), portakal suyunda 9 lambalı bir UV reaktörü kullanarak yapılan UV uygulaması sonucunda, portakal suyunun pH, titrasyon asitliği, brix ve toplam fenol içeriğinde önemli bir değişikliğin olmadığını, buna karşın askorbik asit içeriğinin sistemden 4 geçiş sonucunda %10,6 oranında azaldığını belirlemişlerdir. Guerrero-Beltran vd., (2009) üzüm, cranberry ve greyfurt sularında, UV ışın uygulama süresi uzadıkça her üç meyve suyunda da toplam renk farkının (ΔE) arttığını saptamışlardır.

6. Gamma ve X Işını Teknolojisi

Radyoaktif maddeler, atomlarının sürekli olarak parçalanması sırasında çevreye bazı ışınlar (örn., alfa, beta, gama, X-ışınları) yayarlar. Bu ışınlar çarptıkları materyalde elektrik yüklü iyonların oluşmasına neden olurlar. Bu ışınlara iyonize ışın adı verilir. İyonize ışın; iyonize olmayan görünür ışık, televizyon ve radyo dalgaları ile mikrodalgadan daha fazla enerjiye sahiptir. (Acar, 1999). Gıda ışınlama; gıdaların iyonize enerji olarak da adlandırılan iyonize ışınlarla muamele edilmesidir (Lacroix ve Ouattara, 2000).

Gıdaların muhafazasında gama ışınları, X ışınları ve hızlandırılmış elektron ışınları kullanılmaktadır. Bunlardan endüstride en yaygın olarak kullanılanı gama ışınlarıdır (A.D.A., 2000). Gama ışınları, Kobalt 60 (Co60) ve Sezyum 137 (Cs137) kaynaklarından üretilen ışınlardır. Işınlar direkt olarak ışınlanacak gıdanın üzerine verilir. Fakat gıda hiçbir zaman kobalt veya sezyum ile direkt temas ettirilmez (Lacroix ve Ouattara, 2000). X-ışınları 5 MeV (milyon elektron volt) ve daha düşük enerjide çalışan kaynaklardan üretilmektedir. X ışınlarının malzemeye giriciliği ve doz hızı yüksek olduğu için ışınlama süresi kısadır (A.D.A., 2000).

Gıda ışınlamada "doz" gıda maddesine ilave edilen bir madde değildir. Doz; gıda maddesinin radyasyona maruz bırakıldığı süre içerisinde absorbe ettiği radyasyonun miktarıdır. Işınlama gıdalarda radyoaktiviteye neden olmayan fiziksel bir proses, bir enerji girdisidir (Lacroix ve Ouattara, 2000).
Gıda ışınlama arzu edilen birtakım etkileri (örn., patojenleri öldürmek, raf ömrünü uzatmak, bozulmayı kontrol etmek, kimyasal fumigasyonun yerine kullanmak) elde etmek için iyonize radyasyon ile gıdaların muamele edilmesini kapsar. Bu uygulama; gıdaların ısısında önemli bir artışa sebep olmadığından termal olmayan bir işlem olarak bilinir (A.D.A., 2000).
Işınlama hiçbir atık içermeyen fiziksel bir proses olması nedeniyle taze ve kolay bozulabilen gıdaların korunmasında uygulanan etkin bir yöntem olmakla birlikte her gıdaya uygulanması mümkün değildir (Lagunas-Solar, 1995).

7. Vurgulu (Atımlı) Işık

Vurgulu ışık (PL) teknolojisi; gıda maddelerinin sterilizasyonu amacıyla geniş spektrumlu beyaz ışığın yüksek güçte çok kısa sürelerde vurgular şeklinde uygulanmasıdır. Vurgulu ışık yönteminde, infrared bölgeye yakın olan UV bölgedeki geniş spektrumlu dalga boyları (200 nm-1 mm) kullanılmaktadır (Senorans vd., 2003). İşlem sırasında üründe önemli bir sıcaklık artışı gerçekleşmediği için, bu yöntem ısıl olmayan muhafaza yöntemi olarak kabul edilmektedir (Yıldız, 2012)
PL teknolojisi, meyve suları, et ürünleri, sebzeler ve meyveler gibi gıdaların dekontaminasyonunun kısa bir süre için yüksek yoğunluklu ışık darbeleri kullanılarak elde edildiği termal olmayan bir teknolojidir. Bu işlemden sonra patojen bakterilerin anlamlı bir şekilde azaldığı çalışmalar mevcuttur. Çok kısa muamele süresinde önemli mikrobiyal azalma, düşük çevresel etki ve yüksek esnekliği PL'nin en önemli faydalarından bazılarıdır. PL sistemleri az miktarlarda katı atık üretir (Bhavya ve Umesh Hebbar, 2017).
Çeşitli katı ve sıvı gıda ürünleri, PL işleme ile dekontamine edilir ve bu da raf ömrünü uzatır. Bakterilerin PL'ye duyarlılığı türlerine ve hücre zarı kalınlığına bağlı olarak değişir. Aynı zamanda gıdanın yüzeyindeki pürüzlülük vb. gibi etkenler de dekontaminasyonu olumsuz yönde etkileyebilir. Pürüzsüz, düz yüzeye sahip gıdalarda daha etkili olmaktadır. PL teknolojisi, gıda ürünlerinin beslenme kalitesini arttırmak için de kullanılmaktadır. Lipitlerin oksidatif stabilitesini arttırmakla birlikte, bazı meyvelerde antioksidan kapasiteyi ve toplam fenolik miktarını da arttırabilir (John ve Ramaswamy, 2018).

8. Ohmik Isıtma

Joule yasasına göre bir direnç üzerinden geçen elektrik akımı direncin içerisinde ısı oluşumuna neden olmaktadır. Ohmik ısıtma işleminde gıda direnç görevini görmekte, gıda maddesinden alternatif akım geçirilmekte ve elektrik enerjisi ısı enerjine dönüştürmektedir (Baysal vd., 2011).
Ohmik ısıtma hızlı ve homojen ısıtma sağlaması, daha iyi ürün kalitesi sağlaması, ısıtma süresini kısaltması, düşük sermaye maliyeti gerektirmesi, enerji verimliliğinin yüksek olması ve çevreci bir ısıtma işlemi olması gibi birçok avantaja sahiptir (Varghese vd., 2014).
Yüksek elektriksel iletkenlik değerine sahip gıdalar daha hızlı ısınmaktadır. Gıdaların elektriksel iletkenlik değerleri gıdanın bileşimi ve fiziksel yapısıyla farklılık göstermektedir. İyonik çözeltilerde sıcaklık ve iyon konsantrasyonu arttıkça elektriksel iletkenlik değeri artmakta ve böylelikle ısınma için gereken süre kısalmaktadır. Katı-sıvı karışımlarında ise parçacık boyutunun artması veya azalması ile birlikte efektif elektriksel iletkenlik değeri değiştirilebilmektedir (Baysal vd., 2011). Ohmik ısıtma işlemi günümüzde ön ısıtma, pastörizasyon, sterilizasyon, çözündürme, pişirme, haşlama, ekstraksiyon gibi birçok amaçla uygulama yeri bulmaktadır. Ohmik ısıtmanın kullanıldığı bazı çalışmalar Tablo 2'de gösterilmektedir (Baysal, T., 2011).

10. SONUÇ

Gıda endüstrisinde yeni teknolojilerle birlikte ısıl işleme alternatif olarak doğan yeni teknik ve metotların mikrobiyolojik gelişimi önlemenin ve gıda kalitesini artırmanın yanı sıra fiziksel, besinsel biyoaktif bileşiklerin ve organoleptik özelliklerin de; geliştirmesi ve mevcut özelliklerinin işlenme aşamalarından olumsuz etkilenmesini minimal düzeyde tutarak uygulanmaktadır. Tüm gıda türleri ve tipine göre uyarlanabilir hatta geleneksel termal tekniklerle kombine olarak çalıştırılarak etkisinin yükseltilebilir oluşu açısından geniş bir kullanım alanına sahip olmaları, mikrobiyal inaktivasyon ve besin değerlerindeki kayıplar değerlendirilerek uygun işlem parametrelerinin saptanmasıyla birlikte tekniklerden en yüksek aktivitede faydalanılabilir. Metotların gelişen endüstriyel üretim aşamaların hızlı ve gıda güvenliği açısından arzulanan ürünlerin elde edilmesini kolaylaştırması; ekolojik ve düşük maliyetli tekniklerin global çapta ısıl olmayan teknikler üzerine taleplerin yoğunlaşacağını göstermektedir. Elde edilen ürünlerin tüketiciler üzerinde oluşturdukları metabolik etkilerin araştırılması tekniklerin, ısıl olmayan teknolojiler arasında tercih edilme potansiyellerini yükseltebilir.

Tablo 2. Ohmik ısıtmanın kullanıldığı çalışmalar

Boru hattı sistemlerinde ohmik ısıtmanın kullanıldığı bazı çalışmalar

Ürün	Güç / Voltaj Gradyanı	Sonuç
Portakal Suyu	50 kW	Portakal suyunda pektin esteraz aktivitesinde %98 azalma ve C vitaminde ise %15 azalma meydana gelmiştir.
Domates Suyu	25 - 40 V/cm	40 V/cm değerinde ısıtılan domates suyunda 30 s sonunda örneklerde incelenen mikroorganizmaların tespit limitinin altında olduğu saptanmıştır.
Elma suyu	26.7 V/cm	100°C'de 30 s ohmik ısıtma uygulaması, örneklere inoküle edilen tüm mikroorganizmaların inaktivasyonunu sağlamıştır.

Ohmik ısıtmanın diğer gıda işleme uygulamalarında kullanımına yönelik bazı çalışmalar

İşlem	Ürün	Sonuç
Ohmik Evaporasyon	Nar suyu, Vişne suyu	Yüksek voltaj gradyanlarında ohmik ısıtma destekli vakum evaporasyon uygulamasının enerji verimliliğinin geleneksel vakum altında evaporasyona göre daha yüksek olduğu ve konsantrasyon işleminin süresinin kısaltıldığı belirlenmiştir.
Ohmik Ekstraksiyon	Pektin	Portakal suyu atıklarından elde edilen pektinin daha yüksek verimde ekstrakte edilmesi sağlanmıştır.

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Bjerkandera adusta collected from Niğde: Analysis of Total Phenolic Compound, Antioxidant, and Antimicrobial Properties

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Abstract

Macrofungi have long been used as food and medicinal purposes by humankind. This study aimed to identify a macrofungus sample collected from Niğde, Türkiye in 2019 via molecular techniques and determine the content of total phenolic compounds, antioxidant and antimicrobial activities. According to data obtained from the sequence analysis of ITS fragment of rDNA the macrofungus sample was identified as *Bjerkandera adusta* (Willd.) P. Karst (1880). The sample was extracted with ethanol and methanol. Total phenolic compound content, antioxidant activity via DPPH scavenging method and antimicrobial activity via disc diffusion method of *B. adusta* was determined by using these extracts. The amount of total phenolic compounds was found as 772.28 µg GAE/mL for a methanolic extract of *B. adusta*. The ethanol extract of *B. adusta* showed 79.66% scavenging activity of 0.1 mM DPPH solution. The highest inhibition zone diameter was measured as 28±1 mm against *P. aeruginosa* by ethanolic extract, while the lowest antimicrobial activity was found in 15 µL methanol extract against *S. typhimurium* with an inhibition zone diameter of 8.7±1.2 mm.

Key Words: *Macrofungi, Bjerkandera adusta, antioxidant, total phenolic, antimicrobial*

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The Relationship Between Creative Cities and Expo Cities

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Abstract
This study highlights the national and international achievements of the UNESCO Creative Cities Network and Expo cities, their relationships with their communities, and their influence on shaping the future. Looking at the developments that have shaped the history of Expo, which began in 1851, it is clear that today's World's Fairs will also pave the way for the first inventions of the technologies of the future. International cultural recognition is also strengthened by the UNESCO Creative Cities Network, which ensures that the cultural heritage, architectural structures, diverse geographical features and culinary cultures of cities are passed on in a healthy way to future generations. For this reason, the close relationship between living heritage and creative urban approach should be clarified and cities should be included in local development plans. In conclusion, this study emphasizes that the cultural heritage of cities can be the source for the development of countries through UNESCO Creative Cities Network and the future technologies through Expo Cities.
Key Words: *Unesco Creative Cities Network, World Expos, Cultural heritage, Future technology, Local development*

Yaratıcı Şehirler Ve Expo Şehirleri Arasındaki İlişki

Özet
Bu çalışmada UNESCO Yaratıcı Şehirler Ağı'nda yer alan şehirler ile Expo şehirlerinin ulusal ve uluslararası düzeyde kazanımları, çevresiyle ilişkileri ve geleceğin şekillenmesinde etkileri üzerinde durulmuştur. 1851 yılında başlayan Expo tarihinin iz bırakan gelişmeleri ele alındığında günümüz Dünya Expo'larının da geleceğin teknolojilerinin ilk buluşlarına zemin hazırlayacağı görülmektedir. Şehirlerin sahip olduğu kültürel mirası, mimari yapıları, farklı coğrafi özellikleri ve mutfak kültürlerini gelecek nesillere de sağlıklı aktarılmasını sağlayan Unesco Yaratıcı Şehirler Ağı ile ülkeler arası kültürel tanınırlık da artırılmaktadır. Bu sebeple yaşayan kültürel miras ve yaratıcı şehir yaklaşımı arasındaki güçlü ilişkinin belirginleştirilmesi, şehirlerin yerel kalkınma planları içerisinde de yer alması gerekmektedir. Özetle bu çalışmada şehirlerin sahip olduğu kültürel mirasının UNESCO Yaratıcı Şehirler Ağı ile gelecek teknolojilerin de Expo Şehirleri vasıtasıyla ülkelerin kalkınmalarının kaynağı olabileceği üzerinde durulmaktadır.
Anahtar Kelimeler: *Unesco Yaratıcı Şehirler Ağı, Dünya Expo'ları, Kültürel miras, Gelecek Teknoloji, Yerel Kalkınma*

UNESCO Yaratıcı Şehirler Ağı (UCCN)

Yaratıcı şehirler kavramı literatürde ilk kez 1988 yılında David Yencken tarafından Meanjin isimli bir dergide yayınlanan makalesinde kullanılmıştır. Yencken (1988), yaratıcı şehirleri yaşam standartları yüksek, kültürel geçmişe sahip, vatandaşlarının sıra dışı deneyimler yaşayabileceği şehirler olarak ifade etmiştir (Gülduran ve Arıkan Saltık, 2020). Birleşmiş Milletler Eğitim, Bilim ve Kültür Kurumu (UNESCO) Yaratıcı Şehirler Ağı (UNESCO Creative Cities Network-UCCN), 2004 yılında yaratıcılığın kentlerin sürdürülebilir kentsel gelişim süreçleri içerisinde stratejik bir faktör olarak tanımlanması ve kentlerin birbirleriyle yaratıcı faaliyetlerde iş birliği yapabilmesi için kurulmuş bir network ağıdır. Dünya geneli 295 şehrin katılımıyla bu ağ altında toplanan şehirler uluslararası düzeyde yaratıcı faaliyetler ve kültür endüstrisinde iş birliği içerisinde bulunmakta ve bu aktif çalışmaları yerel düzeyde kalkınma planlarına dâhil etmektedirler.
UNESCO Yaratıcı Şehirler Ağı'na katılan şehirler, bu alanda başarılı olan uygulamalarını paylaşmayı ve sivil toplumu da içerisine alan kamu ve özel sektör ortaklıklarını geliştirmeyi taahhüt etmektedir. Taahhüt edilen maddeler içerisinde kültür ve yaratıcılığın yerel sürdürülebilir kalkınma planlarına tam olarak entegre edilmesi, özellikle marjinalleştirilmiş veya savunmasız gruplar ve bireyler için kültürel yaşama katılımın ve erişimin iyileştirilmesi, yaratıcılık ve yenilik merkezlerinin geliştirilmesi ve kültür sektöründeki yaratıcılar ve profesyoneller için fırsatların genişletilmesi, kültürel faaliyetlerin/ürünlerin/servislerin yaratılması, üretilmesi, dağıtılması ve yaygınlaştırılmasının güçlendirilmesi öne çıkmaktadır. Yaratıcı Şehirler Ağı, yalnızca sürdürülebilir kalkınmanın güçlendirilmesinde yaratıcılığın etkin rolü üzerine düşünmek için bir platform olarak değil, aynı

zamanda 2030 Sürdürülebilir Gelişim Gündemi'nin uygulanması için UNESCO'nun efektif bir kuruluşu olarak önem kazanmıştır UCCN yedi yaratıcı alanı kapsamaktadır (Creative Cities Network, 2022):

- ✓ El Sanatları ve Halk Sanatları
- ✓ Medya Sanatları
- ✓ Film
- ✓ Tasarım
- ✓ Gastronomi
- ✓ Edebiyat ve Müzik

Türkiye'den Yaratıcı Şehirler

Türkiye'den 7 şehir UNESCO Yaratıcı Şehirler Ağı'na katılmıştır (Şekil 1) (TRT Haber, 2022).



Şekil 1. Türkiye'nin UNESCO'da ki yaratıcı şehirleri ve yaratıcılık alanları (TRT Haber, 2022)

2015 yılında Gaziantep, Yaratıcı Şehirler Ağı'na gastronomi alanında Türkiye'den katılan ilk şehir olmuştur. Farklı medeniyetlere ev sahipliği yapmış olan Gaziantep çok kültürlü yapısı ve zengin mutfağıyla dikkat çekmektedir (Akın ve Bostancı, 2017). Gaziantep'ten sonra zengin mutfak kültürüyle gastronomi alanında seçilen ikinci şehir Hatay olmuştur ve 2017 yılında UNESCO Yaratıcı Şehirler Ağı listesine girmeyi başarmıştır. 2016'da UNESCO Somut Olmayan Kültürel Miras Listesine girmeye hak kazanan Kütahya, çini sanatıyla 2017 yılında zanaat ve halk sanatları alanından UNESCO Yaratıcı Şehirler Ağı'na Türkiye'den katılan ilk şehir olmuştur (Şekil 2) (UNESCO Yaratıcı Şehirler Ağı, 2022).



Şekil 2. Kütahya çini sanatı (Anonim, 2022)

Tasarım alanında ise 2017 yılında İstanbul seçilmiştir. İstanbul köklü tarihi, çok kültürlü yapısı, usta ve zanaatkârların emekleriyle şekillenen tarihi yapıları ve doğal güzellikleriyle tasarım alanında dikkat çeken unsurlara sahiptir (Şekil 3) (UNESCO Yaratıcı Şehirler Ağı, 2022).



Şekil 3. Valide Han ve Rumeli Hisarı'ndan İstanbul manzarası (Yıldırım, 2017)

UNESCO Yaratıcı Şehirler Ağı'na müzik alanında Türkiye'den katılan ilk şehir Kırşehir'dir. 2019 yılında katılımı gerçekleşen Kırşehir, Anadolu kültüründeki abdallık ve bozlak geleneğinin önemli isimlerinden Neşet Ertaş, Muharrem Ertaş, Hacı Taşan ve Çekiç Ali gibi halk ozanlarıyla ünlenmiştir (T.C. Kırşehir Valiliği, 2019). Yöresel tariflerle zenginleşmiş mutfak sanatına sahip olan Afyon 2019 yılında gastronomi alanında listeye katılan üçüncü şehir olmuştur (UNESCO Afyonkarahisar Gastronomi Şehri, 2020). 2014'te UNESCO Dünya Mirası Listesi'ne Hanlar Bölgesi, Sultan Külliyeleri ve Cumalıkızık'la giren Bursa şehri, çini sanatı ve ipek işlemeciliği ile zanaat ve halk sanatları alanından UNESCO Yaratıcı Şehirler Ağı'na 2021 yılında dâhil olan ikinci ve son şehirdir (Şekil 4) (Bursa Büyükşehir Belediyesi, 2021).



Şekil 4. Bursa şehri çini sanatı ve ipek işçiliği (Bursa Büyükşehir Belediyesi, 2021)

Dünya Expo'ları

Expo, İngilizce "exposition" kelimesinin kısaltmasıdır ve Türkçe'de "sergi, fuar" anlamına gelmektedir. Fuar kelimesinin kökeni ise Fransızca ''foire'' kelimesinden gelmektedir. Kelime anlamı ''panayır, fuar'' olarak bilinmekte ve Türk Dil Kurumu kaynaklarında tanımı ''belli zamanlarda, belli yerlerde ticari mal sergilemek amacıyla açılan büyük sergi'' olarak yer almaktadır (Hür, 2019). Diğer bir ifadeyle Expolar kültür, tarih, eğitim, sanat, eğlence ve ticaret alanlarında düzenlenen büyük olimpiyatlardır. "Dünya Fuarı" ya da "Dünya Sergisi" olarak da isimlendirilen Expolar Dünya tarihinde 19. yüzyılın ortalarına kadar uzanmaktadır (Kaya vd., 2019). Günümüzden 171 yıl önce gerçekleştirilen ilk Expo Londra, Hyde Park, Kristal Palas'ta 1851 yılında "Bütün Milletlerin Büyük Sanayi Eserleri Sergisi" temasıyla düzenlenmiş ve sanayi devriminin icatları sergilenmiştir.

Uluslararası Sergiler Bürosu (BIE) tarafından gerçekleştirilen bu organizasyonlarda 3-6 ay arası süren 4 çeşit fuar düzenlenmektedir: Dünya EXPO'su, Uluslararası özel temalı EXPO, Bahçecilik EXPO'su ve Milano Trienal. Uluslararası düzenlenen fuarların yanı sıra BIE onayı olmadan ülkelerin kendi içerisinde organize ettikleri 'fuar' ya da 'sergi'ler de düzenlenmektedir (URL-1, 2022). Düzenlenen Expo kategorilerine göre sergi süreleri, minimum sergi alanları ve başvuru süreleri değişmektedir (Tablo 1) (DOĞAKA, 2022).

Tablo 1. Expo kategorilerine göre fuar süreleri, minimum sergi alanları ve başvuru süreleri (DOĞAKA, 2022)

Kategori	*Resmi İsim*	*Süre*	*Minimum Sergi Alanı*	*Başvuru*
A1	Büyük Uluslararası Bahçe Bitkileri Sergileri	3-6 ay	50 ha	2-6 yıl önce (BIE onayı gerekli)
A2	Uluslararası Bahçe Bitkileri Sergileri–Kısa Süreli	8-20 gün	15.000 m^2	En az 4 yıl öncesinde
B1	Uluslararası Katılımlı Sergiler– Uzun Süreli	3-6 ay	25 ha	3-7 yıl öncesinde
B2	Uluslararası Katılımlı Sergiler– Kısa Süreli	8-20 gün	6.000 m^2	2 yıl öncesinde
A2/B1	Uluslararası Katılımlı Sergiler– Uzun Süreli	3-6 ay	25 ha	3-7 yıl öncesinde

Expolar, 1851 yılından bugüne kadar yeniliğin, gelecek teknolojilerin, farklı Dünya kültürlerinin ve yaratıcı endüstrilerin paylaşıldığı interaktif eğitim ve eğlence alanları haline dönüşmüştür. İnsanlık tarihinde iz bırakan önemli gelişmeler bu fuarlarda ziyaretçilere açılmıştır. Örneğin ilk canlı tv yayını 1939 yılında New York Dünya Fuarı'nda, "Ultra High Definition Video(UHDV)" olarak isimlendirilen Süper Hi-Vision Sineması Japonya'da 2005 Expo'da tanıtılmıştır (URL-2, 2022). Expoları ölümsüzleştiren diğer yanı da sergi alanları ve yapılardır. Sergi alanlarında kullanılan pavyonların çoğunluğu süreç sona erdikten sonra sökülmüş veya sahibi olduğu ülkeye geri gönderilmiştir. Gelecek zamana ulaşmayı başaran yapıların başında Paris şehrinin anıtsal mimari eserlerinden Eiffel Kulesi örnek gösterilebilir. 1889 Paris Evrensel Sergisinin merkezinde bulunan yapı 300 metre yüksekliği ile döneminde yapılmış en yüksek kuledir. Dökme demirden oluşturulan strüktürüyle döneminin mühendislik eseridir (Madran, 2000). Yaşanılan dönemin kültürü, teknoloji seviyesi, mimari akımları ve dönemi etkileyen tarihi süreçler Expo'ların tasarımından temalarına kadar belirleyici olmuştur. Tarihte Sanayi Devriminin getirdiği yeni rekabet ortamı, I. Dünya Savaşı (1914-1918), II. Dünya Savaşı (1939-1945) ve II. Sanayi Devrimi gibi önemli dönemler expolarda seçilen temaları birebir etkilemiştir (Özkelle, 2006; Hür, 2019).
Evrensel EXPO olarak ifade edilen Dünya Expo'ları 5 yılda bir düzenlenmekte ve 6 ay sürmektedir. Yakın geçmişte organize edilmiş olan Dünya Expo'ları 2000-Hannover (Almanya), 2005-Aichi (Japonya), 2010-Şanghay (Çin), 2015-Milano (İtalya), 2020-Dubai (Birleşik Arap Emirlikleri) şehirlerinde gerçekleştirilmiştir. 2025 yılı için de Japonya'nın Osaka şehri fuara ev sahipliği yapacaktır. "Hayatlarımız İçin Geleceğin Toplumunu Tasarlamak" ana temasıyla 13 Nisan-13 Ekim 2025 tarihleri arasında düzenlenmesi planlanmaktadır. Orta Doğu'da ilk ke gerçekleştirilen Expo 2020 Dubai, Covid-19 Pandemisi nedeniyle bir yıl sonra 1 Ekim 2021'de açılmıştır. Expo 2020 Dubai'nin "Zihinleri Birleştirmek ve Geleceği Yaratmak" sloganıyla katılımcı ülkeler sergi alanlarını tasarlamıştır. Katılan pavyonların ana temaları "mobilite-hareketlilik", "sürdürülebilirlik" ve "olanak-fırsat" olmuştur (Şekil 5) (URL-3, 2022).
Expolar sayesinde çeşitli alanlarda bilgi birikimi ve uzman görüşlerinin paylaşımı interaktif bir ortamda gerçekleştirilmektedir. Ülkeleri temsil eden ürünleri, sahip oldukları değerli varlıkları, tarihi ve kültürü gerçekleştirilen Expo temasına uygun şekilde çarpıcı mimari yapılarda katılımcılara sunulmaktadır. Dönemlik sergiler olmasına rağmen Dünya Expo'ları; şehirleri değiştirmiş ve bazılarına kentsel imge haline dönüşen eşsiz anıtsal yapılar da kazandırmışlardır.

Türkiye'nin Düzenlediği Expolar

Uluslararası Botanik Sergisine Türkiye, 23 Nisan-30 Ekim 2016 tarihleri arasında Antalya'da "Çiçek ve Çocuk" temasıyla ev sahibi ülke olmuştur. "Gelecek nesiller için yeşil bir dünya" hedefiyle düzenlenmiş A1 kategorisinde Botanik bir expodur. 112 hektarlık bir alan üzerinde gerçekleştirilen Expo 2016 Antalya'nın alt temaları "tarih", "biyo-çeşitlilik", "sürdürülebilirlik" ve "yeşil şehir" dir (Hür, 2019). Botanik Expo'ları Uluslararası Çiçek Üreticileri Birliği (AIHP) ile Uluslararası Sergiler Bürosu (BIE) onayı ile gerçekleştirilmektedir. AIPH Konseyi tarafından kabul edilen projeler düzenlenme hakkının onaylanması için BIE Genel Kurulu'nda değerlendirilmektedir. İki kurumun da onayından sonra ev sahibi ülkeye ve şehre Botanik Expo'su düzenleme yetkisi verilmektedir. Şekil 6'da Expo 2016 Antalya'dan bazı görseller sunulmuştur (URL-4, 2022).



Şekil 5. Dubai Expo 2020 Pavyonlar (URL-3, 2022)



Şekil 6. Expo 2016 Antalya (URL- 5, 2017)

Antalya'dan sonra Türkiye'den Hatay şehri 2021 Botanik Expo'su için ev sahipliği yapmaya hak kazanmıştır. "Medeniyetler Bahçesi" temasıyla ev sahibi olmayı hak kazanan Hatay'da organizasyon pandemi nedeniyle 1 Nisan 2022 – 29 Ekim 2022 tarihlerinde gerçekleştirilmesi kararı alınmıştır. B1 kategorisinde 6 ay sürmesi planlanan botanik dalındaki Expo 2021 Hatay içerisinde Gastronomi Köyü, açık ve kapalı fuar alanları, Medeniyetler Bahçesi, tıbbi ve aromatik bitki parkı, biyolojik gölet, kültür ve sanat sokağı yer almaktadır (Şekil 7) (URL-6, 2022).



Şekil 7. Expo 2021 Hatay (URL- 6, 2022)

Sonuç

Çağımız teknolojisi ve yeni keşifler günümüz Dünya'sında hızla ilerlememize olanak sağlarken gelişime ayak uydurabilmek için ülkeler ortak akılda birleşmeye son yıllarda daha çok önem vermişlerdir. Ülkelerin uzmanlaşmış oldukları alanlarda ki bilgi birikimlerini ve deneyimlerini paylaşmaya olanak sağlayan Expo'lar katılımcılar için interaktif sergilerle eğlenceli ve eğitici sahalar sunmaktadır. 1851 yılıyla başlayan Expo tarihi ilk zamanlarda daha çok yeni teknolojik ürünlerin tanıtımı üzerinde yoğunlaşırken özellikle 2000 yılı sonrasında düzenlenen Dünya Expo'larının ana temalarının içerisinde daha yaşanılabilir, ekolojik ve sürdürülebilir gelecek Dünya üzerinde durulmaktadır. Türkiye'nin de sahip olduğu doğal, kültürel, sosyal zenginliğinin daha tanınabilir hale getirilmesi için bu etkinliklerde yer alması ülke imajını güçlendirecektir. Medeniyetler şehri Hatay'ın 2017 yılında Unesco Yaratıcı Şehirler Ağı'na katılımının arkasından Expo 2021'i düzenlemeye hak kazanması hiç şüphesiz farklı amaçlara hizmet etse de yaratıcı şehirler ve Expolar arasındaki güçlü bağı işaret etmektedir. Dünya'dan bu ilişkiye diğer bir örnekte Dubai'dir. Dubai 2018 yılında "Tasarım" alanında Unesco Yaratıcı Şehirler Ağı'na dahil olmuş ve iki yıl sonra da Expo 2020 Dubai'ye ev sahipliği yapmayı kazanmıştır. Türkiye'den de 2017 yılında "Tasarım" alanında Unesco Yaratıcı Şehirler Ağı'na katılan İstanbul'un gelecekte Dünya Expo'suna ev sahibi şehir olabileceğini öngörebiliriz. Bu amaçla, şehirlerin kalkınma planları içerisinde gelecek organizasyonlara ev sahipliği yapabilmesi için önünde ki engeller kaldırılmalı ve alt yapı, ulaşım ağları, yenilikçi merkezler, kültürel etkinlikler ve akıllı tasarımlar arttırılmalıdır.

Teşekkür

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Is The World Ready for A New Pandemic After The Covid-19 Pandemic?

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Abstract
Although epidemics have occurred many times in human history, each pandemic has different characteristics and brings with it difficulties that change according to its era. The Covid-19 outbreak emerged at a time when a significant portion of the world's population lived in cities. Factors such as spatial use and population density in cities have increased the spread of the virus and the severity of the epidemic. Scientists predict that outbreaks like Covid-19 will become more frequent due to factors such as global warming, etc. In this context, the necessity of integrating the measures to be taken against the pandemic with other disaster risk reduction measures was emphasized by The United Nations Office for Disaster Risk Reduction (UNDRR), and pandemic measures were also included in the studies to strengthen the resilience of cities to disasters. The spatial planning and design approaches of cities need to be re-examined in order to create a sustainable environment without breaking the Nature-Human-City relationship in emergencies such as pandemics. The aim of this study is to examine the changes in urban systems during the post-pandemic period and to reveal new standards in urban living, working and socializing spaces. For this purpose, cities with different sizes and population density are selected and it is aimed to examine how they experience the pandemic process, the environmental and political decisions taken, the use of spatial open spaces, the adaptation process of the city residents to the new conditions, the gains/losses of this new normal to nature and the inner-city socio-cultural environment. As a result of on-site observations and analyzes, data on how urban components such as urban transportation axes, nodal points, public spaces, recreational areas, residential areas and open green lands should be planned in case of new pandemics or natural disasters can be obtained.
Key Words: *Covid-19, spatial planning and design, pandemic, healthy cities, open-green lands*

Covid-19 Pandemisi Sonrası Dünya Yeni Bir Pandemiye Hazır mı?

Özet
Salgınlar insanlık tarihinde pek çok kez yaşanmasına rağmen, her pandemi ayrı özellik göstermekte ve yaşanılan döneme göre değişen zorlukları da beraberinde getirmektedir. Covid-19 salgını dünya nüfusunun önemli bir kısmının kentlerde yaşadığı bir dönemde ortaya çıkmıştır. Kentlerdeki mekânsal kullanım ve nüfus yoğunluğu gibi faktörler virüsün yayılmasını ve salgının şiddetini artırmıştır. Bilim insanları Covid-19 benzeri salgınların küresel ısınma vb faktörlerin etkisiyle sıklaşacağı öngörüsünde bulunmaktadır. Bu bağlamda BM Afet Risklerini Azaltma Özel Temsilciliği (UNDRR) tarafından pandemiye karşı alınacak tedbirlerin diğer afet risklerini azaltma tedbirleriyle bütünleştirilmesi gerekliliğine vurgu yapılmış, kentlerin afetlere dirençliliğinin artırılmasına yönelik çalışmaların arasına pandemi tedbirleri de dahil edilmiştir. Doğa-İnsan-Kent ilişkisinin pandemi vb. acil durumlarda kopmamasını sağlayacak sürdürülebilir bir çevrenin yaratılabilmesi için kentlerin mekânsal planlama ve tasarım yaklaşımlarının yeniden incelenmesi gerekmektedir. Bu çalışmada amaç, pandemi sonrası süreçte kentsel sistemlerin değişimlerini incelemek ve kent içi yaşama, çalışma ve sosyalleşme mekânlarında yeni standartları ortaya çıkarmaktır. Bu amaçla büyüklükleri ve nüfus yoğunluğu farklı olan kentler seçilerek pandemi sürecini nasıl yaşadıkları, alınan çevresel ve politik kararlar, mekânsal açık alanların kullanımı, kent sakinlerinin yeni şartlara uyum süreci, bu yeni normalin doğaya ve kent içi sosyo-kültürel çevreye kazanımları/kayıpları ekseninde incelenmesi hedeflenmektedir. Literatür araştırması neticesinde kent içi ulaşım aksları, düğüm noktaları, kamusal alanlar, dinlenme alanları, yerleşim alanları ve açık yeşil alanlar gibi kent içi bileşenlerin gelecekte yaşanılabilecek yeni pandemiler ya da doğal afetlerde nasıl planlanması gerektiğine yönelik veriler incelenmiştir.
Anahtar Kelimeler: *Covid-19, mekânsal planlama ve tasarım, pandemi, sağlıklı kentler, açık-yeşil alanlar*

Giriş

İnsanlık tarihi boyunca önemli enfeksiyon hastalıklar yaşanmış ve dünya düzenini yeniden şekillendirmiştir. Geçmişte iz bırakan hastalıkların başında veba, kolera, verem, çiçek, frengi, sıtma, ebola, HIV / AIDS, influenza ve sarıhumma gelmektedir (Sherman, 2013). 21. yüzyılın ilk küresel salgını (pandemisi) olan Domuz Gribi (H1N1 İnfluenza) 8.238, 2014'te Batı Afrika'da yaşanan Ebola Virüsü 11.325 kişinin ölümüne neden olurken, 1918'de New York ve Mexico City'de yaşanan İnfluenza (İspanyol Nezlesi) nedeniyle yaklaşık 30 milyon kişi ölmüştür

(Şanlı, 2010; Sherman 2013). 17 Kasım 2019 tarihinde Çin'in Hubei eyaleti başkenti olan Vuhan kentinde hayvansal enfeksiyon etkenli ilk vakanın ortaya çıkmasıyla başlayan (Yılmaz, 2020) ve çok hızlı bir şekilde yayılan yeni tip korona virüsün neden olduğu 2019 Koronavirüs hastalığı (Covid-19) Dünya genelinde küresel bir sağlık krizine neden olmuştur (Kabakcı, 2020; Page vd., 2021). Hastalık SARS Co-V'a benzerliği nedeniyle SARS CoV-2 olarak adlandırılmıştır (Sağlık Bakanlığı, 2020). 11 Mart 2020 tarihinde Dünya Sağlık Örgütü (DSÖ) küresel salgın (pandemi) ilan ettiğini açıklamış ve Türkiye'de de ilk vaka 17 Mart 2020 tarihinde bildirilmiştir (Billur ve Billur, 2020; Yılmaz, 2020; WHO, 2021). 16 Eylül 2022 tarihi itibarıyla Dünya genelinde 616.228.663 onaylanmış vaka, 595.431.698 iyileşen varken, Covid-19 nedeniyle 6.526.150 kişi hayatını kaybetmiştir (Worldometers, 2022). Bu hastalıklarda ölüm oranının fazla olmasının sebeplerinin başında kent içi sirkülasyonda sağlıklı sosyal çevrenin oluşturulamaması, yüksek nüfus yoğunluğu ve dikey kentsel planlama gibi faktörlerle bulaş oranının çok yüksek olması yer almaktadır. Ülkeler bulaşın azaltılabilmesi için çeşitli yaptırımlar, zorunlu kurallar ve caydırıcı cezalar uygulamaya çalışmış ama hastalığın yayılmasını engelleyememişlerdir. Bilim insanları Covid-19 benzeri salgınların küresel ısınma vb. faktörlerin etkisiyle sıklaşacağı öngörüsünde bulunmaktadır. Bu bağlamda Birleşmiş Milletler Afet Risklerini Azaltma Özel Temsilciliği tarafından pandemiye karşı alınacak tedbirlerin diğer afet risklerini azaltma tedbirleriyle bütünleştirilmesi gerekliliğine vurgu yapılmış, kentlerin afetlere dirençliliğinin artırılmasına yönelik çalışmaların arasına pandemi tedbirleri de dahil edilmiştir (The United Nations Office for Disaster Risk Reduction, 2021). Geçmişte de yaşanan benzer hastalık ve salgınlarda, kentler yeniden şekillendirilmiş ve sağlıklı çevreler oluşturulmaya çalışılmıştır. Özellikle, insanların sosyal mesafe kurallarına ceza ve yaptırımlarla uyulmasının sağlanması, zorlama bir yöntem olarak karşımıza çıkmaktadır. Bu nedenle doğa, insan ve kent ilişkisinin pandemi sürecinde kopmadan sürdürülebilir bir çevrenin yaratılabilmesi için kentlerin mekânsal planlama ve tasarım yaklaşımlarının yeniden incelenmesi gerekmektedir. Çalışmanın temel amacı, pandemi sonrası kentlerde mekânın mevcut biçimden, sağlıklı ve sosyal mesafeli çevreler sunan yeni formuna dönüşümünün nasıl olacağıdır; bu dönüşümde, mekânsal gereksinimler neler olmalıdır, vb. sorulara cevap aranmaktadır. Çalışma kapsamında ülkelerin pandemiyle mücadele yolları, mekânların insan sirkülasyonunu çok fazla kesintiye uğramadan aldığı yeni yaratıcı çözümler ve devletlerin aldığı kararlar incelenmiştir.

İklim değişikliği ve benzeri faktörlerle Covid-19 benzeri salgın riskinin giderek artacağı ve sıklaşacağı yönünde öngörüler bulunmaktadır. Covid-19 pandemisinin ülkesel farklılıklarının yanısıra farklı büyüklükteki kentsel alanlarda ve kırsal alanlarda etkileri de birbirinden farklı gerçekleşmiştir. Kırsal alanlarda yerleşim yerlerinin daha seyrek konumlanması, yatay yerleşimin çoğunlukta olması ve kişi başına düşen yeşil alanların oranı dikkate alındığında pandemide uygulanması gereken sosyal mesafe kurallarına daha kolay adapte olduğu izlenmektedir. Kentlerde ise durum daha karmaşık ve zorlayıcı hale dönüşmüştür. 21. yy da nüfusun önemli bir kısmı kentlerde yaşamaktadır. Özellikle büyük kentlerde dikey yerleşimin çoğunlukta olduğu kalabalık binalar, yoğun toplu taşıma noktaları, sokaklar, parklar, meydanlar, vb. yoğun kent hareketliliğinin yaşandığı, bulaş oranı yüksek merkezlerde yeniden düzenlemeler getirilmesi zorunluluk halini almıştır. Bu nedenle pandemi sonrası kentsel hareketliliği ve hareket modellerini anlayabilmek için ihtiyaçlara göre sağlıklı kentsel alanlar oluşturulması amaçlanmaktadır. Bu çalışma ile gelecekte de olabilecek yeni pandemi, epidemi ya da başka felaketlerin yaşanması durumunda hızla alınması gereken kararların neler olduğu ve hastalıklara karşı mekânsal planlama ve tasarım stratejilerinin geliştirilmesine katkı sağlanması ve merkezi/yerel kent planlamalara yol göstermesi hedeflenmektedir.

Araştırma yöntemini literatür araştırması ve karşılaştırma oluşturmaktadır. Covid-19 sürecinin tüm Dünya genelinde etkileri ve yapılan çalışmaların bilimsel değerlendirmesi için salgının ilk çıktığı günden bugüne kadar yapılmış yerli ve yabancı literatür taramasıyla çalışmalar (makaleler, bildiriler, güncel bilimsel veriler, kitaplar, internet siteleri) incelenmiştir. Çalışmada ülkelerin yönetim sistemleri, kendilerine özgü pandemi uygulamaları, kentlerde Covid-19 virüsünün farklı etkileri, yetkililerinin pandemiyle mücadele için aldıkları önlemler, kentlerin pandemi sonrası için hedefledikleri mekânsal planlama ve tasarım yaklaşımları, farklı ölçekteki kentler arasında ki uygulama farklılıkları incelenmiş ve örnekler toplanmıştır.

Ülkelerin Pandemiyle Mücadele Yöntemleri

Ülkelerin pandemiyle mücadele etmek için geliştirdikleri yöntemler farklıdır. Hepsinin ortak amaçları sağlıklı sosyal çevrenin oluşturulması, insanların gereksinimlerini sosyal mesafe kurallarına göre karşılamalarının sağlanması, bulaş riskini azaltıcı yapısal malzemelerin ve kişisel korunma ekipmanlarının kullanılmasının sağlanmasıdır. Çalışmalar, Covid-19 virüsünü bünyesinde daha az ve daha çok tutan malzemelerle ilgili önemli sonuçlar çıkarmıştır. Örneğin paslanmaz çelik, plastik, vb. materyaller yerine kimyasal işleme maruz kalmamış ham haldeki ahşap yüzeylerin tercih edildiği mekânsal planlamaların virüs yoğunluğunun azaltılmasında daha etkili olduğu ortaya çıkarılmıştır (Dietz vd., 2020). Kent kullanıcılarının maruz kaldığı yoğun pandemi korkusuyla psikolojik problemlerin artmaya başladığı gerçeği de sosyalleşme mekânlarının önemini bir kez daha kanıtlamaktadır. Bu nedenle insanları dış çevreyle yeniden sosyalleşebileceği hızlı ve yaratıcı çözümlemelerle güvenli ortamlar oluşturulması için projeler geliştirilmiştir. Amsterdam (Hollanda)'da bulunan bir sanat merkezine

ait restoran farklı amaçlar için yapılan beşgen biçimli seraları yemek odalarına dönüştürerek, farklı masalardaki müşterilerin birbirleriyle temasının kesilmesi ve insanların kendilerini güvende hissetmeleri amaçlanmıştır (Şekil 1) (Dinç, 2020).

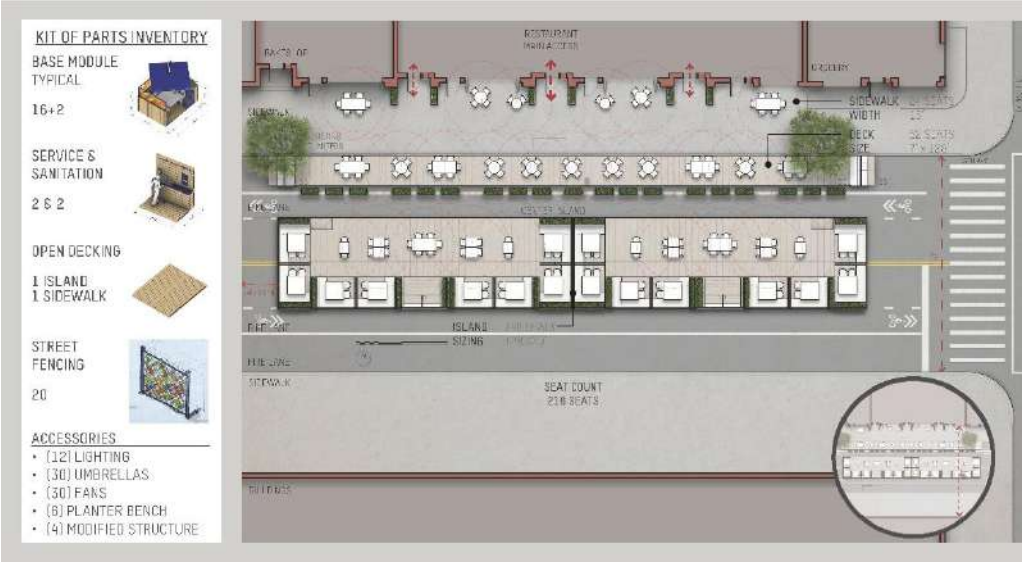


Şekil 1. Küçük seraların güvenlikli restoran bölümüne dönüştürülmesi, Amsterdam-Hollanda (Dinç, 2020)

Bir diğer örnekte de New York Kenti (ABD)'nde tasarımcı David Rockwell ve ekibi tarafından barların ve restoranların pandemi sonrası yeniden açılmasına yardımcı olmak için açık havada yemek yeme şablonu olan bir açık sokak girişimi önerilmektedir. Parça seti formülü ile bir restoranın iç yemek alanı küçük müdahalelerle kaldırımlara ve hatta cadde ortasına taşınarak genişletilmiştir (Şekil 2 ve 3). Bu tasarım stratejileriyle insanların kendini güvende hissetmesini sağlayacak pratik çözümler sunulması hedeflenmiştir (Dinç, 2020; Harrouk, 2020).

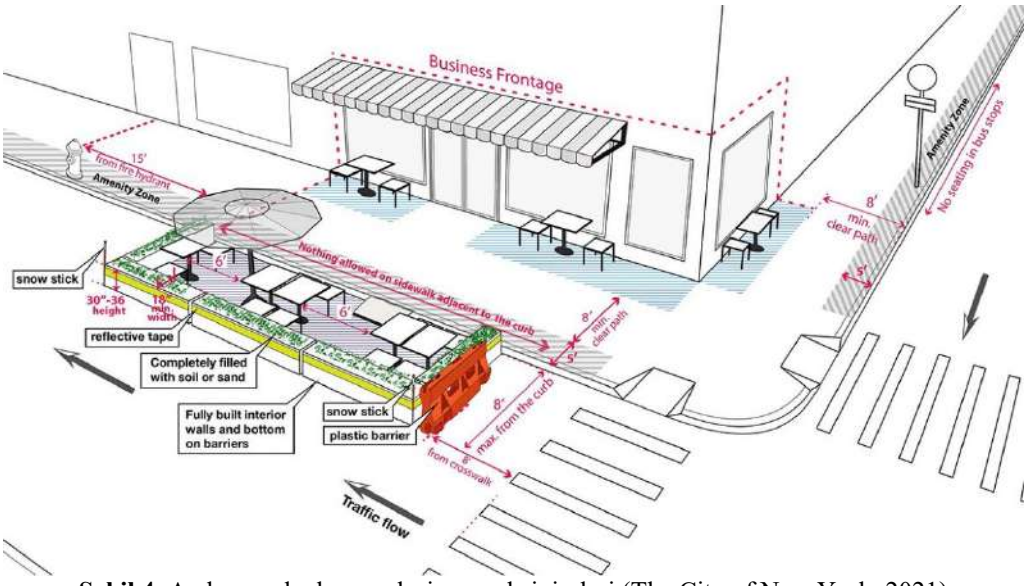


Şekil 2. Açık sokak girişim önerileri-1, Rockwell Group (Harrouk, 2020)



Şekil 3. Açık sokak girişim önerileri-2, Rockwell Group (Harrouk, 2020)

Açık alanı teşvik etmek, sosyal mesafeyi artırmak ve pandemi koşullarında ticaretle uğraşan kesimin ekonomik toparlanmalarına yardımcı olmak için restoranların açık havada oturma seçeneklerini genişletmek için New York Kent'i ne yönelik Açık Restoran Programı başlatılmıştır (Şekil 4) (The City of New York, 2021). Pandemi sürecinde mevcut işlevlerinin yanında çok farklı kullanımlarla topluma hizmete açılan kent içi alanların başında sokaklar, meydanlar ve park alanları gelmektedir. Yürüme, bisiklet sürme, sosyalleşme, yemek yeme, dinlenme alanları olarak tercih edilen bu mekânlar pandemiyle beraber sosyal hizmetlerin kişilere ulaştırılmasında istasyon görevi gördüğü mekânlar haline dönüşmüştür. Gezici sağlık merkezleri, hızlı test istasyonları, hijyen istasyonları, gıda/içme suyu/ilaç dağıtım noktaları ve aşılama merkezlerine kolay ve güvenli ulaşımın anahtar noktaları olmuşlardır. Bu nedenle Covid-19 sonrası için mahalle içi ara sokaklar (konut ağırlıklı), mahalle içi ana sokaklar (ticari, kurumsal, eğitim, vb.), kentsel ana arterler (toplu taşıma koridorları, ticari, ofis, vb.) ve sahil yollarında yeni standartların planlanması ve tasarımı için çalışmalar yürütülmektedir (The Global Designing Cities Initiative, 2020).



Şekil 4. Açık yemek alanı yerleşim gereksinimleri (The City of New York, 2021)

Ülkelerin Covid-19 Salgınıyla Sağlıklı Başa Çıkmasını Sağlayan Etmenler

Covid-19 salgınını kesin sonlandıracak etkili bir aşı veya ilaç tedavisi geliştirilemediği için ülkelerin de bu süreci daha başarılı yönetmesini sağlayan etmenleri şu şekilde sıralayabiliriz (Dinç, 2020);

- ✓ Sağlık sisteminin yeterliliği
- ✓ Sosyal politika adımları
- ✓ Doğru zamanlama ve erken müdahale

- ✓ Etkin takip ve karantina uygulamaları
- ✓ Siyasi sistemler ve yasal uygulamalar
- ✓ Eğitim düzeyi ve halkın bilinçlenmesi
- ✓ Sosyal medya araçlarının etkin kullanımı
- ✓ Mekânların salgına uyumlu yeni formlara dönüştürülebilir olması

Tüm Dünyada alınan önlemlerin başında toplu karantina, kısıtlamalar ve toplu etkinliklerin iptali göze çarpmaktadır. Ülkelere göre alınan ilk önlemler Tablo 1'de verilmiştir.

Tablo 1. Ülkelerin Covid-19 Salgınıyla Mücadelesinde İlk Aldıkları Önlemler

Ülke İsmi	Alınan Önlemler
Çin	✓ Toplu Karantina ✓ Sosyal alanların kapatılması ✓ Olimpiyat vs. etkinliklerin iptali ✓ Stadlar ve geniş açık alanların kitlesel karantina merkezleri haline dönüştürülmesi ✓ Yeni pandemi hastanelerinin inşası ✓ Karantina kurallarına uymayanlar için 3 ile 7 yıl arası hapis cezası ✓ Yurt dışından ülkeye giriş yapanlar için zorunlu karantina (URL-1, 2022)
Türkiye	✓ 65 yaş üstü ve devamında 20 yaş altı için sokağa çıkma yasağı ✓ Okulların kapatılması, uzaktan eğitime geçiş ✓ Sosyal alanların kapatılması ✓ Toplu Karantina ✓ Yurt dışı uçuşların iptali ✓ Çalışma saatlerinin azaltılması ✓ Evden çalışma sisteminin başlatılması (Güngör, 2020)
İtalya	✓ Avrupa'da karantina uygulaması başlatan ilk ülke ✓ İzin belgesi ile sokağa çıkabilme (Kaçak ve Yıldız, 2020)
Fransa	✓ Kısmi karantina ✓ Kalabalık etkinliklerin iptali ✓ Spor, kültür ve sanat etkinlikleri iptali ✓ Okulların kapatılması ✓ Ordunun gerekli hallerde sağlık sistemi içerisinde görevlendirilmesi ✓ İzin belgesi ile sokağa çıkma ✓ Yurt dışı girişlerine yasak ✓ Fransa pasaportu olanların 15 gün karantinada kalması koşuluyla ülkeye alınması (Kaçak ve Yıldız, 2020)
Almanya	✓ Kısmi karantina ✓ 2 kişi arası mesafenin en az 1,5 m olması ✓ Aile üyeleri ve aynı adreste ikamet edenler hariç 2 kişiden daha fazla toplanılma yasağı ✓ Okulların kapatılması ✓ Sosyal alanların kapatılması ✓ Spor, kültür ve sanat etkinlikleri iptali (URL-1, 2022)
ABD	✓ ABD vatandaşları ve sürekli oturum izni bulunanlar hariç ülkeye girişin yasaklanması ✓ Yurt dışından ülkeye giriş yapanlar için evde zorunlu karantina uygulanması ✓ Eyaletlerden yoğun vaka sayısına sahip olanlarda okulların kapatılması ✓ Üniversite eğitimlerinin uzaktan eğitimle sürdürülmesi ✓ Spor, kültür ve sanat etkinlikleri iptali ✓ 10 kişiden fazla toplanılmaması (Aydoğmuş, 2020)
İngiltere	✓ 'Sürü Bağışıklığı' uygulamasını tercih eden ilk ülke ✓ Üniversitelerin uzaktan ya da yüz yüze eğitim uygulamalarını tercih etme özgürlüğü sunulması ✓ Spor etkinliklerinin durdurulması ✓ İlk ve orta dereceli okulların kapatılması (Aydoğmuş, 2020)
Avustralya	✓ Toplu karantina ✓ Sosyal alanların kapatılması ✓ 5 kişiden fazla toplanılma yasağı ✓ Yurtdışından ülkeye giriş yapanlar için 14 gün zorunlu karantina ✓ Avustralya vatandaşları, sürekli oturum izni olanlar ve aileri hariç ülkeye girişlerin yasaklanması (Aydoğmuş, 2020)

Sonuç

Dünya, tarih boyunca salgın kriziyle savaşmak zorunda kalmış, büyük kayıplar vermiş ve gelecek afet, salgın ve felaketlere karşı hızla müdahale etmek ve önlemek için hazırlıklı olunması gerektiği gerçeğiyle yüzleşmiştir. Küresel bir sağlık krizine dönüşen salgın hastalıklarla beraber mekânların kullanımları da yeniden sorgulanmaktadır. Sağlıklı bir insan-doğa-kent ilişkisinde olması beklenenlerin başında kişi başı düşen yeşil alanların miktarı, kent parklarının herkes için erişilebilir olması, karbon emisyon oranlarının düşürülmesi için kent içi bisiklet ağlarının yaygınlaştırılması vb. sağlıklı çevreler oluşturulması beklenirken pandemiyle beraber yeni düzenlemeler ve standartlar zorunlu hale gelmiştir. Pandemi sonrası kentlerin bulaş riskini azaltıcı önlemlerle sosyal mesafe kurallarına göre yeniden planlanması ve tasarlanması geleceğin sağlıklı kentlerine yatırım olacaktır. Araştırma bu bağlamda ele alındığında hem yeni yetişecek mimarlık, planlama ve tasarım (mimarlık, peyzaj mimarlığı, şehir ve bölge planlama, iç mimarlık, endüstri ürünleri tasarımı) programlarında eğitim alacak öğrencilerin hem eğitim-öğretimleri hem de Dünya'da ve Türkiye'de gelecekte yaşanabilecek olası felaketlere karşı alınacak önlemler için önem arz etmektedir.

Ülkelerin gelişmiş, gelişmekte ya da gelişmemiş bir ülke olmasını belirleyen kriterlerin başında kişi başına düşen milli gelir miktarı, sağlık olanakları, eğitim durumu, teknolojik gelişimi, ulaşımı, hukuku gibi birçok faktör belirleyici olmaktadır. Türkiye gelişmekte olan ülkeler arasında yer almaktadır. Pandeminin etkileri sadece ülkelere göre değil farklı büyüklük ve nüfus yoğunluğuna sahip olan kentlerde bile farklılıklar göstermektedir. Her ülke yönetimsel olarak kendi politikalarını uygulamış, kentsel yerleşimler içerisinde pandeminin kamusal alanlar, açık yeşil alanlar, sosyal mekânlar, insan sirkülasyonunun sürekli olduğu kent içi ulaşım ağları, cadde/sokak ve meydanlar üzerinde ki etkileri incelenmiştir. Bu incelemeler neticesinde görülmektedir ki yeni nesil akıllı teknolojiler ve akıllı kentsel uygulamalar salgınla baş etme yöntemlerinin başında gelmelidir. Özellikle nüfusu 10 milyonun üzerinde ki mega kentlerde sosyal düzen ve sağlık hizmetlerinin aksamaması için çeşitli afetlere ve pandemilere dirençli kentsel planlama ve tasarımlara ihtiyaç duyulmaktadır.

Teşekkür

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The Effect of Different Breeding Systems on Egg Quality

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Abstract

In this study, the effect of enriched cage system and free-raising system on egg quality of ATAK-S layer hybrid was investigated. The research was carried out in Niğde Ömer Halisdemir University Ayhan Şahenk Agricultural Research and Application Centre. In the study, there were 3 replications in enriched cages and 20 animals were used in each replication. In addition, 12 replications were used in the free- range system and 30 animals were used in each replication. In total, 60 layer hybrid from the cage system and 360 layer hybrid from the free- range system were used. The study started when the layers were 29 weeks old and continued until 41 weeks old, and egg samples were collected every 4 weeks. For egg quality analysis, 36 eggs were collected from the enriched cage system and 95 eggs from the free-range system. While the effect of the breeding system on egg weight, yolk index and yolk score was found to be significant ($P<0.01$), the effect of other quality characteristics was not statistically significant ($P>0.05$).

As a result, layers in enriched cages have an advantage in terms of egg weight and yolk score, while layers in free-range system have an advantage in terms of yolk index.

Key Words: *Breeding system, Layer hybrid, Egg quality*

Farklı Yetiştirme Sistemlerinin Yumurta Kalitesine Etkisi

Özet

Araştırmada zenginleştirilmiş kafes sistemi ve serbest yetiştirme sisteminin ATAK-S yumurtacı hibritlerin yumurta kalitesine etkisi araştırılmıştır. Araştırma Niğde Ömer Halisdemir Üniversitesi Ayhan Şahenk Tarımsal Araştırmalar Uygulama ve Araştırma Merkezinde yürütülmüştür. Araştırmada, zenginleştirilmiş kafeslerde 3 tekerrür vardır ve her tekerrürde 20 hayvan kullanılmış. Bunun ile birlikte serbest sistemde 12 tekerrür ve her tekerrürde 30 adet hayvan kullanılmıştır. Toplamda kafeste sisteminden 60 hayvan, serbest sistemden ise 360 hayvan kullanılmıştır. Araştırma, yumurtacılar 29 haftalık yaşta iken başlanmış ve 41 haftalık yaşa kadar sürmüştür ve her 4 haftada bir yumurta örnekleri toplanmıştır. Yumurta kalite analizi için zenginleştirilmiş kafes sisteminden 36 adet yumurta ve serbest sistemden 95 adet yumurta toplanmıştır. Araştırmada yetiştirme sisteminin yumurta ağırlığına, sarı indeksine ve sarı skoruna etkisi önemli bulunurken ($P<0,01$), ele alınan diğer kalite özellikleri ise etkisi istatistiki olarak önemli çıkmamıştır ($P>0,05$).

Sonuç olarak, zenginleştirilmiş kafeslerdeki yumurtacılar, yumurta ağırlığı ve sarı skoru bakımından avantajlıdır, öte yandan serbest sistemdeki yumurtacılar sarı indeksi bakımından avantajlıdır.

Anahtar Kelimeler; *Yetiştirme sistemi, Yumurtacı hibrit, yumurta kalitesi*

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Investigation Of The Effect Of Different Irrigation Levels To Be Applied To Strawberry Varieties On Fruit And Plant Development Parameters In Nigde Climate Conditions

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Abstract
In this study, it was carried out to investigate the effects of different irrigation levels on yield and growth parameters of 3 different strawberry cultivars (Monterey, Albion and Sananderas) that can be grown in Nigde climatic conditions and to determine the most suitable strawberry cultivar for the region. Within the scope of the research, three different strawberry varieties suitable for the climatic conditions of the region were used and the study was carried out as a field trial in the research area of Niğde Ömer Halisdemir University, Faculty of Agricultural Sciences and Technologies. Within the scope of growing strawberries under field conditions and setting up the experiment, random blocks were planned according to the experimental design with 3 replications of each strawberry variety and the amount of irrigation water to be applied, and 30 plants in each replication. For the irrigation water to be applied to the plants, a drip irrigation system with a flow rate of 2L/h and a dripper range of 40 cm has been arranged. The experiment was carried out on May 7, 2021 by planting strawberry seedlings on the 3 m long furrow ridges created under field conditions using black mulch. In the study, I_{100} full irrigation and I_{75} and I_{50} limited irrigation were applied to each strawberry variety by considering open surface evaporation. Due to the limited water resources in the region and also due to the predicted decrease in water resources due to climate change in the future, the cut-off levels have been determined as 75% and 50%. The first products taken in the experiment were not taken into account for the adaptation of the plant to the soil, and the yield and quality parameters of the strawberry after the harvest in September were examined. Plant diameter and number of branches, average fruit size and weight were determined for each applied subject. The results were evaluated statistically, the dimensions of the change between the groups and the level of relationship were determined. Accordingly, it was seen that Albion cultivar had the highest fruit weight, fruit length and fruit diameter in I_{100} full irrigation, followed by Monterey and Sananderas cultivars, respectively. The cultivars from the largest to the smallest in the average plant diameter and number of branches were determined as Monterey, Albion and Sananderas, respectively. According to irrigation issues, all varieties were listed as I_{50}, I_{100} and I_{75} from largest to smallest in all parameters except the number of plant branches.
Keywords*: Strawberry Varieties, Irrigation Range, Deficit Irrigation, Nigde Province*

Niğde İklim Koşullarında Çilek Çeşitlerine Uygulanacak Farklı Sulama Düzeylerinin Meyve Ve Bitki Gelişim Parametrelerine Etkisinin Araştırılması

Özet
Bu çalışmada Niğde iklim koşullarında yetiştirilebilecek olan 3 farklı çilek çeşidinde (Monterey, Albion ve Sananderas) farklı sulama düzeylerinin verim ve gelişim parametreleri üzerine etkilerinin araştırılması ve bölgeye en uygun çilek çeşidinin belirlenmesi amacıyla yürütülmüştür. Araştırma kapsamında Bölgeye iklim şartlarına uygun üç farklı çilek çeşidi kullanılmış olup çalışma Niğde Ömer Halisdemir Üniversitesi, Tarım Bilimleri ve Teknolojileri Fakültesi araştırma sahasında tarla denemesi şeklinde yürütülmüştür. Çileklerin tarla şartlarında yetiştirilmesi ve denemenin kurulması kapsamında tesadüfi blokları deneme desenine göre her bir çilek çeşidi ve uygulanacak sulama suyu miktarı konularından 3 tekerrürlü ve her tekerrürde de 30 bitki olacak şekilde planlanmıştır. Bitkilere uygulanacak sulama suyu için ise 2L/h debi verebilen ve 40 cm damlatıcı aralığında damla sulama sistemi tertip edilmiştir. Deneme 7 Mayıs 2021 tarihinde çilek fidelerinin tarla koşullarında oluşturulan 3 m uzunluğundaki karık sırtlarına siyah malç kullanılarak dikilmesiyle gerçekleştirilmiştir. Çalışmada her bir çilek çeşidine açık yüzey buharlaşması dikkate alınarak I_{100} tam sulama konusu ile I_{75} ve I_{50} kısıntılı sulama konuları uygulanmıştır. Bölgede su kaynaklarının kısıntılı olması ve ayrıca gelecekte iklim değişikliğine bağlı olarak su kaynaklarında azalma öngörülmesinden dolayı kısıntı seviyeleri %75 ve %50 olarak belirlenmiştir. Denemede alınan ilk ürünler bitkinin toprağa adaptasyonu için dikkate alınmayıp, Eylül ayında yapılacak hasat sonrasındaki çilekteki verim ve kalite parametreleri incelenmiştir. Uygulanan her bir konuda bitki çapı ve dal sayısı, ortalama meyve büyüklüğü ile ağırlığı ortaya konulmuştur. Sonuçlar istatistiki olarak değerlendirilmiş gruplar arasındaki değişimin boyutları ve ilişki düzeyleri belirlenmiştir. Buna göre I_{100} tam sulama konusunda en yüksek meyve ağırlığı, meyve boyu ve meyve çapına Albion çeşidinin sahip olduğu bunu sırasıyla Monterey ve Sananderas çeşitlerinin takip ettiği görülmüştür. Ortalama bitki çapı ve dal sayısında ise büyükten küçüğe doğru çeşitler sırasıyla Monterey, Albion ve Sananderas olarak belirlenmiştir. Sulama konularına göre ise tüm çeşitler bitki dal sayısı haricinde tüm parametrelerde büyükten küçüğe doğru I_{50}, I_{100} ve I_{75} olarak sıralanmıştır.
Anahtar sözcükler: *Çilek Çeşitleri, Sulama Aralığı, Kısıntılı Sulama, Niğde*

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The Relationship between Shadow Analysis and Sustainability in University Campuses: The Example of Selcuk University Alaeddin Keykubat Campus

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Abstract
Today's cities show an unplanned and rapid development in direct proportion to the development of technology. As a result of rapid and unplanned development, the natural silhouette of the cities has deteriorated and the proportion of reinforced concrete structures has increased day by day. Green areas have been destroyed in cities where there is intense work tempo and high consumption. A city should exist with both its structures and open green spaces (urban forests, neighborhood and pocket parks, road trees, agricultural areas, urban parks, university campuses, green buildings, vertical gardens, green roofs, etc.). Destroying green areas and putting them in the second plan cause air, water, noise, etc. causes ecological problems. It is aimed to contribute to the formation of new generation cities by associating this problem of cities with the concept of sustainability at the international level. With the concept of sustainability, climate control in cities, protecting biodiversity, creating recreational opportunities for urban people living in the monotonous and intense pace of the city, ecological sustainability, etc. It is intended to contribute to problems such as For the sustainability of cities, it is necessary to use renewable energy sources, reduce waste consumption, switch to smart city and smart transportation model, as well as ensure ecological sustainability.
In this study, "Selçuk University Alaeddin Keykubat Campus" located within the provincial borders of Konya, which was evaluated as a small scale city model with its own units, was chosen as the study area. The aim of the study is to determine the shadow lengths created by the buildings in the "Selçuk University Alaeddin Keykubat Campus" on the green areas and the new building or open green areas, and to determine the correct light, shade and water requirements of the plants in the open green areas in line with the data obtained. The aim is to evaluate its contribution to ecological sustainability and green campus studies by revealing whether it is placed in areas with 2D (2D)-3D (3D) software and with different analysis techniques.
Key Words: *Shadow Analysis, Sustainability, Ecology, Campus*

Üniversite Yerleşkelerinde Gölge Analizi ile Sürdürülebilirlik İlişkisi: Selçuk Üniversitesi Alaeddin Keykubat Yerleşkesi Örneği

Özet
Günümüz kentleri teknolojinin gelişmesi ile doğru orantılı olarak plansız ve hızlı bir gelişim göstermektedir. Hızlı ve plansız gelişme sonucunda kentlerin doğal silüeti bozulmuş, her geçen gün betonarme yapıların oranı artmıştır. Yoğun çalışma temposu ve tüketimin çok olduğu kentlerde yeşil alanlar tahrip edilmiştir. Bir kent hem yapıları hem de açık yeşil alanları (kent ormanları, mahalle ve cep parkları, yol ağaçları, tarım alanları, kent parkları, üniversite kampüsleri, yeşil binalar, dikey bahçeleri, yeşil çatılar vb.) ile birlikte var olmalıdır. Yeşil alanların tahrip edilip ikinci plana atılması hava, su, gürültü vb. ekolojik sorunlara yol açmaktadır. Uluslararası düzeyde kentlerin bu sorunu sürdürülebilirlik kavramı ile ilişkilendirilip yeni nesil kentlerin oluşumuna katkı sağlanması hedeflenmektedir. Sürdürülebilirlik kavramı ile kentlerde iklim kontrolü, biyoçeşitliliği koruma, kentin monoton ve yoğun temposunda yaşayan kent insanına rekreasyon imkanı oluşturma, ekolojik sürdürülebilirlik vb. gibi sorunlara katkı sunulması amaçlanmaktadır. Kentlerin sürdürülebilirliği için yenilenebilir enerji kaynaklarının kullanımı, atık tüketimlerinin azaltılması, akıllı şehir ve akıllı ulaşım modeline geçilmesinin yanında ekolojik sürdürülebilirliğinin de sağlanması gerekmektedir.
Bu çalışmada, kendi içerisinde yer alan birimleri ile küçük ölçekte kent modeli olarak değerlendirilip Konya il sınırları içerisinde yer alan “Selçuk Üniversitesi Alaeddin Keykubat Yerleşkesi” çalışma alanı olarak seçilmiştir. Çalışmanın amacı “Selçuk Üniversitesi Alaeddin Keykubat Yerleşkesi” içerisinde yer alan yapıların, yeşil alanlar ve yeni yapılacak olan yapı veya açık yeşil alanlar üzerinde oluşturduğu gölge uzunluklarını tespit etmek ve elde edilen veriler doğrultusunda açık yeşil alanların içerisinde bulunan bitkilerin ışık, gölge ve su isteklerine göre doğru alanlara yerleştirilip yerleştirilmediğini 2 boyutlu (2B)-3 boyutlu (3B) yazılımlar aracılığı ve farklı analiz teknikleri ile ortaya koyarak ekolojik sürdürülebilirlik ve yeşil kampüs çalışmalarına katkısını değerlendirmektir.
Anahtar Kelimeler: *Gölge Analizi, Sürdürülebilirlik, Ekoloji, Kampüs*

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Lipophilic antioxidants of milk and their benefits to human health

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Abstract
Milk and its products are the most basic foods in human nutrition. Milk is also rich in antioxidant compounds. Milk antioxidants are divided into two groups: lipophilic and hydrophilic. Lipophilic milk antioxidants are conjugated linoleic acid (CLA), α-tocopherol, β-carotene, vitamin A, vitamin D_3, and phospholipids. Lipophilic antioxidants have high thermal stability and are active in all dairy products. Antioxidants neutralize free radicals in the body and protect the body against diseases. The negative relationship between milk consumption and the incidence of diet-related diseases confirms that consumption of milk and dairy products has health benefits. The importance of milk consumption, especially the consumption of fatty milk and its products, is understood and in this review, lipophilic antioxidants in milk fat and their health benefits are explained.
Key Words: *Milk, Milkfat, Antioxidant, Lipophilic antioxidant, Health*

Sütün lipofilik antioksidanları ve insan sağlığına yararları

Özet
Süt ve ürünleri insan beslenmesinde en temel gıdalardır. Süt antioksidan bileşiklerce de zengindir. Süt antioksidanları lipofilik ve hidrofilik olmak üzere iki grupta incelenir. Lipofilik süt antioksidanları konjuge linoleik asit (KLA), α-tokoferol, β-karoten, A vitamini, D_3 vitamini ve fosfolipitlerdir. Lipofilik antioksidanların termal stabiliteleri yüksek olup tüm süt ürünlerinde aktiftirler. Antioksidanlar vücuttaki serbest radikalleri nötralize ederek vücudu hastalıklara karşı korur. Süt tüketimi ile diyete bağlı hastalıkların insidansı arasındaki negatif ilişki, süt ve süt ürünleri tüketiminin sağlığa çok yararı olduğunu göstermektedir. Süt tüketimi, özellikle yağlı süt ve ürünleri tüketiminin, önemi anlaşılmış ve bu derlemede, süt yağındaki lipofilik antioksidanlar ve sağlığa faydaları açıklanmıştır.
Anahtar Kelimeler: *Süt, Süt yağı, Antioksidan, Lipofilik antioksidan, Sağlık*

1. Giriş

Süt, bileşiminde bulunan laktoz, kalsiyum, fosfor, magnezyum, esansiyel aminoasitler ve yağ asitleri, B_2 vitamini, süt türüne göre A vitamini ve/veya β-karoten, fosfolipitler vb. birçok bileşen ve özelliği nedeniyle mükemmele yakın bir sıvıdır/gıdadır (Çakmakçı, 2016). Sütün önemli bir bileşeni olan süt yağı %96 trigliserit (1 molekül gliserin ve 3 yağ asidi), %2-3 kadar digliseritler, %1 kadar fosfolipitler ve monogliseritler, serbest yağ asitleri ve yağda çözünen maddeler [(kolesterol, yağda çözünen vitaminler (A, D, E, K)] ve karotenoidlerden oluşmaktadır (IDF, 2008). Süt yağı, süt ürünlerine başka hiçbir yağda olmayan hoş bir aroma ve pürüzsüz bir yapı kazandıran bileşik/bileşendir. Süt, antioksidan etkili bileşikler bakımından zengin olup en önemlileri; konjuge linoleik asit (KLA), α-tokoferol, β-karoten, A vitamini, D_3 vitamini, fosfolipitler, proteinler ve peptidlerdir.

Sütte bulunan antioksidanlar, hem lipofilik (KLA, α-tokoferol, β-karoten, A ve D_3 vitaminleri, koenzim Q_{10} ve fosfolipitler) hem de hidrofilik antioksidanlar (proteinler, peptitler vb) insan vücudunda prooksidan ve antioksidan dengeleri korumada anahtar rol oynamaktadır. Lipofilik antioksidanlar, yüksek termal stabilite ile karakterize edilir ve tüm süt ürünlerinde aktiftirler. Lipofilik ve hidrofilik antioksidanlar, reaktif oksijen türlerinin ve lipit peroksidasyonunun son ürünlerinin etkisiz hale getirilmesi sürecinde etkileşime girer. Süt tüketimi ile diyete bağlı hastalıkların oluş sıklığı arasındaki negatif korelasyon, süt ve süt ürünleri tüketiminin sağlık açısından ne kadar yaralı olduğunu doğrulamaktadır (Grażyna *et al*., 2017). Hücrelerin, dokuların ve organların lipid yapılarında hidrofilik antioksidanlar aktif değildir. Lipofilik ortamda aktif olan süt yağı antioksidanları, oksidatif stresi önlemede savunma sistemini desteklemektedir. Oksidatif stres yaygın olarak Alzheimer hastalığı, Parkinson hastalığı gibi nörodejeneratif hastalıkların patogenezinde rol oynar. Bu nedenle, A vitamini, karotinoidler, E vitamini, koenzim Q_{10}, dokosaheksaenoik asit ve eikosapentaenoik asit gibi lipofilik antioksidanlar, nörodejeneratif hastalıklar için terapötik ve önleyici olarak artan ilgi görmüştür (Grażyna et al., 2017).

Özellikle yetersiz miktarda lipofilik antioksidan tüketimi kardiyovasküler vakalar, kanser, nörolojik ve nörodejeneratif hastalıkların ana nedenidir (Nicco *et al.,* 2005). Süt yağındaki en aktif antioksidan, konjuge çift bağ ile karakterize edilen sütün benzersiz bir bileşeni olan ve ruminantların etinde de bulunan KLA'dır. Süt yağındaki ana antioksidanların KLA başta olmak üzere A ve E vitaminleri, β-karoten ve koenzim Q_{10} olduğu, ayrıca D_3 vitamini, fosfolipidler vb. antioksidan özellikleri olduğu belirtilmiştir (Grażyna *et al*., 2017).

2. Sütün Lipofilik Antioksidanları

Lipofilik süt antioksidanları, yüksek düzeyde termal stabilite ile karakterize edilir ve uygulanan termal işleme yönteminden bağımsız olarak tüm süt ürünlerinde aktif olarak bulunur. Başka hiçbir gıda ürünü, süt yağı kadar faydalı bileşenler içermemektedir. Yağ asitlerinin doğal trans izomerleri (vaccenic asit ve KLA) ruminant (sığır, koyun, keçi) lipidlerinde bulunur ve toplam yağ asitlerinin % 4-6'sını oluşturur (Grażyna *et al*., 2017). Rumen lipazları tarafından yem trigliseridleri hidroliz olunca *cis* konfügürasyondaki serbest yağ asitleri serbest kalır ve bakteriler tarafından biyoyararlı formlara dönüştürülür (Wang and Lee, 2015).

Süt yağının antioksidan içeriği, özellikle lipofilik antioksidan içeriği, büyük ölçüde hayvan diyetinin bileşimi ile ilgilidir. Araştırmacılar, yeşil yemle beslenen ineklerin sütündeki β-karoten ve yağda çözünen vitamin içeriğinin, monodietle beslenen ineklerin sütünden 2-4 kat daha yüksek olduğunu tespit etmiştir. İsviçre'de yapılan bir çalışmada, organik tarım sisteminde yetiştirilen süt inekleri ile geleneksel yüksek yem diyeti ile beslenen inekler arasında; organik süt, daha yüksek konsantrasyonlarda dallanmış zincirli PUFA'lar, özellikle de n-3 yağ asitleri ve KLA ile karakterize edilmiştir. Diyete bağlı metabolik hastalıkların (obezite, tip-2 diyabet, ateroskleroz, kanser, nörolojik ve nörodejeneratif hastalıklar) dünya genelinde artan insidansının uzun süreli lipofilik antioksidan eksikliğine bağlanabileceği belirtilmiştir. Sayılan olumsuzlukların nedenleri olarak; temel olarak düşük süt yağı tüketimi ve süt sığırı işletmelerinde karışık rasyon kullanımı gösterilmiştir (Grażyna *et al*., 2017).

2.1. Konjuge linoleik asit

Süt yağındaki en aktif antioksidan, konjuge çift bağ ile karakterize edilen KLA'dır. KLA, sütün benzersiz bir bileşeni olup ruminantların etinde de bulunur. KLA'nın biyolojik değeri yüksek izomerleri; cis-9, trans-11 ve trans-10, cis-12 KLA'dır (Badr El-Din and Omaye, 2007; Wang and Lee, 2015; Salık ve Çakmakçı, 2021).

Süt ürünleri (toplam tüketimin %70'i) ve sığır eti (toplam tüketim miktarının %25'i) en bol bulunan KLA kaynaklarıdır (Grażyna *et al*., 2017). Koyun sütünün KLA içeriği inek sütüne göre iki kat daha fazladır. Keçi sütü, inek sütünden daha az miktarda KLA içerir (Tsiplakou *et al*., 2009). İnek sütü, rumenik asit olarak bilinen cis-9, trans-11 KLA'nın (%85-90) en iyi kaynağıdır (Grażyna *et al*., 2017). KLA'nın sağlığa önemli yararları şu şekilde sıralanabilir: yüksek seviyelerde antioksidan aktivite (α-tokoferolden yaklaşık 100 kat daha yüksek; Badr El-Din and Omaye 2007), *in vitro* ve *in vivo* çalışmalar, cis-9, trans-11 KLA'nın tümör hücrelerinin gelişimini engelleyebileceğini, sklerotik değişiklikleri ve tip-A diyabeti geciktirebileceğini, yağ dokusunu azaltabileceğini, kemik mineralizasyonunu iyileştirebileceğini ve immünostimülatör ve bakteriyostatik etkiler gösterebileceğini göstermiştir (Parodi, 2003). KLA düşük konsantrasyonlarda bile, α-tokoferolden daha etkili bir serbest radikal süpürücüdür ve aktivite seviyeleri, yağ ve yağlı gıdalarda kullanılan sentetik bir antioksidan olan butil hidroksi tolüen (BHT) ile karşılaştırılabilir.

Yüksek düzeyde antioksidan aktivitesi nedeniyle KLA'nın anti-inflamatuar, antisklerotik ve antikanserojenik etkileri vardır (Lee *et al*., 2009). KLA içeriği zengin olgunlaştırılmış peynirlerin fazla tüketildiği ülkelerde, bu ürünlerin daha az popüler olduğu ülkelere göre meme kanseri ölüm oranlarının daha düşük olduğu belirlenmiştir (Zlatanos *et al*., 2002; Larsson *et al*., 2005). Doğal KLA'nın antikanserojenik etkileri sentetik KLA'dan daha yüksektir (Ip *et al*., 1999).

KLA, bağışıklık sistemi hücrelerinin üretimini artıran ve fagositik aktiviteyi artıran bir bağışıklık uyarıcıdır (Corino *et al*., 2009; Menon *et al*., 2010). KLA'nın çok yönlü sağlık yararları vardır ve araşidonik asit dönüşümlerini kontrol ederek iltihabı önler ve yüksek antioksidan aktiviteyi teşvik eder. Bu etkiler ateroskleroz, kanser ve nörolojik bozukluk riskini azaltır. KLA, kan lipid profilinin düzenlenmesinde, hipertrigliseridemi, obezite ve tip-2 diyabetin önlenmesinde önemli bir rol oynar (Grażyna *et al*., 2017).

Vaksenik asit (cis ve trans konfügürasyonlu C18:1 n-7) cis-9, trans-11 KLA izomerlerinin bir öncüsü olup biyolojik olarak aktif bir hücre zarı lipidi olarak (fosfolipidlerde ve glikolipidlerde bulunur) vücut organlarının ve dokularının bütünlüğü ve işlevinden sorumludur. KLA'ya benzer şekilde, vaksenik asit de antisklerotik ve antikarsinojenik aktivite göstermektedir (Jakobsen *et al*., 2006).

2.2. E vitamini

Süt E vitamini bakımından zengin bir kaynak değildir. Süt yağının E vitamini (tokoferol) içeriği 5 ila 45 µg/g yağ arasında değişmekte, vitamin aktivitesinin %90'dan fazlasını α-tokoferol sağlamaktadır (Parodi, 2004). E vitamini, hücre antioksidan savunma sistemindeki başlıca yağda çözünen bileşendir ve yalnızca diyetten elde edilir (Rizvi *et al*., 2014). Antioksidan aktivitesi nedeniyle vücutta çok sayıda önemli rolü vardır. Oksidasyon, kanser, yaşlanma, artrit ve katarakt dahil olmak üzere çok sayıda olası durum ve hastalıkla bağlantılıdır; E vitamininin bunlara karşı etkili olduğu gösterilmiştir (Rizvi *et al*., 2014). UHT süt gibi uzun süre depolama sırasında süt ürünlerinin E vitamini içeriğinin azaldığı belirtilmektedir (Michlová *et al*., 2015). Süt ve süt ürünlerindeki düşük

E vitamini seviyelerine rağmen, E vitamini, süt yağını oksidasyona karşı koruyucu bir antioksidandır (Öztürk ve Çakmakçı, 2006; Rizvi *et al*., 2014). Sütün E vitamini içeriği yemdeki tokoferol seviyesine bağlıdır. Yeşil yemle beslenen ineklerin sütü, karma rasyonla beslenen ineklerin sütünden çok yüksek miktarda E vitamini içermektedir (Grega *et al*., 2005). E vitamininin biyolojik aktivitesi sadece α-tokoferolde gözlenmekte, diğer izomerler ise tamamen emilseler bile insan vücudunda aktif α-tokoferol'e dönüşmezler. (Grażyna et al., 2017).

Güçlü bir antioksidan olan E vitamininin eksikliği; yaşlanmayı hızlandırabilir ve ateroskleroz, kardiyovasküler hastalıklar, kanser ve nörodejeneratif hastalık riskini artırabilir (Alzheimer hastalığı, Parkinson hastalığı, amyotrofik lateral skleroz) (Farris and Zhang, 2003; Berman and Brodaty, 2004; Niki, 2014). Sentetik E vitamini, hücre membran yapıları için daha fazla afiniteye sahip olduğu ve doğal diyet antioksidanlarını ortadan kaldırdığı için toksik etkiler gösterebilir (Miller *et al*., 2005).

2.3. β-karoten ve A vitamini

Süt ürünleri, özellikle yağca zengin olanlar, iyi bir β-karoten ve/veya A vitamini kaynaklarıdır. İnek sütünün hem A vitamini hem de β-karoten içerdiği; koyun ve keçi sütlerinin ise A vitamini içerdiği belirlenmiştir (Tahmas Kahyaoğlu ve Çakmakçı, 2018). En yüksek A vitamini seviyesi (0.150-1.5 mg/100 g) olgunlaşmış peynirler ve tereyağında bulunurken, süt, süzme peynir ve yoğurt daha düşük miktarda A vitamini içerir (0.015-0.150 mg/100 g). A vitamini ve β-karoten miktarları sığır diyetine bağlıdır. A vitamini öncüleri, sığır yemi ile sağlanan karotenoidler, özellikle β-karotendir (Tahmas Kahyaoğlu ve Çakmakçı, 2018). Retinal ve retinoik asit, A vitamininin biyolojik olarak başlıca aktif formlarıdır. Retinal görme sağlığına katkıda bulunur. Retinoik asit, epiteli doğrudan etkiler ve mide-bağırsak, idrar, üreme ve solunum sistemlerinde cilt, kornea ve mukoza zarlarını yeniler. Retinoik asit, bağışıklık sistemini ve beyaz kan hücrelerinin üretimini uyarır (Kim, 2011).

Karotenoidlerin ve özellikle β-karoten ve A vitamininin en önemli biyolojik işlevlerinden birisi antioksidan aktivitedir. Bu özellik, LDL (düşük yoğunluklu lipoprotein) fraksiyonunun oksidasyonunu önler ve düşük oksijen basıncı olan dokularda lipid peroksidasyonunu engeller. Karotenoidler, özellikle β-karoten, A, E ve C vitaminlerinden daha etkilidir (Müller *et al*., 2011; Fiedor and Burda, 2014). Düşük moleküler ağırlıklı antioksidanlar olarak β-karoten ve A vitamini ateroskleroz ve kanseri önleyen önemli gıda bileşenleridir. Antikarsinojenik etkileri, moleküllerinde (özellikle karotenoidlerde) tekli oksijeni emen birçok konjuge çift bağın olmasına atfedilir. Bu, UV radyasyonunun neden olduğu belirli cilt kanseri türlerinin önlenmesinde önemli bir husustur. Tekli oksijeni absorbe etme yetenekleri nedeniyle karotenoidler, DNA'yı oksidasyona karşı etkili bir şekilde korur. A vitamini, özellikle retinoik asit, vücudu kanserin erken evrelerine karşı korurken, β-karoten neoplastik gelişmeyi önler (Palozza *et al*., 2002; Sharoni *et al*., 2012; Tanaka *et al*., 2012).

2.4. D_3 Vitamini

D_3 vitaminin ön maddesi, cilt yüzeyindeki yağ bezleri tarafından salgılanan 7-hidrokolesteroldür. Deride üretilen kolekalsiferol, kan yoluyla karaciğere ve böbreklere taşınır ve burada 1,25-dihidroksikolekalsiferole dönüştürülür (Zhang and Naughton, 2010).

D_3 vitamini de α-tokoferol, β-karoten ve retinol gibi, sütün enzimatik olmayan antioksidan sisteminin bir parçasıdır. D_3 vitamininin en aktif formu olan 1,25-dihidroksikolekalsiferol, lipid peroksidasyonunu engelleyerek antioksidan etki gösterir (Mutlu *et al*., 2013; Saedisomeolia *et al*., 2013). İnek sütünün D_3 vitamini içeriği, yaz aylarında sonbahar ve kış aylarında çok daha yüksektir. Süt yağı, tereyağı, olgunlaşmış peynir, krema D_3 vitamininin iyi kaynaklarıdır (Jakobsen and Saxholt, 2009). İnsan vücudunda D_3 vitamini esas olarak kalsiyum ve fosfor dengesinin düzenlenmesinden sorumludur. D_3 vitamini ince bağırsakta kalsiyum ve fosfor emilimini etkiler ve parathormon ve kalsitonin ile birlikte kemiklerde kalsiyum ve fosforun emilmesinden sorumludur. D_3 vitamini idrarla atılan kalsiyum ve fosfor miktarını azaltır, bu da kemiklerin ve dişlerin sağlıklı mineralizasyonunu destekler (Zhang and Naughton, 2010; Hossein-nezhad and Holick, 2013). D_3 vitamini paratiroid bezlerinin ve böbreklerin sağlıklı çalışması için gereklidir. Epidemiyolojik araştırmalara göre kolorektal, yumurtalık, meme ve prostat kanseri prevalansı, kan serumundaki D_3 vitamini konsantrasyonu ile ters orantılıdır (Zhang and Naughton, 2010). Güneş ışığına daha az maruz kalan bölgelerde multipl skleroz ve romatoid artrit prevalansı daha yüksek bulunmuştur (Grażyna et al., 2017).

2.5. Koenzim Q_{10}

Süt yağı az miktarda koenzim Q_{10} içerir. Koenzim Q_{10}, elektron taşıma zincirindeki elektronları taşır ve hücrelerde ve dokularda enerji verimliliğini artıran ATP sentezine katılır. Kalp kası koenzim Q_{10} eksikliğine çok duyarlıdır (Bank *et al*., 2011). Koenzim Q_{10} oldukça aktif bir antioksidan olup indirgenmiş formu, hücre zarlarını ve LDL'leri peroksidasyona karşı α-tokoferol ve β-karotenden daha iyi korur (Borekova *et al*., 2008).

3. Süt Yağı Globül Membranı

Süt yağ globül zarında bulunan fosfolipidler, sfingolipidler, kolesterol ve proteinlerin sağlığa önemli faydaları vardır. Süt fosfolipidleri olarak fosfatidilkolin (lesitin), sefalin, sfingomiyelin, fosfatidilinositol, fosfatidilserin sayılabilir (IDF, 2008; Lopez *et al*., 2010; Metin, 2015).

Fosfolipidlerin doymamış yağ asidi içeriği, trigliseritlere göre daha fazladır. Bu yağ asitleri hücreler ve organlarda metabolik reaksiyonlarda önemli rol oynamaktadır. Doymamış yağ asitleri membranlara likidite ve geçirgenlik kazandırmakta, besin maddelerinin ve metabolitlerin taşınmasını teşvik etmekte ve kolesterol metabolizmasını artırmaktadır (Kelley *et al*., 2007). Protein sentezine ve hücre yenilenmesine katılmakta ve ATP sentezi için bir fosfat kaynağı olmaktadır (Starks *et al*., 2008; Schubert *et al*., 2011). Fosfolipitler çoklu doymamış yağ asitlerini (PUFA) içerir ve katyonları bağlayabilir; dolayısıyla gastrointestinal mukozayı, beyni, karaciğeri, dalak ve böbrekleri serbest radikallerin toksik etkilerine karşı koruyan antioksidanlardır (Spitsberg, 2005). Süt yağı fosfolipidleri, linoleik ve α-linolenik asit içerir (Patterson *et al*., 2012). Süt fosfolipidleri nöroprotektif etkiler sergiler: beyin aktivitesini kontrol ederler, hafızayı ve strese karşı direnci geliştirirler ve depresyon ve nörodejeneratif hastalık riskini azaltırlar. Süt fosfolipidlerinin baskın fraksiyonları olan fosfatidilkolin (lesitin) ve sfingomyelin, kolinin tek kaynaklarıdır. Kolin, hücrelerin işlevini ve yapısal bütünlüğünü arttırır, sinir sistemini uyarır, hafızayı geliştirir ve yoğun fiziksel aktivite sonrası toparlanmayı hızlandırır (Osella *et al*., 2008).

Fosfolipid eksikliği ile nörolojik bozukluklar arasında korelasyon olduğu tespit edilmiştir (Oliveira and di Paolo, 2010; Kosicek and Hecimovic, 2013). Sinir sinyal iletiminde anahtar rol oynayan fosfatidilserin, beyin yaşlanmasının önlenmesinde etkilidir. Fosfatidilserin, eksikliği Parkinson hastalığında görülen tirozin hidroksilazı aktive eder (Spitsberg, 2005; Oliveira ve di Paolo, 2010). Fosfolipitler antiviral özelliklere sahiptir ve β-glukuronidazı inhibe ederler. Patojenlerin gelişmesini önleyerek gastrointestinal sistem enfeksiyonlarını önler (Sprong *et al*., 2002). Sfingomyelinlerin antikanserojenik özelliği çok sayıda klinik çalışmada ispat edilmiştir (Dillehay *et al*., 1994; Magnusson and Haraldsson, 2011). Fosfolipidlerin koroner kalp hastalığı, iltihaplanma gibi hastalıklara olumlu etkileri olduğu, bazı ilaçların yan etkilerini azalttığı belirtilmiştir (Grażyna *et al*., 2017).

4. Sonuç ve öneriler

Sütün, özellikle süt yağının, beslenme ve sağlıkta ne kadar önemli olduğu anlaşılmaktadır. Ancak günümüzde, gerçekçi bir nedeni olmayan, tüketicilerin de yağsız süt ve ürünleri tüketiminin gittikçe arttığı görülmektedir. Özellikle tereyağı ve yağlı süt ürünleri tüketiminin azaltılıp yerine bitkisel yağ ve margarin tüketilmesi nedeniyle beslenmede A, E, D_3 vitaminleri ve KLA, Q_{10} ve fosfolipit alımı azalmaktadır. Kardiyovasküler, kanser, nörolojik hastalıklar ile obezite ve tip-2 diyabetin ana nedeninin düşük antioksidan tüketimi, özellikle uzun süreli yetersiz lipofilik antioksidan tüketimiyle ilgili olduğu belirtilmektedir. Bu sonuç, çeşitli nedenlere bağlı olarak, az süt yağı tüketimi ve uygun olmayan hayvan besleme rejimlerinden kaynaklanabilir. İnsan sağlığı ve beslenmesi için süt yağı ve yağlı süt ürünleri, dolayısıyla süt tüketimi artırılmalı, bu yönde tüketici bilinçlendirilmelidir.

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Determination of the frequency of g.1267 G >A polymorphism in the *MC4R* gene in Berrichon du Cher Sheep

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Abstract

Melanocortin 4 receptor (*MCR4*) gene, which has only one exon and is located at chromosome 23 in Ovis aries, is known to regulate the Leptin hormone. Leptin is associated with bodyweight control, energy balance, also food intake. Thus, the *MC4R* gene is one of the significant candidates for growth traits in mammalians. The *MC4R* gene polymorphisms were studied in Karachai, Tibetian, Hu, Awassi, Arabi, German Merino, and East Friesian sheep breeds, but not in Berrichon Du Cher, especially g.1267 G >A polymorphism up to now. The Berrichon du Cher, a meat sheep breed of France, is raised in a wide geographical area in terms of meat production. The aim of the study was to determine the genotypic frequencies of g.1267 G >A polymorphism in the *MC4R* gene in Berrichon du Cher Sheep. For this aim, the polymorphism of the *MC4R* gene was studied by the PCR-RFLP method in Berrichon sheep (n=44). The genomic DNA was extracted by the phenol-chloroform method from blood samples. After the amplification of PCR products (836 bp) of the *MC4R* gene, they were digested by the NdeI restriction enzyme for genotyping. Then, the RFLP products were separated by agarose gel electrophoresis and displayed by DNR's MiniLumi bio-imaging system. As a result, a single band (836 bp) was observed in all individuals. Therefore, all investigated Berrichon du Cher sheep were found monomorphic for g.1267 G >A polymorphism of *MC4R* gene with GG genotype. As a consequence, this is the first report that presents the G >A polymorphism of the *MC4R* gene in Berrichon Du Cher sheep, to the best of our knowledge. This study contributes to the literature on this aspect. On the other hand, the other mutations or single nucleotide polymorphisms of *MC4R* gene should be researched in further studies.

Key Words: *Sheep, polymorphism, growth, PCR-RFLP, MC4R, Berrichon*

Berrichon Du Cher ırkı koyunlarda *MC4R* geni g.1267 G >A polimorfizmi sıklığının belirlenmesi

Özet

Ovis aries türü canlılarda 23. kromozomda yer alan ve tek bir ekzona sahip Melanokortin 4 reseptör (*MCR4*) geninin, Leptin hormonunu düzenlediği bilinmektedir. Leptin vücut ağırlığı kontrolü, enerji dengesi ve yem tüketimi ile ilişkilidir. Bu nedenle, *MC4R* geni, memelilerde büyüme özellikleri açısından önemli aday genlerden biridir. *MC4R* gen polimorfizmleri, özellikle de g.1267 G >A polimorfizmi bu güne kadar; Karachai, Tibet, Hu, İvesi, Arap, Alman Merinosu ve Doğu Frizya koyun ırklarında çalışılmış, ancak Berrichon Du Cher 'de, çalışılmamıştır. Fransa'nın etçi koyun ırklarından olan Berrichon du Cher, et üretimi açısından geniş bir coğrafyada yaygın olarak yetiştirilmektedir. Bu çalışmanın amacı; Berrichon du Cher koyunlarında *MC4R* geni g.1267 G >A polimorfizmine ilişkin genotip frekanslarını belirlemektir. Bu amaçla, Berrichon koyunlarında (n=44) *MC4R* gen polimorfizmi PCR-RFLP yöntemi ile incelenmiştir. Genomik DNA, kan örneklerinden fenol-kloroform yöntemiyle izole edilmiştir. *MC4R* genine ait PCR ürünlerinin (836bp) amplifikasyondan sonra, genotiplendirme için *Ndel* restriksiyon enzimi ile kesilmiştir. Sonrasında RFLP ürünleri, agaroz jel elektroforezi ile ayrılarak; DNR MiniLumi biyo-görüntüleme sistemi ile görüntülenmiştir. Sonuç olarak tüm bireylerde tek bir bant (836 bp) gözlenmiştir. Bu nedenle, incelenen tüm Berrichon du Cher koyunları (GG genotipi ile) M*C4R* geni g.1267 G >A polimorfizmi açısından monomorfik bulunmuştur. Sonuç olarak, mevcut çalışma Berrichon Du Cher ırkı koyunlarda *MC4R* geni G >A polimorfizmini sunan ilk çalışmadır. Çalışma bu yönüyle literatüre katkı sağlamaktadır. Diğer yandan, ileride *MC4R* genine ilişkin diğer mutasyonlar veya tek nükleotid polimorfizmler de çalışılmalıdır.

Anahtar Kelimeler: *Koyun, polimorfizm, büyüme, PCR-RFLP, MC4R, Berrichon*

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Solid Waste Landfill Site Selection; Konya City Sample

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Abstract
In developing countries, consumption habits have changed with the increase in population, the development of technology and industrialization. For this reason, good management of the increase in the amount of solid waste by municipalities is very important for the health and sustainability of nature. The location of the facility to be established is important for the regular storage and efficient disposal of solid wastes. Site selection of landfill facilities in the 'Site Management and Operation Guide for Landfill Facilities' published by the General Directorate of Environmental Management; The ratio of the volume to the area, the distance to the buildings, the wind direction, the external view (landscape), the effect on the traffic on the side, the profit from the finished facility, and the effect on the water are evaluated under the sub-headings. With the 'Konya Solid Waste Management Project', 'Aslım Sanitary Landfill', which was used until 2017, was closed. Instead, the 'Konya Solid Waste Landfill Site', which was established in a different region to meet the need, was put into operation. In the study to be carried out in this context; Both fields were evaluated according to the specified criteria and compared with each other using the Analytical Hierarchy Method. As a result, it is aimed that the success rate of the location selection of the new solid waste storage area will be revealed and it will be a base for similar studies to be done in the future.
Key Words: *Solid waste storage, site selection, Konya*

Katı Atık Düzenli Depolama Sahası Yer Seçimi; Konya Kenti Örneği

Özet
Hızla gelişmekte olan ülkelerde artan nüfus miktarı, gelişen teknoloji alternatifleri ve sanayileşme ile birlikte tüketim alışkanlıkları da değişmiştir. Bu nedenle katı atık miktarında meydana gelen artışların belediyelerce iyi yönetilmesi, canlılarla birlikte içerisinde bulundukları doğanın sağlığı ve sürdürülebilirliği için şarttır. Katı atıkların düzenli depolanması ve verimli bir şekilde bertaraf edilmesi için kurulacak olan tesisin konumu öncelikli öneme sahiptir. Çevre, Şehircilik ve İklim Değişikliği Bakanlığı, Çevre Yönetimi Genel Müdürlüğü tarafından yayımlanan Düzenli Depolama Tesisleri Saha Yönetimi ve İşletme Kılavuzu'nda düzenli depolama tesisleri yer seçimi; hacmin alana oranı, yapılara olan uzaklık, rüzgâr istikameti, dış görünüş (manzara), yandaki trafiğe tesiri, bitmiş tesisten kazanç, suya tesiri alt başlıklarında değerlendirilmeye alınmaktadır. 'Konya Katı Atık Yönetimi Projesi' ile 2017 yılına kadar kullanılan Aslım Düzenli Depolama Sahası'nın kapatılıp, ihtiyacı karşılamak üzere farklı bir bölgede kurulan 'Konya Katı Atık Düzenli Depolama Sahası' faaliyete geçirilmiştir. Bu kapsamda yapılacak olan çalışmada her iki saha belirtilen kriterlere göre değerlendirilerek, Analitik Hiyerarşi Yöntemi ile birbirleriyle karşılaştırılmıştır. Sonuç olarak yeni katı atık depolama alanının yer seçiminin başarı oranı ortaya konularak daha sonra yapılacak benzer çalışmalara altlık olması hedeflenmektedir.
Anahtar Kelimeler: *Katı atık depolama, yer seçimi, Konya*

ID: 820

Testing the Biological Control Potentials of Fungi Associated Within Potato Crop in Higher Lands of Rwanda

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Abstract

The potato grows well in the highlands of northwestern Rwanda, and it is the country's main food reservoir. Currently, potato faces many pests and diseases in Rwanda. To control these diseases, farmers rely on the overuse of chemical pesticides, which have negative impacts on people and the environment. The aim of the current study was to investigate the potential of potato-associated fungi as biological control agents against major potato diseases. To this end, nine potato farms in each of the three major potato growing districts of Burera, Musanze and Nyabihu, were selected to collect potato diseased samples. In the laboratory, 17 fungal isolates were found in potato farms with the genera Alternaria spp. (11.76%), Aspergillus spp. (23.53%), Colletriticum spp. (11.76%), Fusarium spp. (11.76%), Penicillium spp. (11.76%), Phytophthora spp. (17.65%) and unknown genera (11.76%). In testing the potential of biological control, Aspergillus species, many from soil, were found to be highly inhibitory to the growth of Phytophthora spp. with 66%, Colletriticum species from stems and tubers controlled the growth of Fusarium spp. at 68.7%. From all these findings, it is recommended that further studies to be conducted to explore potato diseases in other areas of Rwanda and to model plant disease dynamics for predictions. In addition, continued testing of the isolates from this study for biological control agents and their molecular levels is highly encouraged.

Keywords: *Biological control, antagonism, endophyte, Potato*

ID: 821

Determination of Some Virus Diseases Infecting *Dahlia* Species Grown for Landscape Purposes in Konya Province Parks and Home Gardens by Serological Methods

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Abstract
Dahlias *(Dahlia* spp.*)*, which are members of the *Asteraceae* family, are named as "star flower" in Turkish. Around 30 species of this genus have been identified in the world, and it is known that these species have around 20.000 varieties. They are especially preferred in home gardens and landscaping areas due to the covering feature of the plant habitus and huge variation in colours, sizes, and shapes of flowers. In addition, the fact that it can bloom from summer to late autumn and can be used as a cut flower causes an increase in the interest in this genus. There are many biotic and abiotic factors that can cause negative effects on yield and quality in *Dahlia* cultivation. Virus diseases also have an important place among these factors. In this study, it was aimed to reveal some viruses that are a problem in *Dahlia* plants grown for ornamental plants in parks and home gardens in Selçuklu, Karatay and Meram districts of Konya. For this reason, in the 2019 summer, leaf samples were taken from 152 *Dahlia* plants showing symptoms similar to virus disease symptoms such as mosaic, deformations, yellowing, blight on the leaves and stunted plants. Possible infections of *Cucumber mosaic virus* (CMV), *Tomato spotted-wilt virus* (TSWV) and *Impatiens necrotic spot virus, (*INSV*)* on these leaves were tested by serological-based DAS-ELISA (Double Antibody Sandwich- Enzyme Linked Immuno Sorbent Assay) method. According to DAS-ELISA results, it was determined that 46,71% of the samples were infected with at least one of these three viruses. In addition, TSWV was detected as the most common virus with a 38,82% relative incidence in the samples, followed by CMV (27,63%). Mixed infections of the viruses were also detected in the leaf samples tested. As a result of the tests, only CMV + TSWV double infection was detected in a total of 30 samples. On the other hand, INSV infection was not detected in any of the leaf samples tested. As a result of survey studies, the average of prevalence rate of virus diseases in *Dahlia* plants grown in Konya was calculated as 69.56%. Moreover, it was determined that virus diseases were most common in Selçuklu district (75,47%). This is the first report of CMV and TSWV on *Dahlia* spp. in Türkiye.
Key Words: *CMV, Dahlia spp., DAS-ELISA, Konya, TSWV*

Konya İli Park ve Ev Bahçelerinde Peyzaj Amaçlı Yetiştirilen *Dahlia* Türlerinde Enfeksiyon Yapan Bazı Virüs Hastalıklarının Serolojik Yöntemlerle Belirlenmesi

Özet
Asteraceae familyasına bağlı olan *Dahlia* türleri dilimizde yıldız çiçeği olarak isimlendirilmişlerdir. Dünya'da bu cinse ait 30 kadar tür belirlenmiş olup, ayrıca bu türlerin 20.000 civarında çeşide sahip olduğu bilinmektedir. Bitki habitusunun örtücü özellikte olması, boylanabilmesi ve iri, gösterişli ve renk çeşitliliğine sahip çiçeklerinden dolayı özellikle ev bahçeleri ve peyzaj alanlarında tercih edilmektedirler. Bunun yanında, yaz aylarından başlamak üzere sonbaharın sonlarına kadar çiçek açabilmesi ve kesme çiçek olarak ta kullanılabilmesi bu cinse olan ilginin artmasına sebep olmaktadır. *Dahlia* yetiştiriciliğinde verim ve kalite üzerinde olumsuzluklara sebep olabilen birçok biyotik ve abiyotik etken bulunmaktadır. Virüs hastalıkları da bu etkenler arasında önemli bir yere sahiptir. Bu çalışmada, Konya ilinin Selçuklu, Karatay ve Meram ilçelerindeki park ve ev bahçelerinde süs bitkisi amaçlı yetiştirilen *Dahlia* bitkilerinde sorun olan bazı virüslerin ortaya konulması amaçlanmıştır. Bu sebeple, 2019 üretim sezonunda sürveyler gerçekleştirilerek yapraklarda mozaik, şekil bozuklukları, sararmalar, yanıklıklar, bitkilerde bodurluk gibi virüs hastalık belirtilerine benzer belirtiler gösteren 152 *Dahlia* bitkilerinden yaprak örnekleri alınmıştır. Bu yapraklardaki olası Hıyar mozaik virüsü (*Cucumber mosaic virus*, CMV), Domates lekeli solgunluk virüsü (*Tomato spotted-wilt virus*, TSWV) ve Camgüzeli nekrotik leke virüsü (*Impatiens necrotic spot virus*, INSV) enfeksiyonları serolojik test yöntemlerinden DAS-ELISA (Double Antibody Sandwich-Enzyme Linked Immuno Sorbent Assay) testi ile araştırılmıştır. DAS-ELISA sonuçlarına göre örneklerin % 46,71'inin bu üç virüsten en az bir tanesi ile bulaşık olduğu belirlenmiştir. Ayrıca, TSWV örneklerde % 38,82'lik bulaşıklık oranı ile en yaygın virüs olarak tespit edilirken, bu virüsü CMV (% 27,63) takip etmiştir. Testlenen yaprak örneklerinde söz konusu virüslerin karışık enfeksiyonları da belirlenmiştir. Testlemeler sonucunda sadece CMV + TSWV ikili enfeksiyonu toplam 30 örnekte tespit edilmiştir. Bununla birlikte testlenen hiçbir yaprak örneğinde INSV enfeksiyonu belirlenememiştir. Sürvey çalışmaları neticesinde, Konya ilinde yetiştirilen *Dahlia* bitkilerindeki virüs hastalıklarının yaygınlık oranı % 69,56 olarak hesaplanmıştır. Ayrıca, virüs hastalıklarının Selçuklu ilçesinde (% 75,47) en yaygın olarak görüldüğü belirlenmiştir. Gerçekleştirilen bu çalışma ile CMV ve TSWV enfeksiyonları *Dahlia* spp.'de Türkiye için ilk kez belirlenmişlerdir.
Anahtar Kelimeler: *CMV, Dahlia spp., DAS-ELISA, Konya, TSWV*

ID: 822

Some Bioactive Properties of Tea Waste

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Abstract
Tea is one of the most consumed beverages in Turkey, and the processing and consumption of tea generates a considerable amount of waste. Tea waste is a lignocellulosic biomass with high content of cellulose, hemicellulose, lignin, proteins, polyphenols, and tannins. In this study, black tea waste generated after brewing was studied for its total phenolic and protein content and *in vitro* protein digestibility. The total phenolic content was determined by the Folin-Ciocalteu method. Protein digestibility was assessed by quantifying total nitrogen using the Kjeldahl method after *in vitro* digestion with the Infogest protocol. It was found that tea waste contains phenolic compounds and these compounds mainly consist of bound forms (43.2 ± 0.7 mg GAE/g). The free soluble phenolics content was 4.07± 0.5 mg GAE/g, with about 50% of this amount consisting of tannins (2.29 ± 0.5 mg GAE/g). The protein content of the tea waste was 22%, suggesting that tea waste is a promising source of protein recovery. Nevertheless, it should be noted that only 12% of the protein content was found to be digestible. The results suggest that tea waste has considerable potential for use as a protein- and phenolic-rich functional ingredient in the formulation of functional foods.
Key Words: *in vitro protein digestibility, phenolic content, tea waste*

Çay Atığının Bazı Biyoaktif Özellikleri

Özet
Çay, Türkiye'de en çok tüketilen içeceklerden birisi olup işlenmesi ve tüketimi sırasında önemli miktarda atık oluşmaktadır. Çay atığı, yüksek oranda selüloz, hemiselüloz, lignin, protein, polifenoller ve tanen içeriğine sahip lignoselülozik bir biyokütledir. Bu çalışmada, demleme sonrası oluşan siyah çay atığının toplam fenolik madde ve protein içeriği ile *in vitro* protein sindirilirliği incelenmiştir. Toplam fenolik madde içeriği Folin-Ciocalteu yöntemi ile belirlenmiştir. Protein sindirilirliği ise Infogest protokolüne göre uygulanan *in vitro* sindirim sonrası toplam azot içeriğinin Kjeldahl yöntemiyle belirlenmesine dayalı olarak saptanmıştır. Çay atığının fenolik bileşikler içerdiği ve bu bileşiklerin temel olarak bağlı formlardan (43.2 ± 0.7 mg GAE/g) oluştuğu görülmüştür. Serbest çözünür fenolik madde içeriği 4.07 ± 0.5 mg GAE/g olarak saptanmış ve bu miktarın yaklaşık %50'sinin tanenlerden (2.29 ± 0.5 mg GAE/g) oluştuğu belirlenmiştir. Çay atığının protein içeriği 22%'dir ve bu sonuç çay atığının protein geri kazanımı için umut verici bir kaynak olduğunu göstermektedir. Yüksek protein içeriğine sahip olmasına rağmen, proteinin sadece %12'sinin sindirilebilir olduğu saptanmıştır. Çalışma sonuçları, çay atığının, fonksiyonel gıdaların formülasyonuna fayda sağlayabilecek protein ve fenolik madde bakımından zengin fonksiyonel bileşen olarak kullanım için yüksek bir potansiyele sahip olduğunu göstermektedir.
Anahtar Kelimeler: *in vitro protein sindirilirliği, fenolik içeriği, çay atığı*

ID: 823

Applications of Organomineral and Chemical Fertilizers in Strawberry Production Effects on Plant Growth

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Abstract

Strawberry (Fragaria x ananassa Duch.), which is widely grown all over the world, can be consumed fresh and processed and suitable for family business, is one of the commercially important fruit species with increasing production. This study was carried out to determine the effects of some organomineral fertilizers on the vegetative growth and fruit quality of strawberry plants under greenhouse conditions. The study was carried out in an unheated glass greenhouse in Çukurova University Yumurtalık Vocational School Research and Application Field between 2019-2021. In the study, 'Albion' cultivar, which is a day-neutral cultivar as plant material, was carried out as organomineral fertilizer in Trial, Random Blocks Trial Design with 4 replications. Research application pattern 1) Control 0 kg/ha without fertilizer, 2) 30 kg/ha Agrotolia® 15.15.15+15 + SO3 + 15 + OM + 1 Zn+1 Fe organomineral fertilizer, 3) 30 kg/ha Agrotolia®10.25. 10+(15 SO3)+1 Zn organomineral fertilizer, 4) 30 kg/da Agrotolia® NPK+S+Humic Acid + 15 OM organomineral fertilizer, 5) Agrohum 30 kg/da inorganic compound fertilizer and 6) 30 kg/ha Azurite 6 different application patterns of chemical fertilizers were created. In order to determine the effects of the applications on the vegetative development of the plants throughout the experiment, stem diameter, plant height, leaf number measurements and fruit quality analyzes throughout the season (fruit weight, fruit diameter, SÇKM, pH, titratable acid values) were made at weekly intervals. The mean values of the measurements made at the end of the study were evaluated statistically. When the results of the applications were compared with the control plots, statistically significant differences were detected and it was concluded that compost-containing organomineral fertilizer applications can be recommended in strawberry cultivation.

Key Words: *Albion 1, organomineral fertilizer 2, Berries 3, Greenhouse 4, Plant Nutrition 5*

Çilek Üretiminde Organomineral ve Kimyasal Gübre Uygulamalarının Bitki Gelişimi Üzerine Etkileri

Özet

Tüm dünyada yaygın olarak yetiştirilen, taze ve işlenmiş olarak tüketilebilen ve aile işletmeciliğine de uygun olan çilek (Fragaria x ananassa Duch.) ticari açıdan önemli ve üretimi artan meyve türlerinden birisidir. Bu çalışma örtüaltı koşullarında bazı organomineral içerikli gübrelerin çilek bitkisinin vegetatif gelişimi ve meyve kalitesi üzerine olan etkilerini belirleyebilmek amacıyla yürütülmüştür. Çalışma 2019-2021 yılları arasında, Çukurova Üniversitesi Yumurtalık Meslek Yüksekokulu Araştırma ve Uygulama Arazisinde ısıtmasız cam serada gerçekleştirilmiştir. Çalışmada bitkisel materyal olarak gün nötr bir çeşit olan 'Albion' çeşidi, organomineral gübre olarak Deneme, Tesadüf Blokları Deneme Desenine göre 4 tekerrürlü olarak yürütülmüştür. Araştırma uygulama deseni 1) Kontrol 0 kg/ha gübresiz, 2) 30 kg/da Agrotolia® 15.15.15+15 + SO3 + 15 + OM + 1 Zn+1 Fe organomineral gübre, 3) 30 kg/da Agrotolia®10.25.10+(15 SO3)+1 Zn organomineral gübre, 4) 30 kg/da Agrotolia® NPK+S+Humik Asit + 15 OM organomineral gübre, 5) Agrohum 30 kg/da inorganik kompoze gübre ve 6) 30 kg/da Azurit kimyasal gübre 6 farklı uygulama deseni oluşturulmuştur. Deneme boyunca uygulamaların bitkilerin vejetatif gelişimine olan etkilerini tayin edebilmek amacıyla haftalık aralıklarla bitkilerde gövde çapı, bitki boyu, yaprak sayısı ölçümleri, sezon boyunca meyve kalite analizleri (meyve ağırlığı, meyve çapı, SÇKM, pH, titre edilebilir asit değerleri) yapılmıştır. Çalışma sonunda yapılan ölçümlerin ortalama değerleri istatistiksel olarak değerlendirilmiştir. Uygulamalara ait sonuçlar kontrol parselleri ile kıyaslandığında istatistiksel anlamda önemli düzeyde farklılıklar tespit edilmiş ve kompost içerikli organomineral gübre uygulamalarının çilek yetiştiriciliğinde tavsiye edilebileceği sonucuna varılmıştır.

Anahtar Kelimeler: *Albion 1, organomineral gübre 2, Üzümsü Meyveler 3, Örtüaltı 4Bitki Besleme*

Giriş

Çilek iştah açıcı tat ve aroması ile yılın her döneminde tüketilebilen ve yoğun bir talebi olan meyvedir. Bu özelliği ile önemli bir gelir kaynağı olarak çileğin yetiştiriciliği küçük, orta ve büyük her düzeydeki tarım işletmesi için uygundur. Çilek çoğunlukla taze olarak tüketilmekle birlikte farklı gıda sanayi kollarında meyve suyu, marmelat, reçel, ve pasta gibi ürünlerin üretiminde girdi olarak değerlendirilmesi çileğe olan talebi arttırmıştır. Bu faydaları yanında günlük beslenme diyetlerinin önemli bir unsuru olan antioksidanların alımı açısından çilek önemli bir kaynaktır (Wang, 2014; Giampieri ve ark., 2014).

Ekonomik değeri yüksek olan çilek 8.861.381 tonluk üretim miktarı ile dünyada en çok yetiştirilen üzümsü meyvelerden biridir (FAO, 2020). Ülkemizde 2020 yılı verilerine göre 179.780 da alanda 546.525 tonluk çilek

üretimi yapılmış ve ortalama verim 3,04 ton/da olarak gerçekleşmiştir (FAO, 2020). Bu veriler, Ülkemizin çilek üretiminde istenilen verimlilik seviyesine ulaşamadığını kanıtlamaktadır.

Çilek yetiştiriciliğinde verimlilik ve meyve kalitesi çok önemli iki unsurdur. Çilekte meyve kalitesini etkileyen başlıca unsur çeşitlerin genetik özellikleri kabul edilmekle birlikte meyvenin kalite özellikleri, (tat, koku, meyve büyüklüğü vb.), bitki büyümesi ve gelişmesi üzerinde yetiştiricilik koşulları da etki etmektedir (Kays, 1999). Verimlilik artışı ve meyve kalitesini sağlamak için dengeli bir gübreleme yapılmalıdır. Ancak aşırı ve yanlış gübreleme toprakların tuzluluğunun artmasına neden olmakta, toprağın fiziksel, kimyasal ve biyolojik aktivitesini üzerine olumsuz yönde etkilemektedir. Yapılan yanlış uygulamalar insan ve hayvan sağlığını olumsuz etkilemektedir. Kimyasal gübreler yoğun kullanımı bu olumsuz etkilerin başında yer almaktadır. Kimyasal gübreler yüksek verim ve üretim miktarında artış sağlarken, toprakların yapısını bozarak verimlilikte önemli olan organik madde miktarını azaltmaktadır (Singh, 2018). Son zamanlarda dünya nüfusunun artmasına paralel olarak kimyasal gübre kullanımı da artmıştır. Kimyasal gübrelerin bilinçsizce kullanımının neden olduğu problemlerin, insan sağlığı ve çevre üzerindeki olumsuz etkilerinin anlaşılması, sürdürülebilir tarımsal üretim için yoğun uygulamaların yapıldığı tarım alanlarında alternatif bitki besleme uygulamalarının araştırılmasına neden olmuştur (Nicolopoulou-Stamati ve ark., 2016).

Toprak verimliliğini ve organik madde miktarını yükseltmek için organik atıkların kullanılması büyük önem taşımaktadır (Goss ve ark., 2013). Toprakta organik madde miktarının artırılması ve kültür bitkilerinin gelişimleri için gerekli olan besin maddelerinin karşılanması bakımından organomineral gübreler, sürdürülebilir tarım uygulamaları için alternatif olarak görülmektedir. Bu sebeple insanların ve çevrenin sağlığını korumak, toprakların sürdürülebilir verimliliğini sağlamak, topraktaki organik madde miktarını artırmak, ürünlerde verimliliği ve kaliteyi yükseltmek amacıyla alternatif üretim sistemleri geliştirilmeye çalışılmıştır (Bettiol ve ark. 2004). Üretimde kullanılan gübrelerin genellikle yavaş salınımlı olması, içeriğinde bulunan besin maddelerinin dağılımının değişken yapıda olması sebebiyle organik gübreler birbirinden farklı olabiliyor. Organomineral gübreler ise farklı olarak kimyasal gübre içeriğinde bulunan besin maddeleri ile organik madde birlikte bulunduğundan besin maddesi içerikleri daha standart halde bitkiye verilebilmektedir.

Bu çalışmanın amacı çilek yetiştiriciliğinde farklı organomineral ve kimyasal gübrelerin meyve verimi, kalitesi ve besin maddesi alımı üzerine olan etkilerini belirlemektir.

Materyal ve Yöntem

Çalışma; Adana ili Yumurtalık ilçesinde 2019-2021 yılları arasında yürütülmüştür. Yumurtalık ilçesi; Adana iline 80 km uzaklıkta, deniz seviyesinde olan Çukurova Üniversitesi Yumurtalık Meslek Yüksekokulu Araştırma ve Uygulama Arazisi'nde (36.75° kuzey enlem, 35.71° Doğu meridyen") yürütülmüştür. Denemede bitkisel materyal olarak "Albion" çilek çeşidi kullanılmıştır. "Albion" Kaliforniya üniversitesi tarafından 1999'da ıslah edilen bir çeşit olup Diamante x Cal 94.16-1 arasındaki çaprazlamadan selekte edilmiştir. Nötr gün bir çeşittir. Fenotipik özellikleri yetiştirme koşullarına göre değişiklik gösterebilmektedir (Shaw ve Larson, 2009). Deneme alanı, genişliği 75 cm ve yüksekliği 20-25 cm olan siyah polietilenle kaplı masuralar üzerine 30x30 cm aralıklar ile 28.09.2019 tarihinde yaz dikim yöntemiyle dikilmiştir.

Araştırmanın yürütüldüğü alandan 0-30 cm derinliğinden alınan toprak örneğinin kimyasal özellikleri Çizelge 1'de verilmiştir. Deneme alanına ait toprağının yapısı killi tınlı, kireçli (30.2) ve organik madde miktarı 1.82 toprak yapısına sahiptir

Çizelge 1. Deneme alanına ait toprağın bazı kimyasal özellikleri.

Yıl	pH	N (%)	P ($mgkg^{-1}$)	K ($mgkg^{-1}$)	Ca ($mgkg^{-1}$)	Mg ($mgkg^{-1}$)	Mn ($mgkg^{-1}$)	Cu ($mgkg^{-1}$)	Fe ($mgkg^{-1}$)
2019-2021	7.42	0.18	1.58	170	4395	642	1.96	0.90	1.85

Denemenin başlangıcından itibaren bitkilere kültürel işlemler uygulanmış, gerekli hastalık ve zararlı kontrolleri yapılmış, denemenin sağlıklı bir şekilde yürütülmesi sağlanmıştır. Deneme, Tesadüf Blokları Deneme Desenine göre 4 tekerrürlü olarak yürütülmüştür. Araştırmada 6 farklı uygulama konusu; 1) Kontrol 0 kg/ha gübresiz, 2) 30 kg/da Agrotolia® 15.15.15+15 + SO3 + 15 + OM + 1 Zn+1 Fe organomineral gübre, 3) 30 kg/da Agrotolia®10.25.10+(15 SO3)+1 Zn organomineral gübre, 4) 30 kg/da Agrotolia® NPK+S+Humik Asit + 15 OM organomineral gübre, 5) Agrohum 30 kg/da inorganik kompoze gübre ve 6) 30 kg/da Azurit kimyasal gübre uygulamaları değerlendirilmiştir. Çilek dikiminden önce sonbaharda, kontrol parselleri hariç konulara göre farklı organomineral ve kimyasal gübreler ilgili her parselin yüzeyine deneme desenine göre dekara 30 kg doz hesabıyla homojen bir biçimde elle uygulanmış ve toprakla iyice karıştırılmıştır.

Araştırma kapsamında farklı gübrelerin etkilerini belirlemek amacıyla; yetiştirme sezonu boyunca bitkilerde ayda dört kez olmak üzere bitki boyu, gövde çapı ve yaprak sayısı ölçümleri yapılmıştır. Ayrıca yetiştirme sezonunda toplamda dört kez hasat edilen meyvelerde meyve kalite kriterlerinden, meyve ağırlığı, meyve eni, suda çözünebilir kuru madde oranı (SÇKM), titre edilebilir asit oranı (TAA) ve pH tayini yapılmıştır. Her bir tekerrürden elde edilen 10 adet meyvede hassas terazi ile meyve ağırlığı ve dijital kumpas ile meyve eni belirlendikten sonra örnekler homojenize edilerek, dijital refraktometre ile SÇKM değeri ayrıca pH metre ile pH değeri belirlenmiştir. TA

ölçümleri için her bir tekerrürde elde edilen meyve suyundan 10 ml alınmış, üzerine 10 ml saf su ilave edilerek pH 8.1 değerine ulaşana kadar 0.1 N sodyum hidroksit (NaOH) ile titrasyonda harcanan NaOH miktarı esas alınarak g malik asit 100 mL^{-1}olarak ifade edilmiştir.
Çalışma sonucunda elde edilen verilere varyans analizleri, SPSS 23 paket programında, değerlendirilmiş olup, ortalamalar arasındaki fark $p<0,05$ önem seviyesinde verilmiştir.

Bulgular ve Tartışma
Çalışma süresince değerlendirilen 'Albion' çilek çeşidine farklı mikrobiyal gübreuygulamalarının yetiştirime sezonu boyunca bitki boyu, gövde çapı ve yaprak sayısıüzerine etkileri Şekil 1. Şekil 2. ve Şekil 3.'de sunulmuştur.İncelenen parametrelerden bitki boyu üzerine yapılan uygulamaların etkilerinin değerlendirildiği Şekil 1'degörüldüğü gibi tüm ölçümlerde uygulamaların bitki boyu üzerine olan etkileri arasında istatistiksel anlamda farklılıklar belirlenmiştir. Ekim (14,10 cm), kasım (14,82 cm) ve aralık (16,20 cm) ayı boyunca yapılan ölçümlerde SimBacil uygulaması en yüksek bitki boyu sonucunu verirken ocak ayında OrgaStar uygulamasından diğer uygulamalara kıyasla daha yüksek ortalama bitki boyu değeri (21,30 cm) elde edilmiştir. Yapılan tüm ölçümlerde en düşük bitki boyu ortalama değeri kontrol uygulamasında tayin edilmiştir (Şekil 1).Aras (2009), benzer şekilde organik madde içerikli ticari gübrelerin, bitki boyu üzerine etkisinin önemli olduğunu, Camarosa çilek çeşidinde bitki boyu üzerine en olumlu etkinin 29,64 cm ile Nidoplant isimli preparattan elde edildiğini en düşük değerlerin ise Nidominhumat (27,0 cm) ve Kontrol (26,7 cm) uygulamalarından elde edildiğini bildirmiştir.

Çizelge 2. Uygulamaların Bitki Gelişimine etkisi

Doz (ton/da)	Gövde Sayısı (adet)	Yaprak sayısı (adet)	Bitki Boyu (cm/bitki)	Bitki Eni (cm/bitki)	Yaprak Alanı (cm^2)
Kontrol	3.75c	82.88c	25.96c	13.90c	47.86c
N:%20+NO_3-N:%5+NH_4-N:%5+Üre:%10	4.63bc	84.65bc	27.17bc	16.75b	54.11bc
Hümik+Fülvik Asit:%10+ K_2O:%2+OM:%20	4.88bc	102.00ab	31.30ab	16.88b	59.17ab
Agrotolia® NPK+S+Humik Asit + 15 OM	5.00ab	106.00a	31.57ab	18.63ab	61.52ab
Agrotolia® Hümik+Fülvik Asit:%10+ K_2O:%2+OM:%20	5.75ab	107.13a	31.77ab	18.83ab	62.77ab
Agrotolia® Hümik+Fülvik Asit:%40+ K_2O:%2+OM:%30	6.13a	107.50a	33.17a	20.08a	65.81a

Aynı sütunda yer alan farklı harfler $P < 0.05$ önem seviyesinde farklı bulunmuştur.

Gübre uygulamalarının ortalama meyve ağırlığına olan etkisi değerlendirildiğinde, Agrotolia® Hümik+Fülvik Asit:%40+ K_2O:%2+OM:%30 (17.00 g/meyve), Agrotolia® Hümik+Fülvik Asit:%10+ K_2O:%2+OM:%20 (14.92 g/meyve), Agrotolia® NPK+S+Humik Asit + 15 OM (13.86 g/meyve) uygulamaları, Hümik+Fülvik Asit:%10+ K_2O:%2+OM:%20 (12.62 g/meyve), N:%20+NO_3-N:%5+NH_4-N:%5+Üre:%10 (12.62 g/meyve) ve kontrol (10.24 g/ meyve) arasında istatistiksel anlamda önemli düzeyde fark tayin edilmiştir (Çizelge 3). En yüksek ortalama meyve ağırlığı değeri organomineral gübre uygulamaları arasında Agrotolia® Hümik+Fülvik Asit:%40+ K_2O:%2+OM:%30 uygulamasında belirlenmiş en düşük değer ise kontrol uygulamasında belirlenmiştir (Çizelge 3). Albion çilek çeşidinin ortalama meyve ağırlığı değerleri ise çeşitli çalışmalarda 23,1 g/meyve (Çekiç ve Aksu, 2012), 16.15 –18.81 (Ateş, 2015) aralığında bildirilmektedir. Bu değerler bizim çalışmamızdan elde edilen değerler ile örtüşmektedir.
Farklı gübre uygulamalarının meyvelerin meyve eni, SÇKM ve TAA oranına olan etkisi önemli olurken; pH üzerine etkisi olmamıştır (Çizelge 3). Bu veriler incelendiğinde en yüksek meyve eni Agrotolia® Hümik+Fülvik Asit:%40+ K_2O:%2+OM:%30 (33.75 cm) organomineral gübre uygulamasından alınırken, en düşük değer kontrol uygulamasından (12. 00 cm) alınmıştır. Uygulamaların SÇKM üzerine olan etkisi değerlendirildiğinde Agrotolia® Hümik+Fülvik Asit:%40+ K_2O:%2+OM:%30 (%8.77), Agrotolia® Hümik+Fülvik Asit:%10+ K_2O:%2+OM:%20 (%8.63), Agrotolia® NPK+S+Humik Asit + 15 OM (% 8.53), Hümik+Fülvik Asit:%10+ K_2O:%2+OM:%20 (%8.16) ve N:%20+NO_3-N:%5+NH_4-N:%5+Üre:%10 (%7.87) uygulamalarından elde edilen ortalama SÇKM değerlerinin istatistiksel anlamda kontrol (% 7.65) uygulamasından farklı olduğu görülmektedir. TAA değerleri incelendiğinde en yüksek ortalama TAA değerinin Agrotolia® Hümik+Fülvik Asit:%40+ K_2O:%2+OM:%30 (%1.16)) uygulamasında en düşük ise %0.18 ile kontrol uygulamasında belirlendiği görülmektedir (Çizelge 3). Çileklerde kabul edilebilir bir lezzet için SÇKM değerinin en az % 7 olması gerektiği vurgulanmıştır (Mitcham ve ark, 1996). Galletta ve ark (1995), çeşide bağlı olarak SÇKM değerlerinin % 7 - % 12 arasında değiştiğini belirlemişlerdir. Bildirilen bu değerler bu çalışmadan elde edilen verilere yakın değerler sergilemektedir. Meyvelerde yeme kalitesini etkileyen parametre ise, meyve suyunda belirlenen asit miktarıdır. Gidemen (2003) %0.67; Kadıoğlu ve ark. (2009) %0.7–0.9 arasında değerler elde etmişlerdir. Taghavi ve ark. (2019), olgun çilek meyvesinin asit içeriğinin beslenme ya da ışık gibi çevre koşullarından da etkilenebildiğini bildirmişlerdir. Arada bulunan farklılığın ise ekolojikkoşullardan ve yetiştirme koşullarından kaynaklanabileceği düşünülmektedir.

Çizelge 3. Uygulamaların Meyve Kalitesi Üzerine Olan Etkisi

Doz (ton/da)	Meyve Ağırlığı (g)	Meyve Eni (cm)	pH (%)	SÇKM (%)	TAA (%)
Kontrol	10.24d	12.00d	3.29	7.65b	0.18c
N:%20+NO_3-N:%5+NH_4-N:%5+Üre:%10	12.03c	14.00d	3.33	7.87ab	0.42bc
Hümik+Fülvik Asit:%10+ K_2O:%2+OM:%20	12.62c	19.50c	3.62	8.16ab	0.43bc
Agrotolia® NPK+S+Humik Asit + 15 OM	13.86b	21.50c	3.85	8.53ab	0.45bc
Agrotolia® Hümik+Fülvik Asit:%10+ K_2O:%2+OM:%20	14.92b	27.25b	3.97	8.63ab	0.91ab
Agrotolia® Hümik+Fülvik Asit:%40+ K_2O:%2+OM:%30	17.00a	33.75a	3.99	8.77a	1.16a

Aynı sütunda yer alan farklı harfler $P < 0.05$ önem seviyesinde farklı bulunmuştur.

Sonuç

Sonuç olarak, Adana ili Yumurtalık ilçesinde 2019-2021 yılları arasında Albion çilek yetiştiriciliğinde üç adet "Agrotolia® NPK+S+Humik Asit + 15 OM, Agrotolia® Hümik+Fülvik Asit:%10+ K2O:%2+OM:%20, Agrotolia® Hümik+Fülvik Asit:%40+ K2O:%2+OM:%30" isimli compost içerikli organomineral gübrelerle birlikte kimyasal gübre uygulaması olarak N:%20+NO3-N:%5+NH4-N:%5+Üre:%10, Hümik+Fülvik Asit:%10+ K2O:%2+OM:%20 kompoze gübreleri ve gübresiz standart olmak üzere 6 farklı uygulama konusuyla yapılan iki yıllık deneme sonucunda; organomineral gübre uygulamalarından kimyasal gübreye göre sırasıyla, Agrotolia® Hümik+Fülvik Asit:%40+ K_2O:%2+OM:%30, Agrotolia® Hümik+Fülvik Asit:%10+ K_2O:%2+OM:%20 ve Agrotolia® NPK+S+Humik Asit + 15 OM yüksek değerler alınmıştır. Yapılan bu çalışmada da organomineral ve kimyasal gübre uygulamalarının Albion çilek çeşidinde; bitki gelişimi ve meyve kalitesi üzerine etkileri değerlendirildiğinde organomineral gübre uygulamasının kimyasal gübreye göre olumlu yönde etkilediği belirlenmiştir. Sonuç olarak, organomineral gübreler bitki gelişimi ve meyve kalitesini pozitif yönde etkilediği belirlenmiştir. Bu gübreler, kimyasal gübreye alternatif olarak önerilebileceği sonucuna varılmıştır.

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Production of Vitamin B12 by Propionic Acid Bacteria

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Abstract
Propionic acid bacteria (PAB) are extremely important because of the metabolites they produce (vitamins, propionic acid, conjugated linoleic acid, bioactive peptides). Nowadays, the increasing interest in healthy nutrition has led to the formation of the concepts of probiotics, postbiotics and functionality with studies.
Vitamin B12 is one of the postbiotics produced by PAB and is known to be beneficial for human health. Due to its coenzyme feature, it plays a key role in the body process, as well as shows anti-inflammatory properties. The recommended dietary intake of vitamin B12 for adults is 4 µg/day. Although it is highly found in meat products, it is known that the bioavailability of B12 in dairy products is higher. Fermented dairy products, especially products that contain PAB in their natural microflora, are good tools for the production and intake of vitamin B12. In this study, the factors affecting the microbial production of vitamin B12 were examined.
Key Words: *Vitamin B12, Propionibacterium, Postbiotics, Cobalamin, Probiotics*

Propiyonik Asit Bakterileri ile B12 Vitamini Üretimi

Özet
Propiyonik asit bakterileri (PAB) ürettikleri metabolitler nedeniyle (vitaminler, propiyonik asit, konjuge linoleik asit, biyoaktif peptidler) son derece önemlidir. Günümüzde sağlıklı beslenmeye yönelik olarak günden güne artan ilgi çalışmalarla birlikte probiyotikler, postbiyotikler ve fonksiyonellik kavramlarının oluşmasına neden olmuştur. B12 vitamini PAB'ın ürettiği postbiyotiklerden olup, insan sağlığına faydalı olduğu bilinmektedir. Koenzim özelliği taşımasından dolayı vücutta önemli olaylarda rol oynamasının yanında, antiinflamatuar özellik göstermektedir. Yetişkinler için önerilen diyette B12 vitamini alımı 4 µg/gün'dür. Hayvansal gıdalarda bulunmasına rağmen süt ürünlerinde bulunan B12'nin biyoyararlığının daha fazla olduğu bilinmektedir. Fermente süt ürünleri özellikle PAB'ı doğal mikroflorasında bulunduran ürünler B12 vitaminin üretiminde ve alınmasında iyi birer araç olmaktadır. Bu çalışmada PAB'ın B12 vitamini üretim sürecini etkileyen pH, sıcaklık, aerasyon, inoculum tipi ve oranı gibi faktörler irdelenmiştir.
Anahtar Kelimeler: *B12 vitamini, Propionibacterium, Postbiyotikler, Kobalamin, Probiyotikler*

1. Giriş
Propiyonik asit bakterileri *Pseudomonas* ve *Actinomycetes* gibi B12 vitamini üretiminde kullanılan mikroorganizma gruplarının yerini endüstriyel olarak kullanılmaya başlamaları ile almıştır (Özer vd., 2014). Son zamanlarda probiyotiklere olan ilginin artması araştırmacıların propiyonik asit bakterilerinin probiyotik özellikleri üzerine çalışmalarına neden olmuştur. *Propionibacterium*'un probiyotik etkisi, yararlı metabolitleri ve antimikrobiyal bileşenleri üretme, zararlı bakterilere karşı direnç gösterme, antikarsinojen ve antikolesterolemik etki gösterme bağırsak mikroflorasının stabilizasyonuna dayanmaktadır (Mantere-Alhonen, 1995).
Probiyotik taşıyıcı ürünler içinde en büyük oranı yoğurt ve peynir gibi fermente süt ürünleri oluşturmaktadır (Zahed vd., 2022). Probiyotik özellik gösteren mikroorganizmaların fermente süt ürünlerine ilavesi fonksiyonel özelliklerini artırırken, süt ise bu mikroorganizmalar için ideal bir ortam yaratmaktadır.

2. Propiyonik Asit Bakterileri
İlk kez Eduard von Freudenreich, Orl-Jensen ve van Niela tarafından izole edilen ve tanımlanan *Propionibacterium* cinsi bakteriler Gram pozitif ve katalaz pozitif basillerdir. Aynı zamanda bakteri sporları üretmezler ve 1-5 µm uzunluğa sahiptirler (Piwowarek vd., 2018).
Propiyonik asit bakterileri, elde edildiği kaynağa göre deri kökenli ve klasik olmak üzere iki ana gruptan oluşur. Deri kökenli grup insanlar için birincil patojenler olarak kabul edilirken, klasik PAB peynirlerin olgunlaşma süreci başta olmak üzere gıda ve ilaç endüstrilerinde yaygın olarak kullanılmaktadır (Meile vd., 2008). PAB'ın teknolojik açıdan sağladığı faydaların en önemlileri karbon kaynağı olarak laktoz ve laktatları kullanabilmeleri, gıdalar için koruyucu özelliklere sahip bileşikleri (propiyonik asit, asetik asit ve bakteriyosinler vb.) üretebilmeleri, aroma ve tat bileşenlerini sağlamalarıdır (Guan vd., 2015). Tablo 1'de süt ve süt ürünleri kaynaklı *Propionibacterium* cinsi bakteriler ve izolasyon kaynakları verilmektedir.

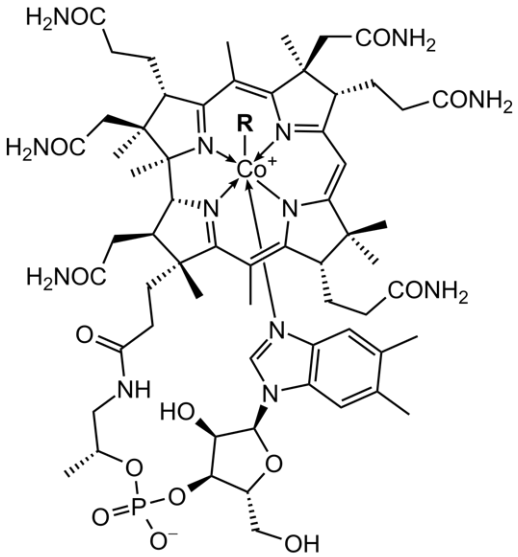
Tablo 1. Süt ve Süt Ürünleri Kaynaklı Propiyonik Asit Bakterileri (Özer vd., 2014)

Türler	**İzolasyon kaynağı**
Propionibacterium freudenreichii	Çiğ süt İsviçre peynirleri Diğer süt ürünleri
Propionibacterium jensenii	Süt ürünleri Silaj Enfeksiyonlar
Propionibacterium thoenii	Emmental peyniri Diğer süt ürünleri
Propionibacterium acidipropionici	Süt ürünleri
Propionibacterium cyclohexanicum	Bozulmuş portakal suyu
Propionibacterium coccoides	Süt ve taze peynir

Aynı zamanda B12 vitamini üretme yetenekleri vardır. Bu nedenle endüstriyel olarak takviye ve farmasötik tüketim için kullanılmaktadır (Calvillo vd., 2022). B12 vitamini üretiminde PAB'dan yararlanılmaktadır. *Propionibacterium freudenreichii* B12 vitamini üreten mikroorganizmalar arasında GRAS (generally recognized as safe) statüsüne sahip tek bakteridir. Bazı suşlarının probiyotik özellikleri bulunmaktadır (Altieri, 2016).
İsviçre tipi peynirlerde ve Emmantel peynirinin olgunlaştırılmasında PAB büyük rol oynamaktadır (Bücher vd., 2021) . Ülkemize özgü bir peynir olan, Balıkesir-Bursa bölgesinde yoğun olarak üretilen Mihaliç peynirinde karakteristik tat-aroma ve gözenek oluşumunda propiyonik asit bakterileri önemli rol oynamaktadır (Tirpanci Sivri & Öksüz, 2019).
B12 üretiminde kullanılan *Propionibacterium* suşları şu şekildedir: *Propionibacterium acidipropionici* DSM 8250, *P. freudenreichii* subsp. *shermanii* DSM 20270, *P. freudenreichii* subsp. *shermanii* OLP-5, *P. freudenreichii* NCIB 1081, *P. shermanii* FRDC Pr1, *P.shermanii* PZ-3, *P. freudenreichii* CICC 10019 (Massoud vd., 2018).

3. B12 Vitamini

B12 vitamini (kobalamin) suda çözünen ve merkezinde kobalt iyonu bulundurduğundan tek metalloprotein olan vitamindir (H. Wang vd., 2019). Şekil 1'de B12 vitaminin kiyasal yapısı yer almaktadır.



Şekil 1. B12 Vitaminin Kimyasal Yapısı (Gröber vd., 2013)

B12 vitamini yapısında bulunan R grubunun hidroksil grubu (OH-) olması durumunda hidroksikobalamin, glutatyonil (GS) grubu olması durumunda glutatyonilkobalamin, siyanid (CN) grubu olması durumunda siyanokobalamin, metil grubu (CH_3) olması durumunda metilkobalamin ve 5'-deoksiadenozin grubu olması durumunda ise deoksiadenozilkobalamin olmak üzere farklı şekillerde isimlendirilir (Özkanay Yörük, 2020). Hidroksikobalamin, glutatyonilkobalamin ve siyanokobalamin inaktif formlar olmasının yanında B12 vitamininin aktif formları için prekürsör olma özellliği taşımaktadır (Uzun, 2021).
B12 vitamininin vücutta protein, yağ ve karbonhidrat metabolizması, sinir sisteminin normal fonksiyonları ve kırmızı kan hücrelerinin oluşumu gibi önemli görevleri vardır (Repossi vd., 2017). İnsan hücreleri tarafından sentezlenemeyen B12 vitamini esansiyeldir ve dışarıdan alınması gerekmektedir (Sezgin, 2019).

Avrupa Gıda Güvenliği Otoritesi (EFSA) yetişkinler için günlük diyetle birlikte alınması gereken B12 vitamini alımı 4 µg/gün olarak tavsiye etmektedir. Hamilelik ve laktasyon süresince yeterli miktarın daha fazla olması tavsiye edilmektedir (Rampazzo vd., 2022). Karaciğer, et, yumurta, balık ve süt ürünleri B12 vitamini kaynaklarıdır. Süt ve süt ürünlerinin B12 vitamini içeriği etten daha düşük olsa da, süt ürünlerindeki B12 vitamininin biyoyararlılığı daha yüksektir (Gille & Schmid, 2015; Xu vd., 2020).

Türkiye'de B12 vitamini eksikliği yaygın olarak görülen bir halk sağlığı problemidir (Yazan Şahan & Erdoğmuş Mergen, 2019). Kadınlardaki B12 vitamini eksikliği erkeklere göre üç kat daha fazla görülmektedir (Uzun, 2021). Beslenme yetersizliği, metabolik bozukluklar ve emilim bozukluğu B12 vitamini eksikliğine ve ciddi sağlık sorunlarına neden olmaktadır (Öncel Van, 2022). B12 vitamini eksikliği aneminin yaygın bir nedenidir. Aynı zamanda nörolojik, gastrointestinal, psikiyatrik, kardiyovasküler, dermatolojik ve nöropsikiyatrik hastalıklara neden olabilmektedir (Oh & Brown, 2003).

Endüstriyel olarak B12 vitaminin kimyasal sentezinin teknik olarak zorlayıcı ve ekonomik olarak maliyetinin yüksek olması nedeniyle üretim mikrobiyal fermentasyon ile yapılmaktadır (Martens vd., 2002). B12 vitamini üretme yeteneği olan başka mikroorganizmalar olmasına rağmen, *P. freudenreichiii*, B12 vitamininin aktif formunu sentezleyebilmesi ve GRAS statüsünde kullanılan tek mikroorganizma olması nedeniyle öne çıkmaktadır (Piwowarek vd., 2018).

Son yıllarda fermentasyon yoluyla gıda ürünlerinde B12 vitamini düzeyinin artırılmasına yönelik çalışmalar artmıştır. Bu nedenle B12 vitamini üretim şartlarının iyileştirilmesi elzemdir.

4. B12 Vitamini Üretimini Etkileyen Faktörler

4.1 pH ve sıcaklık

Propiyonik asit bakterilerinin gelişimi çeşitli ortam şartlarından etkilenmektedir. Bunların başında ise sıcaklık ve pH gelmektedir. Sıcaklık ve pH'ı kontrol etmek, fermantasyon işleminin verimliliğini arttırmada iki önemli faktördür.

Propionibacterium türlerinin büyümesi için uygun ortam pH 6 - pH 7 aralığındayken, gelişim için minimum pH 4,6'dır (Ahmadi vd., 2017). Süt ürünlerinde PAB herhangi mevcut ortam asitliğinde B12 vitamini üretebilmektedir. Coral ve diğer araştırmacılar tarafından yapılan çalışmada *P. acidipropionici* ile propiyonik asit üretiminin optimum olduğu sıcaklık değeri 30°C, biyokütle artışının optimum olduğu değer ise 36°C'dir (Coral vd., 2008). Hedayati ve diğer araştırmacıların yaptığı çalışmada B12 vitamini üretimin için optimum sıcaklık değerinin 38,3°C olduğu ancak, bu sıcaklık değerinin altında PAB gelişimi ile artan biyokütle artışının B12 vitamininin üretimini desteklediği görülmüştür (Hedayati vd., 2020).

4.2 Besi ortamına eklenen ve gelişimi stimule edici bileşenler

B12 vitamini üretimini ortamdaki amino asitler ve bileşikler etkilemektedir. Azot kaynağının ortamda yer alması biyokütleyi ve B12 vitamini üretimini etkilemektedir (Santos vd., 2009). PAB için amino asitler, protein hidrolizatları gibi organik azot kaynakları iyi birer stimule edici faktördür.

Kosmider ve diğer araştırmacılar tarafından yapılan çalışmada *Propionibacterium freudenreichii* subsp. *shermanii* ile B12 vitamini üretimi optimizasyonu üzerine yapılan çalışmada kalsium pantotenat, $NaH_2PO_4.2H_2O$, $FeSO_4.7H_2O$ ve kazein hidrolizatın B12 vitamini üretimini önemli derecede artırıcı etkiye sahip olduğu görülmüştür (Kośmider vd., 2012).

Marwaha ve diğer araştırmacılar tarafından yapılan çalışmada 11 farklı amino asitin *Propionibacterium shermanii* 566 ile B12 vitamini üzerine en iyi sonuçların glutamik asit başta olmak üzere L-lösin ve L-fenilalanin ile alındığı görülmektedir. Bunun yanında L-aspartik asit, glisin ve L-lisinin gelişimi biyokütle ve B12 vitamini artışını inhibe ettiği görülmektedir (Marwaha vd., 1983).

4.3 Farklı karbon kaynaklarının etkisi

PAB tarafından üretilen B12 vitamini miktarına fermentasyon süresince kullanılan karbon kaynağının da etkisi vardır. Wang ve diğer araştırmacılar tarafından yapılan çalışmada *Propionibacterium freudenreichii* ile B12 vitamini üretilirken çeşitli kütlesel oranlarda (1:1, 1,5, 2, 2,5, ve 3) gliserol-glikoz karşımı kullanılmıştır. Araştırma sonuçlarına göre gliserol-glikoz oranındaki artış propiyonik asit verimini artırsa da B12 üretimini düşürmüştür. En iyi sonuçlar B12 vitamini için 1:2,5 kütlesel oranda 0,37 mgL^{-1} olarak kaydedilmiştir. Bu değer yalnızca gliserol ya da yalnızca glikoz olan ortamda elde edilen sonuçlardan daha yüksektir (P. Wang vd., 2014). Liu ve diğer araştırmacılar tarafından yapılan çalışmada ise glukoz (40 gL^{-1}) ve glisinin (2 gL^{-1}) kullanımının B12 vitamini düzeyini artırdığı görülmektedir (Liu vd., 2021).

4.4 İnokulum tipi ve oranı

Van Wyk ve diğer araştırmacıların yaptığı çalışmada farklı *P. freudenreichii* suşları ile B12 vitamini üretimi yapılmıştır. Çalışmada en yüksek üretim olan, *P. freudenreichii* subsp. *shermanii* J15'in ürettiği B12 vitamini miktarı 68,05 µg 100 mL^{-1}'dir. Farklı suşların ürettiği B12 vitamini miktarlarının arasında anlamlı fark olduğu görülmüştür (van Wyk vd., 2011). İnokulum tipi, mikroorganizmanın cins, tür ve suşuna bağlı olarak B12 vitamini üretimi üzerine etkilidir.

İnokulum oranı B12 üretiminde verimi etkileyen bir faktördür. İnokulum oranının yeterli miktardan az ya da fazla olması mikrobiyal üretimi etkilemektedir. Örneğin inokulum oranının belirli bir seviyeden az olması adaptasyon

sürecinin uzamasına neden olurken; fazla olması ise şeker tüketiminin artmasına ve hücre birikmesine neden olmaktadır. B12 vitamini fermantasyonunda ideal inokulum oranı fermantasyon hacminin yaklaşık %1 ila %5'i kadar olmalıdır (Massoud vd., 2018).

4.5 Fermentasyon süresi

Madhu ve diğer araştırmacılar tarafından yapılan çalışmada *Lactobacillus plantarum* ile B12 vitaminin mikrobiyal fermentasyonla üretiminde 48-120 saat aralığında izlendiğinde 96. saat sonrası ortamdaki B12 vitamini konsantrasyonunda %25 civarında düşme görülmüştür (Madhu vd., 2010). B12 vitamininin üretimi fermentasyon süresi uzadıkça ortamda PAB'ın ürettiği metabolitlerin birikmesi nedeniyle azalmaktadır.

4.6 Aerasyon

Propionibacterium cinsinden bakteriler, vitamin B12'yi etkili bir şekilde üretmek için hem anaerobik hem de aerobik koşullara ihtiyaç duyarlar. PAB'lar fakültatif anaerob olmasına rağmen oksijene karşı toleransları yüksektir (de Assis vd., 2022).

Ye ve diğer araştırmacılar tarafından yapılan çalışmada anaerobik ve arobik koşulların avantajından yararlanmak için fermentasyon dönüşümlü şartlar altında uygulanmıştır. Bu şekilde B12 vitamini üretimi anaerobik fermentasyon ile üretilene kıyasla 2 kart arttırılabilmektedir. Aerobik fermentasyon 6 saatten fazla uygulandığında sitokrom sentezi üzerindeki oksijenin inhibisyonu nedeniyle hücre gelişimini olumsuz etkilemektedir. Diğer yandan çözünmüş oksijen konsantrasyonun düşük olduğu (0,5-1 ppm) durumda ise propiyonik asit tüketimini artırdığından ve asetat üretimini düşürdüğünden hücre gelişimine avantaj sağlar. Dönüşümlü olarak uygulanan aerasyon şartları B12 vitamini üretimini artırmaktadır (Ye vd., 1996).

5. Sonuç

Propionibacterium ürettiği postbiyotikler nedeniyle son derece önemlidir. Özellikle metaboliti olan B12 vitamini Türkiye'de eksikliği yaygın olarak görülen bir vitamindir (Yazan Şahan & Erdoğmuş Mergen, 2019). *Propionibacterium* cinsi bakterilerin ürün oluşmasında etkin olduğu fermente süt ürünleri, B12 vitamini düzeyinin artırılmasına yönelik çalışmalara iyi bir araç olma potansiyeli taşımaktadır. Bu çalışmada propiyonik asit bakterilerinin kültür koşullarını etkileyen faktörlere ve B12 vitaminine yönelik olarak yapılan uygulamalarına değinilmiştir. B12 vitamini üretimi üzerine etkili olan faktörler araştırılarak en etkili parametrelerin optimizasyonu ile B12 üretimi maksimize edilebilir ve bu koşullar fermente süt ürünlerine uygulanabilir.

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Determination of Factors Affecting Red Meat Consumption Habits in Duhok Province (Northern Iraq)

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Abstract

In this study, it was aimed to determine the factors affecting red meat consumption habits in Duhok province of Northern Iraq. For this purpose, questionnaire forms consisting of questions to determine the demographic characteristics and red meat consumption habits of the participants (n=100) were used. To the question "Do you find the red meat you buy reliable?" 3.7% of women and 12.3% of men answered no ($p<0.05$). The relationship between education level and the amount of red meat purchased monthly ($p<0.05$) and the number of employees in the household ($p<0.05$) was found to be statistically significant. Similarly, the education level of the participants was determined as an important factor affecting the frequency of red meat consumption ($p<0.05$). While the majority of high school and university graduates (55.2% and 76%, respectively) consumed red meat 1-3 times a week, 55.6% of primary school graduates stated that they consumed red meat 1-3 times a month. The work of the participants affected the amount of red meat purchased monthly ($p<0.01$), and the majority of the self-employed (85.7%) stated that they purchased ≥2 kg of red meat per month. While 69.2% of the workers stated that they did not consume red meat due to its high price, this rate was 32.5% in the self-employed workers ($p<0.01$). Again, while 53.8% of the workers consumed red meat 1-3 times a month, 68.8% of the self-employed workers stated that they consumed red meat 1-3 times a week ($p<0.05$).

Key Words: *Red meat, Consumption, Habit, Duhok*

Duhok İlinde (Kuzey Irak) Kırmızı Et Tüketim Alışkanlıklarını Etkileyen Etmenlerin Belirlenmesi

Özet

Bu çalışmada, Kuzey Irak'ın Duhok ilindeki kırmızı et tüketim alışkanlıklarını etkileyen etmenleri belirlemek amaçlanmıştır. Bu amaçla, katılımcıların (n=100) demografik özelliklerini ve kırmızı et tüketim alışkanlıklarını belirlemeye yönelik sorulardan oluşan anket formları kullanılmıştır. "Satın aldığınız kırmızı eti güvenilir buluyor musunuz?" sorusuna kadınların %3.7'si, erkeklerin ise %12.3'ü hayır cevabını vermiştir ($p<0.05$). Eğitim düzeyi ile aylık satın alınan kırmızı et miktarı ($p<0.05$) ve hanedeki çalışan sayısı ($p<0.05$) arasındaki ilişki istatistiksel olarak önemli bulunmuştur. Benzer şekilde katılımcıların eğitim düzeyi, kırmızı et tüketim sıklığını etkileyen önemli bir faktör olarak belirlenmiştir ($p<0.05$). Lise ve üniversite mezunlarının çoğunluğu (sırasıyla %55.2 ve %76) haftada 1-3 defa kırmızı et tüketirken ilkokul mezunlarının %55.6'sı ayda 1-3 defa kırmızı et tükettiklerini belirtmiştir. Katılımcıların yaptığı iş, aylık satın alınan kırmızı et miktarını etkilemiş ($p<0.01$) ve serbest çalışanların büyük çoğunluğu (%85.7) ayda ≥2 kg kırmızı et satın aldıklarını belirtmiştir. Mesleği işçi olanların %69.2'si yüksek fiyatından dolayı kırmızı et tüketmediklerini belirtirken serbest meslek çalışanlarında bu oran %32.5 olmuştur ($p<0.01$). Yine işçilerin %53.8'inin kırmızı et tüketim sıklığı ayda 1-3 defa olurken serbest meslek çalışanlarının %68.8'i haftada 1-3 defa kırmızı et tükettiklerini belirtmiştir ($p<0.05$)

Anahtar Kelimeler: *Kırmız et, Tüketim, Alışkanlık, Duhok*

ID: 826

The Effect of Indole Acetic Acid on Forage Soybean under Drought Stress

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Abstract

Drought is an important environmental stress that limits crop production in the world. Its importance has increased with global warming and it has become one of the most important factors limiting plant production. Soybean is the source of obtaining more and cheaper protein per unit area. Soybean has a widespread use in livestock because it contains valuable amino acids as well as high protein quality. The objective of this research is to reduce negative effect of drought stress in the forage soybean with indole acetic acid application. The experiment was carried out in the growth chamber according to a randomized block design with 4 different doses (0,5,10,20 µM IAA) of indole acetic acid, 2 drought levels (0 and -0.5 MPa PEG-6000) and 3 replicate. Leaf length, leaf width, leaf proportional water content, cell membrane damage and malondialdehyde (MDA) content of the plants were determined. The data were evaluated by analysis of variance using a statistical package program. According to the analysis of variance, all parameters were found to be statistically significant in drought x indole acetic acid interaction. Indole acetic acid applied to the forage soybean plant alleviated the damage caused by drought.For this reason, it is thought that it may be important to ensure less damage to plants grown under stress.

Key Words: *Indole acetic acid, Drought stress, Forage soybean*

Kuraklık Stresi Altında İndol Asetik Asidin Yemlik Soya Fasulyesine Etkisi

Özet

Kuraklık, dünyada bitkisel üretimi sınırlayan önemli bir çevresel strestir. Küresel ısınmayla birlikte önemi daha da artmış ve bitkisel üretimi sınırlayan en önemli faktörlerden biri olmuştur. Soya birim alandan daha fazla ve daha ucuz protein elde etmenin kaynağıdır. Soya fasulyesi, yüksek protein kalitesinin yanı sıra değerli amino asitler içerdiğinden hayvancılıkta yaygın bir kullanıma sahiptir. Bu araştırmanın amacı, indol asetik asit uygulamasıyla yemlik soya fasulyesinde kuraklık stresinin olumsuz etkisini azaltmaktır. Deneme, 4 farklı doz (0,5,10,20 µM IAA) indol asetik asit, 2 kuraklık seviyesi (0 ve -0,5 MPa PEG-6000) ve 3 tekerrürle tesadüf blokları deneme desenine göre kurulmuş yetiştirme odasında yürütülmüştür. bitkilerin yaprak boyu, yaprak eni, yaprak oransal su içeriği, hücre membran zararı ve malondialdehit (MDA) içeriği belirlenmiştir. Veriler, istatistiksel paket program kullanılarak varyans analiziyle değerlendirilmiştir. Varyans analizine göre, kuraklık x indol asetik asit interaksiyonunda tüm parametreler istatistiksel olarak önemli bulunmuştur. Yemlik soya bitkisine uygulanan indol asetik asit kuraklığın yarattığı hasarı hafifletmiştir. Bu nedenle stres altında yetiştirilen bitkilerin daha az zarar görmesini sağlamak için önemli olabileceği düşünülmektedir.

Anahtar Kelimeler: *İndol asetik asit, Kuraklık stresi, Yemlik soya fasulyesi*

ID: 828

Agriculture 4.0 and Its Applications in Turkey

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Abstract
Agriculture is one of the elements that play the most important role in the transition to a settled order. The needs that emerged over time and the new discoveries made to facilitate human life have an important place in cultural evolution. Cultural evolution has led to the use of different methods in agriculture. With the fusion of agriculture and information technologies, technology has begun to enter the operation of agricultural production in some way. Manufacturers have sought innovation to facilitate their work, reduce costs, and increase production and efficiency in various ways. Agriculture 4.0 aims to prevent the waste of resources, increase the gross return of the product, and minimize environmental pollution caused by the production. Smart farming techniques can be used in almost every period of plant production, from tillage to harvest. In this study, the techniques of Agriculture 4.0 applied by the producers will be mentioned. Applications such as smart spraying, herbal diseases, monitoring of crops and soil, and smart harvesting should be used in the strategies of agricultural enterprises in agricultural production. Recently, the low number of young populations in agriculture and the increase in the average age is seen as significant disadvantages. With Agriculture 4.0 applications, the return of young people to agriculture should be ensured.
Key Words: *Agriculture 4.0, Application areas, Profitability, Technology*

Türkiye'de Tarım 4.0 ve Uygulamaları

Özet
Tarım, yerleşik düzene geçilmesinde en önemli rolü oynayan unsurlardan bir tanesidir. Zaman içerisinde ortaya çıkan ihtiyaçlar ve insanın yaşamını kolaylaştırması amacıyla ortaya konulan yeni keşifler kültürel evrimde önemli bir yer tutmaktadır. Kültürel evrim tarımda da farklı yöntemlerin kullanılmasına neden olmuştur. Tarım ve bilgi teknolojilerinin kaynaştırılmasıyla teknoloji, tarımsal üretimin işleyişine bir şekilde girmeye başlamıştır. Üreticiler işlerini kolaylaştırmak, gideri azaltmak, üretim ve verimi çeşitli yollarla arttırmak için yenilik arayışına girmişlerdir. Tarım 4.0 kaynak israfının önüne geçmeyi, ürünün brüt getirisini arttırmayı ve üretimden kaynaklanan çevresel kirliliği en aza indirmeyi amaçlamaktadır. Akıllı tarım teknikleri, toprak işlemeden hasata kadar, bitkisel üretimin hemen her döneminde kullanılabilmektedir. Bu çalışmada Tarım 4.0'ın üreticiler tarafından uygulanan tekniklerinden bahsedilecektir. Tarımsal işletmelerin tarımsal üretimdeki stratejilerinde akıllı ilaçlama, bitkisel hastalıklar, ürün ve toprağın izlenmesi, akıllı hasat gibi uygulamalar kullanılmalıdır. Son zamanlarda tarımda genç nüfus sayısının az oluşu, yaş ortalamasının yükselişi önemli bir dezavantaj olarak görülmektedir. Tarım 4.0 uygulamaları ile gençlerin tarıma dönüşü sağlanlamalıdır.
Anahtar Kelimeler: *Tarım 4.0,, Uygulama alanları, Karlılık, Teknoloji*

Giriş
Tarım, yerleşik düzene geçilmesinde en önemli rolü oynayan unsurlardan bir tanesidir. İnsanoğlu bitkileri ilk evcilleştirdiği zamandan bu yana çeşitli biçimlerde tarım yapmıştır. Zaman içerisinde ortaya çıkan ihtiyaçlar ve insanın yaşamını kolaylaştırması amacıyla ortaya konulan yeni keşifler kültürel evrimde önemli bir yer tutmaktadır. Kültürel evrim tarımda da farklı yöntemlerin kullanılmasına neden olmuştur.
Üreticiler işlerini kolaylaştırmak, gideri azaltmak ve üretim ve verimi çeşitli yollarla arttırmak için yenilik arayışına girmiştir. Tarım 4.0 teriminden önce tarımdaki dijitalleşme, hassas tarım gibi birçok kavramın kullanıldığı bir dönemde üreticiler tarımda işçilik maliyetlerini düşürme, tarımda sürekli tekrarlanan işlerin olması ve bunun can sıkıcı bir hale gelmesiyle tarımda robotik ve dijital uygulamaların arayışı artmıştır (Kaya, 2019; Şahin, 2022). Tarımsal üretimde geleneksel olarak uygulanan yöntemlerde üretimi artırmak için teknolojiden faydalanmak gerekiyor. Bu da kısaca akıllı tarımla üretim yapmaktan geçmektedir (Öcel ve ark., 2022). Tarım sektörü, teknoloji ve inovasyonu iyi değerlendirmeli, çok acil eylem planlarını hayata geçirmelidir (Klavuz ve Erdem 2019). Akıllı tarım uygulamaları, tarımsal ürün tedarikinde verimliliği arttırmakla birlikte, sosyal ve çevresel faydalar da sağlamaktadır. Pestisit ve herbisit kullanımını engelleyen robotik yabancı ot ayıklama uygulamaları ve hassas püskürtücü sistemler gibi uygulamalar da doğrudan pozitif çevresel bir etkiye sahiptir. Sürdürülebilir tarımsal kalkınmayı gerçekleştirmek için bu kaynakların daha verimli kullanılması bir zorunluluktur. Verimi arttırmak için de geleneksel tarım ve enerji yaklaşımlarından vazgeçilip hızla dijital ve akıllı teknolojilerin geliştirilerek çiftçinin hizmetine sunulması gerekmektedir. Tarım 5.0'ın konuşulmaya başlandığı bu dönemde Tarım 4.0 uygulamalarının entegrasyonu bir an önce sağlanmalıdır. Dünyanın en büyük tarımsal ekonomileri içerinde yer alan ülkemizin Tarım 4.0' ile ilgili uygulamaları ve kullanımının yaygınlaştırılması için örnek uygulamalardan bahsedilecektir.

Materyal ve Yöntem

Çalışmada, Tarım 4.0 ve Türkiye Uygulamaları ile ilgi üretici uygulamaları değerlendirilecektir.

1. İklim ve topografya uygunluğuna göre bitki deseni belirlenmesi
2. Ekim ve dikimde tarla haritalama ve tohum hesabı
3. Yabancı otların İHA kullanılarak tespit edilmesi, ilaçlanması ve mücadelesi
4. İHA'lar ile tarımsal ürünlerin takibi ve verim tahmini
5. Tarımsal Sulama otonumları ile digital sulama
6. İHA'lar ile hastalık ve zararlı tespiti
7. Konukçu takibi ve entegre ilaçlama
8. Hasat

Bulgular ve Tartışma

Tarımsal gelişmenin ön koşulu, tarımda yenilikleri uygulamaya ve geliştirmeye bağlıdır. Tarımsal karlılık üzerinde teknolojik yeniliklerin ve entegrasyonun önemli bir etkisi vardır. Özellikle tarımın en çok yapıldığı kırsal alanlarda teknolojik yeniliklerin uygulanma oranının yüksekseltmek ve yeni tarımsal üretim yöntemlerinin uygulanmasını sağlamak üreticileri ürünlerini sanayinin farklı kollarını sunmasını sağlayacaktır.

Tarımsal üretimde robotik, otomatik kontrol ve yapay zekâ teknikleri içerisinde farmbots ve farmdronelar da dâhil olmak üzere her türlü uygulama sürecini kapsar. Tarımsal robotlar, üreticiler için işlerini kolaylaştırmak, gideri azaltmak ve üretim ve verimini çeşitli yollarla artırmak için tasarlanmışlardır. İHA'lar, otonom traktörler ve tarım aletleri vb. tarımsal robotlar, çiftçiler için iş gücünü azaltmak, zaman tasarrufu sağlamak ve toplam üretim verimini artırmayı amaçlamıştır.

İklim ve topografya uygunluğuna göre bitki deseni belirlenmesi

Tarım arazilerinde bitki deseninin belirlenmesi ve ayırt edilmesi çalışmalarında uzaktan algılama yoğun olarak kullanılmaktaydı. Uzaktan algılamada, uyduların gerek her zaman aynı yerden görüntü elde edememesi tarımsal bitki deseni belirlenmesinde yetersiz kalmaktadır (Doğan, 2019.

İHA'ların kolay kullanımı ve istenilen zaman ve yer örnekleme aralığına uygun yükseklikte uçurulabilmesiyle beraber esnek hareket kabiliyetine sahip olmasını büyük avantajlar sağlamaktadır. İHA'lar üzerine yerleştirilen multispektral kameradan elde edilen görüntüler ile belirli bir tarımsal alanda bitki deseni tespitinin rahatlıkla yapılmasına veya bir tarım arazisinde hangi bitkinin yetiştirilebileceği konusunda öneriler sunabilmektedir. Ayrıca ulaşım imkânın zor olduğu yamaç arazilerindeki tıbbi ve aromatik bitkilerin kolay bir şekilde tespit edilmesi sağlamaktadır (Jurado-Expósitove ark., 2019).

Bitki örtüsü tespiti, küresel iklim değişikliğinin olası etkilerinin değerlendirilmesinde, tarımsal sulama projelerinin değerlendirilmesin, arazi toplulaştırma projelerinin etkin bir şekilde yapılması için oldukça önemli bir unsurdur. bitki deseninin uzaktan algılama yöntemleri veya İHA'lar kullanarak arazi kullanımın sınıflarının belirlenmesinde yüksek hassasiyet ve doğruluklu haritaların üretilmesine bağlıdır.

İHA'lara monte edilen multispektral kameralar ile arazi kullanım durumları ve bitki deseni tespiti yapılabilmektedir. İHA kullanılarak elde edilen yakın kızılötesi (NIR) Kırmızı Yeşil Mavi (NIR-RGB) bant veri setlerinden bitkilerin ayırt edilebilmesi için bu veri kümelerinin hem tek başına hem de kombinasyonun kullanıldığı, rastgele orman temelli bir yöntem ile analiz edildiği ve özellik faktör yüklemesine dayalı farklı bant azaltma yöntemlerinin analiz edildiği bildirilmiştir (Özgüven ve ark. 2022).

Ekim, Dikim, Hasat, İlaçlama ve Toplama işlemleri otomasyonu



Tarımsal Faaliyetleri Kontrolü

Modern tarımsal alanda tohumlamada uçaklar ve İHA'lar kullanılmaktadır. İHA'lar uçaklara göre daha ucuz ve basit çalışma mekanizması ile daha uygun bir alternatif olduğunu, hassas sensör ve kamera sistemi sayesinde tarımsal üretim alanlarında sürdürülebilirliğin gelişimine katkı sunmaktadır. Tarımsal çalışmalarda, maliyet girdi miktarını azaltacak yenilikleri çiftçiler tarafında azda olsa kullanımına başlanmıştır. Bunlardan toprak işleme, tohum yatağı hazırlama ve ekim ve dikim işleminin GPS "li traktörlerle yapılması, otomatik dümenleme sistemlerinin ve hasat öncesinde anlık verim, nem ve kalite ölçüm değerlerini alabilen otonum sistemler kullanılmaktadır. Buna ek olarak toprak haritalaması uygulamaların başlaması inovasyonun daha geniş alanları yayılabileceğinin göstergesi olmuştur (Akıllı ve ark., 2019). Akıllı tarım sistemlerinde kullanılan teknolojik makineler özellikle hassas ekim mibzerleri elektronik sensörler aracılığıyla işlem yapmakta ve her tohum uygun miktarda ve uygun derinlikte ekim yapabilmektedir. Fazladan tohum atımı ve derine ekimlerde çıkış probleminin önüne geçmektedir.



GPS ile tarla hazırlığı ve Hasat Kontrolü



Hastalık, Zararlı ve Yabancı ot kontrolü otonomları

•



•Püskürtme ve inceltme,



• Yeni nesil drone ilaçlama (70 Lt kapasite)



Akıllı Üretim ve Çiftlik sistemleri

Sonuç

Akıllı Tarım**,** Dijital tarım ve Tarım 4.0, tarımsal makine, robotlar, İHA'lar, robotik hasat makineleri vb birçok uygulamanın tarımdaki karşılığıdır. Ayrıca entegre üretim sisteminin temelinden tarımsal süreçlerin tamamımda otonumlarım kullanımı sonucunda verim artışı, çevreyi koruma, zaman tasarrufu ve karlılık gibi birçok faydayıda beraberimde getiren sistem Tarım 4.0'dan Tarım 5.0 evrilmeye başlamıştır. Bu sektöre uyumluluk sağlayan tüm tarım işletmeler güvenli, sürdürülebilir ve yüksek verimli gıda üretiminde karlılığı artırmaktadır. Tarımsal işletmelerin tarımsal üretimdeki stratejilerinde akıllı ilaçlama, bitkisel hastalıklar, ürün ve toprağın izlenmesi, akıllı hasat gibi uygulamalara geçilmelidir. Son zamanlarda tarımda genç nufüsün az oluşu yaş ortalamanın yükselişi önemli bir dezavantaj olarak görülmektedir. Genç ziraatcileri tarım 4.0 uygulamaları ile tarıma dönüşü sağlanlamalıdır.

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Determination of The Ratio of Essential Oils and Components of *Lavandula stoechas* spp. (Karabaş) at Different Harvest Times

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Abstract

The aim of this study was to determine the essential oil content and composition of Karabaş plant (*Lavandula stoechas* spp.) collected from its natural environment in Altınözü district, Hatay Province, in two different periods, flowering and during seed formation. GC-MS was used to analyze the essential oil content of the plant. The dry flowers of Karabaş plant used in this study were obtained by water distillation to obtain the essential oil, and the essential oil content was determined to be 1.28% in the flowering period and 1.39% in the seed-forming period. The main components obtained from Karabaş plant were determined as fenchone (65.79%) in the mean flowering period and fenchone(68.15%) in the seed-forming period.

Key Words: *Karabaş, Harvest Time, Essential Oil, Lavandula stoechas spp.*

Farklı Toplanma Zamanında *Lavandula stoechas* spp (Karabaş) Bitkisinin Uçucu Yağ Oran ve Bileşenlerinin Belirlenmesi

Özet

Çalışmada, Hatay ilinden Altınözü ilçesinden doğal ortamından toplanan Karabaş (*Lavandula stoechas* spp.) bitkisinin çiçeklenme dönemi ve tohum baglama döneminde olmak üzere iki farklı dönemdeki uçucu yağ oran ve kompozisyonlarını belirlemek amacıyla yapılmıştır. Bitkinin uçucu yağ içeriklerini analiz etmek için GC-MS cihazı kullanılmıştır. Bu çalışmada kullanılan karabaş bitkisin kuru başak çiçekleri uçucu yağ elde etmek amacıyla su distilasyonu yöntemiyle elde edilmiş ve uçucu yağ oranı çiçeklenme dönemini %1.28 ve tohum bağlama döneminde ise %1.39 oranında belirlenmiştir. Karabaş bitkisinden elde edilen ana bileşenler, çiçeklenme döneminin ortasında Fenchone (%65.79) ve tohum bağlama döneminde Fenchone (%68.15) olarak tespit edilmiştir.

Anahtar Kelimeler: *Karabaş, harvest time, essential oil, Lavandula stoechas spp.*

Giriş

Lamiaceae familyası, dünyada yaklaşık 236 cins ve 7200 tür içerir ve insanlar için yararlı olan uçucu yağlar ve antioksidan özelliklere sahip yabani aromatik bitki türleri bakımından zengindir. Türkiye florasında 256 tanesi endemik olmak üzere toplam 574 Lamiaceae türü bulunmaktadır. Lavandula L. (Lamiaceae) cinsi Türkiye'de 3 takson ile temsil edilmektedir; *Lavandula stoechas* L. *subsp. stoechas, Lavandula pedunculata subsp. cariensi*s (Boiss.) Upson & S.Andrews ve L. *angustifolia* Mill. *subsp. Angustifolia*'dır. Türkiye'de angustifolia yerel olarak "lavanta" olarak, *pedunculata* "karan" ve stoechas "karabaşotu, karan, gargan, keşişotu" olarak bilinir.(Baytop, 1984). Karabaş otu halk arasında genellikle birbirinin yerine tıbbi amaçlarla yüzyıllardır kullanılmaktadır (Mill, 1982; Erik ve Tarıkahya, 2004;Küçük ve ark., 2019; Çatav ve ark., 2021; Sevindik ve ark., 2022). Lavandula stoechas esansiyel yağı, en önemlileri linalil asetat, sineol, linalool, nerol ve borneol olan 40'tan fazla farklı bileşik içerir. Ayrıca bütirik asit, propiyonik asit, valerik asit, germbulin, tanenler ve flavonoidler gibi bileşikler içerir (Cherrat ve ark., 2014).*Lavandula stoechas*, Fas da dahil olmak üzere Akdeniz ülkelerinde geleneksel olarak enflamatuar hastalıklar, sistit, nefrit ve romatizmal artrit gibi ağrılı hastalıkların tedavisi için kullanılan çoğu bitkiden biridir. Birçok çalışma, L. stoechas'ların sulu ve alkollü ekstraktlarının çeşitli biyolojik etkilerle karakterize olduğunu bildirmiştir. Bitkinin, antifungal, antioksidan, antihiperglisemik aktiviteler, antikonvülsan, antispazmodik ve yatıştırıcı etkiler ve anti-enflamatuar aktiviteyesahip olduğu bildirilmiştir. (Yassine ve ark., 2016; Karabagias ve ark., 2019; Fadil ve ark., 2021)

Bu çalışmada Karabaş (Lavandula stoechas spp.) bitkisinin çiçeklenme dönemi ve tohum baglama döneminde olmak üzere iki farklı dönemdeki uçucu yağ oran ve kompozisyonlarını belirlemek amacıyla yapılmıştır.

Materyal ve Yöntem

2.1. Materyal

Çalışmada, Hatay ilinden Altınözü ilçesinden doğal ortamından toplanmış ve oda sıcaklığında kurutma işlemi yapılmıştır.

2.2. Metot

2.2.1. Bitki Uçucu Yağlarının Elde Edilmesi

Çalışmamızda kullanılan uçucu yağlar bitki kuru çiçek herbalarından (1000 g) su distilasyonu yöntemiyle ve clevenger sisteminde 3 saatlik işlem sonucunda elde edilmiştir. Distilasyon sonucu elde edilen uçucu yağlar analizleri için koyu renkli cam şişelerde konulup, Namık Kemal Üniversitesi Merkez Araştırma Laboratuvarına analiz için teslim edilmiştir (Türkmen, 2021).

2.2.2. Uçucu Yağ Bileşenlerinin Belirlenmesi

Analizi Namık Kemal Üniversitesi merkez araştırma laboratuvarında, Hewlett-Packard 6890 serisi GC-MS MS analiz cihazı kullanılarak gerçekleştirilmiştir. Cihazın kolonu HP-5MS fused silica column (5% phenyl methyl polysiloxane 30 m 0.25 mm i.d., film thickness 0.25 µm) ve dedektörü Hewlett-Packard mass selective detector 6890'dır. GC-MS MS analizi literatürde belirtilen prosedüre göre gerçekleştirilmiştir. Fırın 60 ºC'ye ısıtılıp bu sıcaklıkta 2 dakika beklenir. Daha sonra sıcaklık dakikada 4 derece arttırılarak 180 ºC'ye, oradan dakikada 2 derece arttırılarak 210 ºC'ye ve dakikada 5 derece arttırılarak 230 ºC'ye yükseltilir ve 1 dakika bekletilir. Son olarak sıcaklık dakikada 1 derece artırılarak 280 ºC'ye yükseltilir Helyum (%99.9999) taşıyıcı gaz olarak ve 1 mL/dakika akış hızında kullanılmıştır. Enjektör sıcaklığı 200 ºC'de tutulmuştur. Ayrılma oranı 1:5'dir (Asil, 2021).

Bulgular ve Tartışma

Çalışmada, Karabaş (*Lavandula stoechas* spp.) bitkisinin çiçeklenme dönemi ve tohum bağlama döneminde olmak üzere iki farklı dönemdeki uçucu yağ oran ve kompozisyonlarını belirlemek amacıyla yapılmıştır. Bitkinin çiçeklenme dönemindeki uçucu bileşenleri dağılımı Tablo 1'de gösterilmiştir.

Karabaş bitkisinin çiçeklenme dönemindeki analiz sonucunda en yüksek sırasıyla Fenchone % 65.79, Linalyl acetate % 10.76 ve Silene % 3.01 oranında elde edilmiştir. Uçucu yağ oranı çiçeklenme dönemini ortasında %1.28 olarak hesaplanmıştır.

Tablo. 1. Karabaş bitkisinin çiçeklenme dönemindeki uçucu bileşenleri dağılımı (%)

No	**RT**	**Kimyasal adı**	**Area (%)**
1	47.81	Fenchone	65.79
2	16.52	Linalyl acetate	10.76
3	67.34	Silane	3.01
4	16.70	Benzene	2.39
5	76.13	Ledol	2.25
6	32.50	Eucalyptol	1.87
7	73.30	Azulene	1.85
8	27.41	D-Limonene	0.99

Karabaş bitkisinin tohum bağlama dönemindeki analiz sonucunda en yüksek sırasıyla Fenchone % 68.15 Linalyl acetate % 9.06 ve Alpha.-Pinene % 6.97 oranında elde edilmiştir. Uçucu yağ oranı çiçeklenme dönemini ortasında %1.39 olarak hesaplanmıştır.

Tablo. 2. Karabaş bitkisinin tohum bağlama dönemindeki uçucu bileşenleri dağılımı (%)

No	RT	Kimyasal adı	Area (%)
1	21.21	Fenchone	68.15
2	59.40	Linalyl acetate	9.06
3	19.09	Alpha.-Pinene	6.97
4	27.75	D-Limonene	2.89
5	42.76	Cyclopentane, 2-propenyl-	2.31
6	72.93	Ledol	2.24
7	68.19	Benzenemethanol, alpha,alpha,4-trimethyl-	1.43
8	21.87	Camphene	1.34
9	32.40	Eucalyptol	1.28

Çalışma ile ilgili literatür çalışmaları incelendiğinde, fenkon ve ökaliptol ve linalol ve linalil asetat içerdiği olduğunu bildirmişlerdir (Oztürk ve ark., 2005; Bousta ve Farah, 2020). Bu çalışmada benzer uçucu bileşenler farklı oranlarda bulunmuştur.

Sonuç

Karabaş otunun farklı toplama zamanlarındaki uç yağ oranı ve bileşenleri üzerine yapılan çalışmada, elde edilen bulgular dikkate alındığında her iki toplama döneminde de en yüksek oranda Fenchone ve Linalyl acetate uçucu bileşenleri olarak ön plana çıkmaktadır. Bu bileşenlerin geleneksel kullanımı, antimikrobiyal ve antioksidan potansiyeli düşünüldüğünde ilaç ve gıda sanayinde değerlendirilebilir. Aynı zamanda tıbbi ve aromatik bitkilerin toplanma zamanlarının bitkinin içeriğini değiştirebileceği ve dolayısıyla bu konudan çalışmaların yapılması gerektiği sonucu çıkmıştır.

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Essential Oil Components of Çalba Plant in Altınözü

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Abstract

The aim of this study was to determine the content and composition of essential oils in the leaves and flowers of Çalba plant (*Phlomis longifolia* var. *bailanica*) collected in its natural environment in the Altınözü district, Hatay province. GC-MS was used to analyze the essential oil content of the plant. The flowers and leaves of Çalba plant used in this study were obtained by water distillation to obtain the essential oil. Alpha.-cubebene (50.88%) and caryophyllene (49.12%) were determined as the main constituents in the flowers of Çalba plant. Bis(p-tolylthio)methane (25.25%) and 2-(3,7-dimethyl-octa-2,6-dienyl)-4-methoxy-phenol (17.81%) were determined as the main components of the essential oil of leaves.

Key Words: *Çalba, Şalba, essential oil, Phlomis longifolia var. bailanica*

Altınözü'deki Çalba Bitkisinin Uçucu Yağ Bileşenleri

Özet

Çalışmada, Hatay ili Altınözü ilçesinden doğal ortamından toplanan Çalba (Phlomis longifolia var. bailanica) bitkisinin yaprak ve çiçeğinin uçucu yağ oran ve kompozisyonlarını belirlemek amacıyla yapılmıştır. Bitkinin uçucu yağ içeriklerini analiz etmek için GC-MS cihazı kullanılmıştır. Bu çalışmada kullanılan çalba bitkisin çiçeklerive yaprakları uçucu yağ elde etmek amacıyla su distilasyonu yöntemiyle elde edilmiştir. Çalba bitkisinden elde edilen çiçeğinde ana bileşen olarak, alpha.-Cubebene (%50.88) ve Caryophyllene (%49.12) tespit edilmiştir. Yaprak uçucu yağında ise, ana bileşen olarak Bis(p-tolylthio)methane (%25.25) ve 2-(3,7-Dimethyl-octa-2,6-dienyl)-4-methoxy-phenol (%17.81) tespit edilmiştir.

Anahtar Kelimeler: *Çalba, Şalba, Uçucu yağ,, Phlomis longifolia var. bailanica*

Giriş

Tıbbi ve aromatik bitkilerin yeni terapötik ajanlar olarak ve değerli biyositler için bir kaynak olarak kullanılması talebine artan bir ilgi vardır. Bitkilerden elde edilen uçucu yağlar, mantar önleyici, antibakteriyel, antiviral ve böcek öldürücü özelliklerinden dolayı gıda, baharat, gıda muhafaza, halk hekimliği, ilaç endüstrisi ve koku gibi birçok alanda kullanılmaktadır (El Mokni vd., 2019).).

Lamiaceae, 236 cins ve 6900-7200 tür ile dünyadaki en büyük ve en yaygın familyalardan biridir. Lamiaceae familyasındaki bitkilerin çoğunun tıbbi özelliklere sahip olduğu iyi bilinmektedir. Lamiaceae familyasına ait çok yıllık bir bitki cinsi olan Phlomis'in tıbbi özellikleri olduğu bilinmektedir.

Türkiye florası Phlomis cinsinin Huber-Morath (1982) tarafından 34 tür ve 10 melez içerdiği belirlenmiştir. 34 türden 22'sinin endemik olduğu bilinmektedir (Huber, 1982; Çelik ve ark., 215; Aghakhani ve ark., 2018). Phlomis türleri Flomoides ve Phlomis olmak üzere iki ana cinse ayrılır ve Flomoides ve Phlomis dahil 100'den fazla tür içerir (Moench, 1874; Albaladejo ve ark., 2015).

Phlomis üç alt cins içerir (Dendrophlomis, Gymnophlomis ve Oxyphlomis) ve esas olarak Akdeniz bölgesinde bulunur. Türkiye, bu ana cins türlerinin ana habitatlarından biri olarak kabul edilmektedir (Huber., 1982; Henge, 1986). Son zamanlarda yapılan araştırmalar, Türkiye'de ve bazı ülkelerde toplanan farklı Phlomis türlerinden elde edilen uçucu yağların ana bileşenlerinin heksahidrofarnesil aseton, spathulenol, germacrene D, β-karyofilin ve karyofilin oksit olduğunu göstermiştir.

Çalışmada kullanılan çalba (Phlomis longifolia var. bailanica (Vierh.) Hub.-Mor.) Hatay-Altınözü bölgesi çevresinde bol miktarda bulunmaktadır. Endemik değildir. Coğrafi dağılımda C6 koridorunda yer alır (Yüzbaşoğlu vd., 2009).

Çalışma, Hatay Altınözü doğal ortamından toplanan Çalba (*Phlomis longifolia* var. *bailanica*) bitkisinin yaprak ve çiçeğinin uçucu yağ oran ve kompozisyonlarını belirlemek amacıyla yapılmıştır.

Materyal ve Yöntem

2.1. Materyal

Çalışmada, Hatay ilinden Altınözü ilçesinden doğal ortamından toplanmış ve oda sıcaklığında kurutma işlemi yapılmıştır.

2.2. Metot

2.2.1. Bitki Uçucu Yağlarının Elde Edilmesi

Bu çalışmada kullanılan çalba bitkisin çiçekleri ve yaprakları uçucu yağ elde etmek amacıyla (200 g) su distilasyonu yöntemiyle elde edilmiştir. Bitkilerin uçucu yağları clevenger sisteminde 3 saatlik buhar distilasyonu ile elde edilmiştir. Distilasyon sonucu elde edilen uçucu yağlar analizleri yapılıncaya kadar +4 ºC'de koyu renkli cam şişelerde saklanmıştır. Distilasyon sonucu elde edilen uçucu yağlar analizleri için koyu renkli cam şişelerde konulup, Namık Kemal Üniversitesi Merkez Araştırma Laboratuvarına analiz için teslim edilmiştir (Türkmen, 2021).

2.2.2. Uçucu Yağ Bileşenlerinin Belirlenmesi

Analizi Namık Kemal Üniversitesi merkez araştırma laboratuvarında, Hewlett-Packard 6890 serisi GC-MS MS analiz cihazı kullanılarak gerçekleştirilmiştir. Cihazın kolonu HP-5MS fused silica column (5% phenyl methyl polysiloxane 30 m 0.25 mm i.d., film thickness 0.25 µm) ve dedektörü Hewlett-Packard mass selective detector 6890'dır. GC-MS MS analizi literatürde belirtilen prosedüre göre gerçekleştirilmiştir. Fırın 60 ºC'ye ısıtılıp bu sıcaklıkta 2 dakika beklenir. Daha sonra sıcaklık dakikada 4 derece arttırılarak 180 ºC'ye, oradan dakikada 2 derece arttırılarak 210 ºC'ye ve dakikada 5 derece arttırılarak 230 ºC'ye yükseltilir ve 1 dakika bekletilir. Son olarak sıcaklık dakikada 1 derece artırılarak 280 ºC'ye yükseltilir Helyum (%99.9999) taşıyıcı gaz olarak ve 1 mL/dakika akış hızında kullanılmıştır. Enjektör sıcaklığı 200 ºC'de tutulmuştur. Ayrılma oranı 1:5'dir (Asil, 2021).

Bulgular ve Tartışma

GC-MS MS analizi ile Çalba bitkisinin çiçek ve yaprak yağ verimi ve uçucu bileşenlere ait analiz sonuçları incelenmiş olup, çiçekte iki uçucu bileşen ve yaprakta ise 10 adet uçucu bileşen tespit edilmiştir.
GC-MS MS kütüphanesinde bulunan elde edilen bileşenlerin eşleşme faktörleri ve bunların toplam pik alanları Tablo 1'de özetlenmiştir. Elde edilen sonuçları göre çiçek uçucu yağında %50.88 oranında alpha.-Cubebene ve %49.12 oranında ise Caryophyllene uçucu bileşenleri tespit edilmiştir (Tablo 1). Çiçekte uçucu yağ oranı eser miktarda bulunmuştur.

Tablo. 1. Çalba bitkisinin çiçek uçucu bileşenleri dağılımı (%)

No	***RT***	***Kimyasal adı***	***Area (%)***
1	41.13	.alpha.-Cubebene	50.88
2	52.41	Caryophyllene	49.12
	Toplam		**100.00**

Çalba bitkisinin yaprak uçucuyağ analiz sonucunda en yüksek sırasıyla Bis(4-methylphenylthio)-methane % 25.25, 2-(3,7-Dimethyl-octa-2,6-dienyl)-4-methoxy-phenol % 17.81 ve 2-Propanone, 1-phenylthio-1-methyl % 15.49 oranında elde edilmiştir. Yapraktaki uçucu yağ oranı %1.00 olarak hesaplanmıştır.

Tablo. 2. Çalba bitkisinin yaprak uçucu bileşenleri dağılımı (%)

No	**RT**	**Kimyasal adı**	**Area (%)**
1	16.73	Caryophyllene	7.85
2	16.86	2-Nonanone, 9-hydroxy-	0.43
3	38.74	Thiirane	5.16
4	69.87	2-(3,7-Dimethyl-octa-2,6-dienyl)-4-methoxy-phenol	17.81
5	72.39	1-Hydroxy-4,8-dimethylspiro[4.5]dec-7-en-6-one	12.39
6	73.94	2-Propanone, 1-phenylthio-1-methyl	15.49
7	74.40	Androstane	8.77
8	74.53	Anethofuran	1.23
9	75.82	Bis(4-methylphenylthio)-methane	25.25
10	100.29	4,5,6,6a,6b,7,8,12b-Octahydrobenzo[j]fluoranthene	5.62
		Toplam	**100.00**

Sonuç

Tıbbi ve aromatik bitkilerin uçucu yağ ve bileşenlerinin belirlenmesine yönelik artan bir ilgi ve araştırma vardır. Bu tür bitkilerin potansiyel kullanımlarını keşfetmek için hala daha fazla çaba gerekiyor. Bu çalışma, Çalba bitkisinin potansiyel uçucu yağ oran ve bileşenlerini ortaya çıkardı. Daha ileri çalışmalar, bu bileşenlerin ilaç, farmakolojik ve biyoaktivite uygulamaları olarak olası kullanımını araştıracaktır.

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Identification of Traded Medicinal Plants and their Socioeconomic Impact on Local Community of Astore District

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Abstract:

Background: Medicinal plants are those plants that have chemicals in one or more of their parts that can be used to treat ailments. Medicinal plants are used by the local people of the study area for the treatment of numerous ailments from prehistoric time. The study was conducted to assess the status, availability of traded medicinal plants for local and national demand. Secondly, to identify the traded medicinal plants and their socioeconomic impact on local community of Astore district, Gilgit Baltistan.

Methods: Different economically important traded medicinal plants belonging to 19 families were collected from different villages by random sampling method. Apiaceae was the most abundant family. The collected traded medicinal plants were pasted on herbarium sheets for identification purpose. These Sample plants were identified by Flora of Pakistan and they were also confirmed by the Arid Agriculture University Botany Department expert. Ethanomedicinal uses were also documented and the collected data was analyzed by using ethnobotanical indices i.e. Use value, Relative frequency citation, Fidelity level and Pearson correlation coefficient. Questionnaire survey was conducted to access the socioeconomic impact of traded medicinal plants, their current status, and availability for local and national demand. 80 respondents were interviewed consisting 66 men and 14 women. SPSS software was used to find out percentage and frequency of respective medicinal plants after field survey.

Results: About 26 economically important medicinal plants were identified from the study area and their ethanomedicinal uses were also documented. Use value and Relative frequency citation shows statistically significant relation. Survey results showed that the traded medicinal plants played pivotal role by enhancing socio-economic condition of local communities and they earned stipulated amount of income from sale of traded medicinal plants. Currently the traded medicinal plants are gradually decreasing due to anthropogenic activities like improper method of collection, uprooting and unsustainable use. Overall survey findings indicated that the traded medicinal plants are easily available for local demand but they are not easily available for national demand due to over exploitation, illegal trade, lack of protection and conservation measures.

Conclusion: Local people don't have sufficient information about identification of traded medicinal plants due to this only few economically important medicinal plants are traded in the area. The knowledge about medicinal plants is also limited to old age people. Traded medicinal plants have great role in improving economic condition of people. They are easily available for local demand but their availability for national demand is low because the traded medicinal plants are gradually decreasing due to unsustainable use and improper method of collection. Therefore, there is pressing need to create awareness among local people for the sustainable use and conservation of traded medicinal plants.

Keywords: Ailments; Astore; Medicinal plants; SPSS; Socioeconomic impact; Sustainable use

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Seed Handling And Extraction In *Dacryodes edulis* And Its Implications On Seed Germination: Prospect For Food Security

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Abstract
Dacryodes edulis is an African indigenous fruit tree with potential for food security that needs adequate knowledge in handling the seed for high germination and production of seedlings of good vigour. The various studies in this report were aimed at achieving high germination with good seedling vigour. Mature fruits were collected and subjected to various extractions and handling techniques. Data were collected on mean germination count and number of days to germination and results were analyzed using descriptive statistics. The results show that
The seeds soften natural before extraction had the highest germination of 83.33after 18 DAS in this same vein seeds sown vertically with the pointed tip facing downward direction recorded the highest percentage of germination of 100% after 19 days. Total removal of the seed coat to expose the seed gave the highest percentage of 94% after 27 days of sowing. The damaging effect of the seeds of *D. edulis* did not affect its germination as clearly observed in this study as the seeds damaged at both end produced germination percentage of 88 with its first germination recorded on the 14th DAS. High germination were recorded in all the media used, however the highest seed germination 93% was observed in seeds sown in river sand after 21 DAS. The study concluded that seed handling and processing have proven to be important factor in seed germination of *D. edulis*.

Key words: Dacryodes edulis seeds extraction, handling, positioning, pulp softening

Introduction

Food security is a condition in which all people at all times have physical, social and economic access to sufficient, safe, nutritious and affordable food as foundation for active healthy and productive life (Agbetoye, 2016). Food is very vital to everyday life for without food, it is almost impossible to live a normal life. The quality and quantity of food consumed also is very vital because healthy and balance diet is the prerequisite for a healthy living.
The forest houses the plants which are important sources of food ranging from staple items like fruit pulp and condiments of *Parkia biglobosa* seeds to leafy vegetables of *Vitex doniana*, edible fruits of *Dacryodes edulis* and *seeds of Plukenetia conophora* and many others. Wild fruits and leaves from trees and shrubs provide good nutritious supplements to diet such as protein, vitamins and roughages (Schreckenberg *et al*., 2006; Omonhinmin, 2012). They also provide income and employment opportunities to rural and urban households (Tee and Popoola, 2007). Latiff *et al*.,(2002) reported that forest resources contributed directly up to 80% of the livelihoods of the rural people living in extreme poverty.. They also provide environmental and social benefits but these forests had been treated in the users as inexhaustible (Ladipo, 2010). It is however, obvious that forest is currently at the point of extinction if nothing is done to reverse the unsustainable use. Therefore, there is an urgent need to enrich the forest with good planting materials to meet the demand of the ever increasing population that depends of the forest. To do this, there is the need for better understanding of the handing of the seeds which will be used for the mass production of good planting materials.

The Nigeria forest is enriched with useful plant genetic resources that are food and fruit producing plants which are of immense benefits to the growing population most especially the rural people who depend on them for their livelihood. Among these resources is the *Dacryodes edulis* fruit, a multipurpose agroforestry food species.
Dacryodes edulis (G. Don) H. J. Lam belongs to the family *Burseraceae* is an important fruit tree at the national and international levels, has high nutritional values and plays an important role in food security (Ajayi and Adesanwo, 2009; Duru *et al*., 2012). The fruit form an important part of the diet of people in West and Central Africa being rich in vitamins and containing 63.5% fat, 24.2% protein and 9.2% carbohydrate (Mbofung *et al.*, 2002).The fruit is an ellipsoidal drupe which varies in length from 4 to 12 cm (Plate 1). The skin colour of the mature fruit is dark blue to violet while the immature colour is pink (Anegbe *et al.*, 2005).The fruit is the edible part which can be eaten boiled, roasted or raw along side with maize or bread. The fruits contain considerable amount of fatty acids such as palmitic acids, linoleic acid and oleic acids (Iyare, 2009).because the fruit is rich in protein and oil, it can help to make diets more balanced in and in turn plays an important role in combating mal-nutrition among poor populations who have little access to protein rich diet (Obame *et al.*, 2008; Ajiwe *et al.*, 1997; Ikhouria and Maliki, 2007; Kapseu and Tchiegang, 1996). Oil from the fruit is rich in amino acids and

triglycerides and can augment common household oils (Ajayi and Adesanwo, 2009; Ikhouria and Maliki, 2007: Ajibesin, 2011). The pulp also contains substantial amounts of carbohydrates, minerals, vitamins and fibres (Obame *et al.*, 2008). Iyanre (2009) reported that the result of physiochemical indicated that the seeds have valuable functional attributes of industrial interests. This therefore placed a high demand in the production of this multipurpose tree species.



Plate 1: Fruits of *D. edulis* with various sizes and colour

Most tropical tree plants are propagated by seed (Bowes, 1999; Adebisi *et al*, 2011). However, propagation of these species is usually limited by unavailability of seeds, failure to germinate among other factors (Adebisi *et. al.*, 2011). Owing to the important of seed in the life cycle of plant, it is therefore appropriate to know the proper techniques in seed handling through the processes of ripening or maturation, collection, processing, as well as germination in order to obtain high germination with good vigour. Planting materials with good vigour is required for success for the continuity of such species. Often, these seeds are scarce and in high demand for various users while some species do not produce seeds all year round. Seed handling is therefore vital to maximize the limited seed that is available in order to secure the supply of good quality and quantity seedlings for planting.

Pulp softening of edible fruit tree eaten when fermented such as *D. edulis* remains a key factor both for the nursery managers and the populace who depend on this species for food and other vital needs, therefore finding a common ground becomes a necessity. Therefore it is necessary to find out the possibility of germinating seeds from fermented fruits so that the soften fruits could be eaten while the seeds from the fermented or softened pulp could be used in the regeneration of *D. edulis* for mass production of seedlings for rapid domestication the species.

D. edulis is often valued for its fruit which has the edible flesh/pulp. The fruit houses the seed which are often soften in hot water or roasted for consumption. However a few others eat the pulp raw. In the propagation of *D. edulis* by seeds, seed extraction is often carried out. The seed can be extracted from the fresh fruit (Plate 2A) or fermented fruit (Plate 2B). The freshly collected mature fruits which are often purple, blue, blue-black, violet or lilac in colour are carefully extracted manually with the use of knife (Plate 3) to obtain the fragile seeds which contain the cotyledon attached to lobes (Plate 4) which are often between 8-11 in number. However, due to the loose nature of the seeds, varying degree of seed damages is often recorded. it is therefore of a necessity to determine how these levels of damages affect seed germination in *D. edulis.*

This study was therefore thoughtfully designed and carried out to determine the various seed handling and extraction procedures and how they affect seed germination in *D. edulis* in order to provide a data base for the propagation of this choice specie.

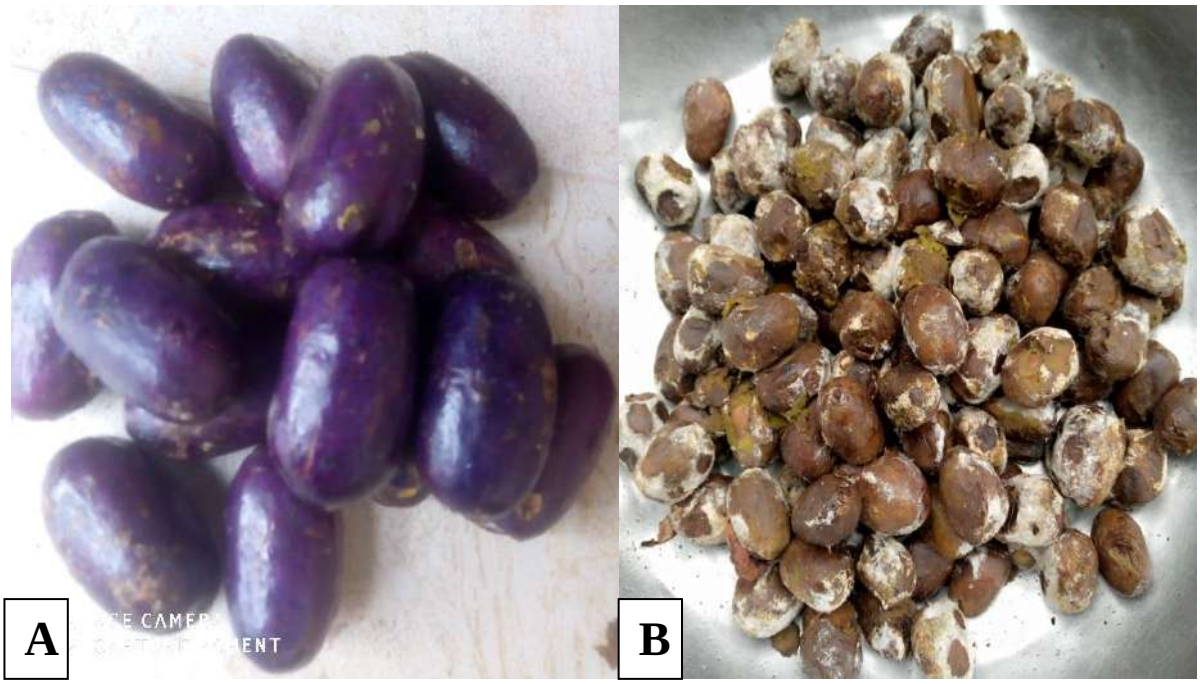

Plate 2: Seeds of *D. edulis*: Fresh (A) and fermented (B)



Plate 3: Process of manual extraction of *Dacryodes edulis* seeds



Plate4: Extracted seed of *D. edulis* showing the lobes attached to the cotyledon

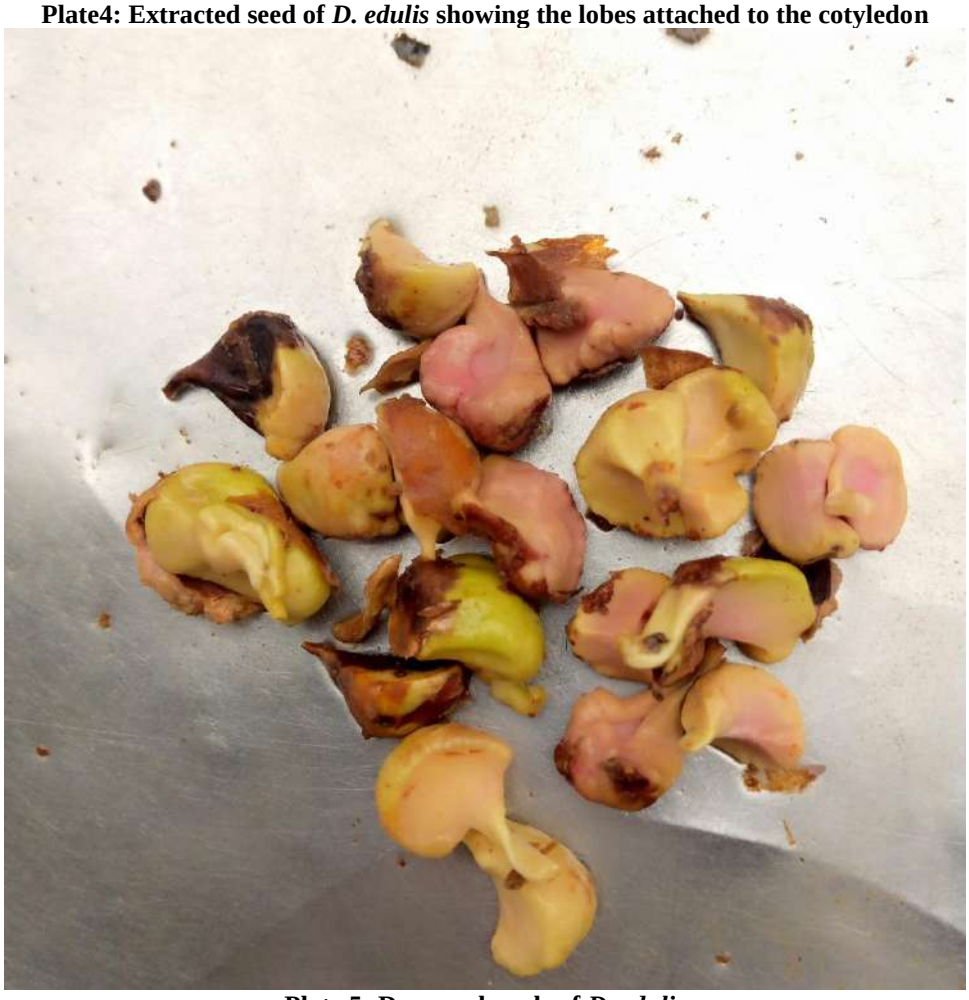

Plate 5: Damaged seeds of *D. edulis*

Materials and method

Sources of seeds for the experiment

Mature fruits of *Dacryodes edulis* were collected from Forestry Research Institute of Nigeria, Ibadan, Nigeria at the peak of fruiting time in July, 2021 and 2022.

Experimental site and set up

The experiment was set up at the screen house of nursery section of Tree Physiology and Breeding section of Sustainable Forest Management of Forestry Research Institute of Nigeria (FRIN), Ibadan. FRIN is located on the

longitude 070 23’18’’N to 070 23’43’’N and latitude 03051’. The rainfall distribution pattern is bimodal with peak in June and July. The dry season occurs between November and March while the wet season is usually between April and September. The mean minimum and maximum temperatures are 19.5° C and 34.9° C while relative humidity was between 50 and 86.7% (FRIN, 2015)

Seed extraction and sowing were done according to the different studies and germination count was assessed once germination occurs until no further germination was observed. In each study, the experiment was replicated five times in a completely randomized design arranged in a nursery shed. Data collected were average using descriptive statistic .Germination is said to occur when the radical pushes the seed above the soil with the emergence of plumule. Germination percentage derived from the germination count as well as the mean days to germination is determined.



Plate 6: Seed germination pattern in *D. edulis*



Plate 7: Stages of seed germination in *D. edulis*

Study 1

Effect of method of fruit softening on the germination of *D. edulis*

Experimental procedure

The collected fruit were subjected to the following means of softening the pulp before seed extraction.

T1 Natural softening (allowed the pulp to soften naturally)

T2 Warm water softening (50oc water to soften the pulp)

T3 Hot water softening (1000c water to soften the pulp)

T4 No pulp softening (No pulp soften, extracted immediately after collection)

The extracted seeds were sown in a germination sieve containing top soil at ten seeds per sieve replicated five times. Data were collected on germination count and days to germination. Germination percentage was derived from the germination count.

Study 2

Seed positioning effect on germination of *D. edulis*

The collected fruits were manually extracted with the used of knife to obtain the seeds

The seeds were sown in nursery polythene pots containing topsoil collected from the FRIN arboretum. The seeds were placed at one seed per pot in the following directions (Plate 4):

A Seeds sown vertically with the pointed tip facing upward direction

B Sown vertically with the pointed tip facing downward direction

C Seeds sown horizontally face up with the pointed tip sideways direction

D Seeds sown horizontally face down with the pointed tip sideways direction.



Plate 8: Seed positioning in planting of *D. edulis*

Each of the above consisted of 50 pots (seeds) arranged in completely randomized design with five replicates. These are kept in nursery shed and monitored daily for commencement of germination.

Study 3

Level of seed extraction on germination ability of *D. edulis*

The collected fruit were heaped together to soften the pulp. The seeds were extracted from the soften pulp according to the following levels of extraction (Plate 12).

A Total (100%) removal of the seed coat to exposure the extracted seeds
B Partial removal of the seeds coat to exposure the extracted seeds
C No removal of the seed coat, without exposure of the seeds
D soften (fermented) pulp without extraction



Plate 9: Levels of seed extraction of *D. edulis*

Study 4: Effect of seed extraction damage on germination

The level of damage of the extracted seeds of *D. edulis* on seed germination was evaluated by grouping the extracted seeds into three based on the level of damage observed (Plate 11). It is of importance to state that totally damaged seeds (Plate 10) are not included in the study.

A seeds damaged at both end
B Seeds damaged at one end
C whole seeds without damage



Plate 10: Totally damaged seeds not included in the study.



Plate 11: Levels of seeds damage in seed extraction of *D. edulis*

Study 5

Effect of sowing media on seed germination of *D. edulis* seeds

The collected fruits heaped together to soften the pulp for easy extraction of seeds. The seeds were extracted manually and a total of 300 undamaged seeds were retained for the study.

These were subjected to three different media which comprised of top soil collected from FRIN arboretum, River sand collected from the flowing river at FRIN and a mixture of both media at 50:50 ratio contained in a germination sieve at 50 seeds per sieve. Watering and monitoring of seeds for germination was done daily. This continued until no further germination occurs.

Results and discussion

Providing appropriate technique that can be easily understood and adopted by local farmers who are mostly the regeneration agents remain a veritable tool for rapid domestication of useful tropical species (Leakey *et. al*., 2004). Gbademosi (2013), also stated that this is very important in nursery and field establishment of forest crops and further stated that this method will be easily demonstrated to peasant farmers. Achieving high germination does not only have its importance among farmers and nursery men, it is also important to scholars and policy makers. According to Eyo (2009), seed germination is important in propagation and breeding programme as well as for testing and using germplasms.

Study 1

Effect of method of fruit softening on the germination of *D. edulis*

The seeds soften natural before extraction had the highest germination of 83.33after 18 DAS closely followed by fresh seeds manually extracted before sowing which gave a germination percentage of 81.30% after 21 days of sowing (Table 1). Seeds soften in hot water gave a very low germination percentage of 0.07% after 37 DAS. The low germination of seed soften in water and near to zero germination of seeds soften in hot is a clear indication that the seed of *D. edulis* is heat dependent, which resulted in seed death. This may be due to inhibition, oxygen

starvation and high temperature. This agrees with Hartmann *et al.* (2007) and Kramer (1983) who noted the harmful effect of restriction of oxygen supply during some critical metabolic stage of germination. A higher percentage germination and lesser days of germination of natural and no softening seeds is an indication that *D. edulis* naturally can germinate and establish quickly by just allowing the fruits to soften before seed extraction or extract the seeds from freshly collected fruits before sowing. The low germination and increase in days of germination from warm water fruit softening to hot water fruit softening further indicate that *D. edulis* seeds is not high temperature tolerant, this is in line with Amira and Mohamed, (2013) who reported negative relationship between increasing water temperature and time to germinate of seeds.

This invariably implies that seeds from boiled or roasted fruits consumed cannot be used for regeneration purposes. Fruits of *D. edulis* are often soften by heat through roasting or boiling in hot water before consumption, when this happens, the resultant seed from such process will not germinate if eventually planted due to the effect of heat on the seeds.

Table 1: Effect of fruit softening on germination and days of germination

Fruit softening	Mean germination percentage (%)	Days of germination (days)
Natural softening	83.33	18
Warm water softening (50oC)	35.81	25
Hot water softening (100oC)	0.07	37
No softening (freshly manure extraction)	81.30	21

Study 2

The manner at which the seed of *D. edulis* is positioned in planting has effect on the result of germination obtained as clearly observed in this study. Sown vertically with the pointed tip facing downward direction recorded the highest percentage of germination of 100% after 19 days of sowing whereas the least percentage of germination 25.50% was observed in Seeds sown vertically with the pointed tip facing upward direction after 45 days of sowing (Table 2). The seeds of *D. edulis* when placed wrongly in the soil will take longer time to emerge as revealed in this study. In extracted seeds of *D. edulis*, the radical is the pointed tip as against the normal occurrence in some seeds whereby the plumule is seen when the seed coat is removed. When the radical is placed facing up, the seed will need much energy and time to re position itself for germination and when there is no enough energy to do, the seed will not germinate hence the low germination and when it eventually germinated, the emerged seedling vigour is adversely affected.

Seed positioning in *D. edulis* also has effect on the vigour and quality of seeds produced (Plate 12). The seeds positioned vertically with the pointed tip facing downward as well as the those placed horizontally performed well in terms of the number of seed germinated as well as the quality of seeds produced.

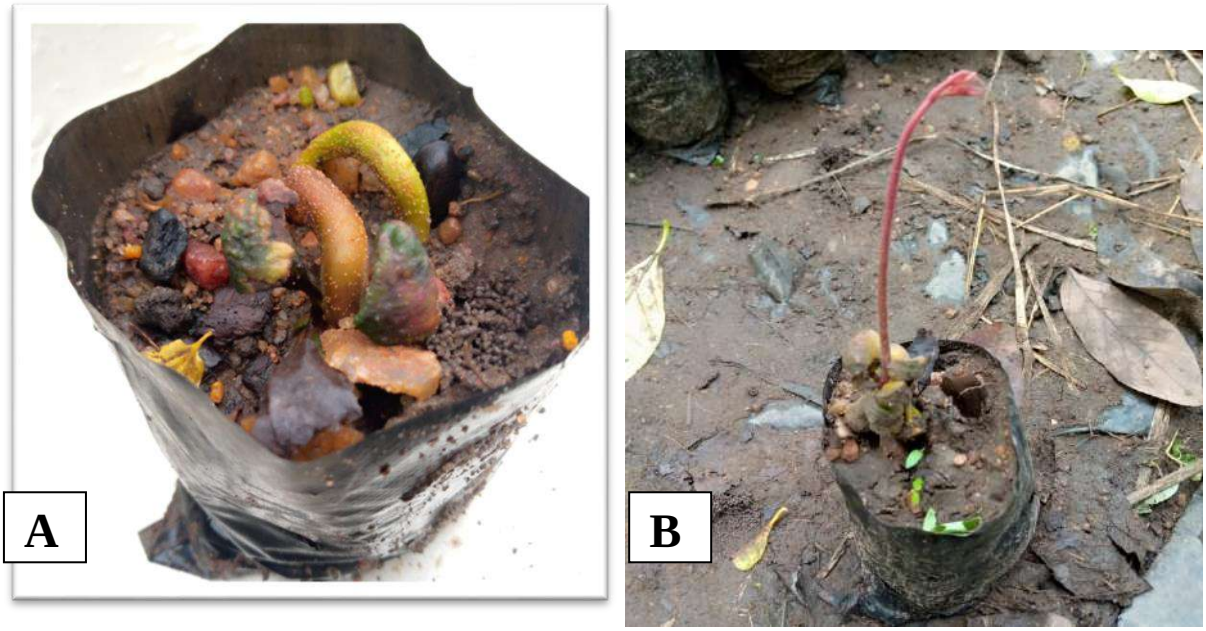

Plate 12: Seedling from Seeds sown vertically with the pointed tip facing upward (A) and Seedling from Seeds sown vertically with the pointed tip facing downward (B)

Table 2: Effect of seed positioning on germination of *D. edulis*

Treatment code	Treatment narration	Germination percentage (%)	Days to first germination	Days to last germination	Days to 50% germination
A	Seeds sown vertically with the pointed tip facing upward direction	25.50	25	62	45
B	Sown vertically with the pointed tip facing downward direction	100.00	12	19	16
C	Seeds sown horizontally face up with the pointed tip sideways direction	90.25	14	25	21
D	Seeds sown horizontally face down with the pointed tip sideways direction.	80.00	15	23	17

Study 3

Level of seed extraction effects on germination ability of *D. edulis*

The level of seed extraction in *D. edulis* affects both it germination percentage as well as the number of days for the commencement as well as completion of seed germination. Total removal of the seed coat to expose the seed gave the highest percentage of 94% closely followed by seed partially removal of seed coat with a germination percentage of 90% after 27 days of sowing (Table 3). The least germination of 42% was observed in seeds from softened pulp that were not extracted after 48 days of sowing. When the seeds are totally exposed, they absorb water quickly and faster than the unexposed seeds. When this happens, the embryo is quickly activated to commence the process of cell division, differentiation and multiplication to grow into a seedling. This according to Sabongari and Aliero, 2004 is due to hydrolysis of complex into simple sugars that are readily utilized in the synthesis of auxins and proteins. The auxins produced help to soften cell walls quickly and to facilitate growth and the proteins are readily utilized in the production of new tissues (Sabongari and Aliero, 2004). The low germination recorded in unextracted seeds which were simply allowed to ferment and decomposed is an eye opener that the seeds of *D. edulis* must be extracted before sowing for optimum results in germination. It is a known fact that heat is generated during the process of decomposition. This heat affects the fragile seeds of *D. edulis* therefore causing adverse effect on the seeds.

Table 3: Effect of level of seed extraction on germination ability of *D. edulis*

Treatment code	Narration	Germination percentage (%)	Days to first germination	Days to last germination	Days to 50% germination
A	Total (100%) exposure of the extracted seeds	94	14	26	19
B	Partial exposure of the extracted seeds	90	18	27	19
C	No exposure of the seeds	78	19	36	26
D	soften (fermented) pulp without extraction	42	21	48	29

Study 4: Effect of seed extraction damage on germination

The different levels of damaging effect of extraction on germination showed a high percentage of 88% and above for all the categories. The damaging effect of the seeds of *D. edulis* did not affect its germination as clearly observed in this study as the seeds damaged at both end produced the germination percentage of 88 with its first germination recorded on the 14th DAS which was the earliest record when compared to the other categories of damage (Table 4). It took the three categories of seed damage the same number of days to complete their germination though the whole seed had the highest seed germination percentage.

Table 4: Effect of seed extraction damage on germination percentage of *D. edulis*

Treatment code	Seed extraction damage	Germination percentage (%)	Days to first germination	Days to last germination	Days to 50% germination
A	Damaged at both end	88	14	22	16
B	Damage at one end	92	15	22	18
C	Whole seeds	94	15	22	18

Study 5: Effect of sowing media on seed germination of *D. edulis* seeds

High germination were recorded in all the media used, however the highest seed germination 93% was observed in seeds sown in river sand after 21 days of sowing the seeds followed by seed sown in a mixture of topsoil and river sand at the ration 50:50 with average germination of 89% after 23 days of sowing the seeds (Table 5). The least seed germination of 84% was observed in seeds sown in topsoil after 25 days of sowing. The high seed germination by the growth media used in this study may be explained by Diaz-Zorita *et al.* (2005), and Cernac *et al*. (2006) who stated that germination and seedling emergence is independent of soil nutrient status, but rather depends totally on the cotyledons still attached to the seedling which are rich in stored food reserves until the seedling becomes autotrophic and the ability of the seedlings to utilize these food reserves.

Table 5: Effect of sowing media on seed germination of *D. edulis* seeds

Treatment code	Germination percentage (%)	Days to first germination	Days to last germination	Days to 50% germination
Topsoil	84	15	31	25
Topsoil + river sand	89	16	28	23
River sand	93	17	26	21

Conclusion

D. edulis is an edible fruit tree with prospect for food security. However, seed handling and processing have proven to be important factor in seed germination of *D. edulis* as revealed from the results gotten from the different studies carried out in this report. The methods of softening the pulps of *D. edulis* before seed extraction and planting had effects on its germination. The seeds soften natural before extraction had the highest germination of 83.33after 18 DAS

The manner at which the seed of *D. edulis* is positioned in planting has effect on the result of germination obtained as well as the vigour and quality of seeds produced. Total removal of the seed coat to expose the seed gave the highest percentage of 94%.

Damaging effect of the seeds of *D. edulis* did not affect its germination as clearly observed in this study as all the categories of damage on the seeds recorded a high percentage of 88% and above.

The highest seed germination 93% was observed in seeds sown in river sand after 21 days

Recommendations

The use of warm water as well as hot water in softening the pulp of *D. edulis* before extraction should be discouraged. The pulp should be softened naturally before seed extraction.

To obtain high germination as well as seedling with good vigour and quality in *D. edulis*, seed should be sown vertically with the pointed tip facing downward direction

In the extraction of seeds of *D. edulis*, total removal of the seed coat and exposure of the seeds will hasten the germination as well as produced the highest seed germination percentage

Although all the three media used are good for the propagating of *D. edulis*, however, river sand has proven to be the best. Damaged seeds as a result of seed extraction, as long as it retain it cotyledon should not be discarded.

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Uses of Lupine (Lupinus angustifolius l.) Plant

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Abstract
Lupine is an annual herbaceous plant belonging to the Leguminosae family. Some species have begun to be cultivated 3000 years ago. Most of the wild species grow around the Mediterranean and in North America. Some species are planted in fields for soil improvement as green manure or in gardens as ornamental plants. Its seeds are generally used as provender. Turkey abounds in terms of both cultivated species and their wild forms, and lupine species cultivated for limited purposes.
The plant which is also known as lupine, is becoming more and more important due to its soil-improving, plant-preserving (bio-insecticide) and growth-promoting (bio-stimulator) properties, especially in organic farming practices carried out for natural and healthy nutrition, as well as its use in human and animal nutrition. In this study, the usage opprtunities of the lupine plant were examined under the titles.
Key Words: *Lupine, thermia, lupine, bio insecticide, bio stimulator*

Acı Bakla (Lupinus angustifolius l.) Bitkisinin Kullanım Olanakları

Özet
Acı bakla (*Lupinus angustifolius* L), Leguminosae familyasına bağlı, tek yıllık, otsu bir bitki cinsidir. 3000 yıl önce bazı türlerinin tarımına başlanmıştır. Yabani türlerinin çoğu Akdeniz çevresinde ve Kuzey Amerika'da yetişir. Bazı türleri yeşil gübre olarak toprak ıslahı amacıyla tarlalara ya da süs bitkisi olarak bahçelere ekilir. Tohumları ise genellikle hayvan yemi olarak kullanılır. Türkiye hem kültürü yapılan türler ve onların yabani formları, hem de sınırlı amaçlarla kültürü yapılan acı bakla türleri açısından oldukça zengindir
Lüpen olarak da bilinen bitki, özellikle insan ve hayvan beslenmesindeki kullanımı yanında, doğal ve sağlıklı beslenme amacıyla yürütülen organik tarım uygulamalarında, toprak iyileştirici, bitki koruyucu (biyo insektisit) ve büyümeyi teşvik edici (biyo stimülatör) özelliklerinden dolayı gittikçe değer kazanmaktadır. Bu çalışmada lüpen bitkisinin kullanım olanakları başlıklar halinde incelenmiştir.
Anahtar Kelimeler: *Lüpen, termiye, acı bakla, biyo insektisit, biyo stimülatör*

Giriş

Lüpen (*Lupinus sp*.),yüksek protein ve yağ içeriğine sahip bir baklagil bitkisidir. Diğer baklagillerin yetişmediği marjinal alanlarda yetişebilme kabiliyetiyle bu familyanın önemli cinslerinden birini oluşturmaktadır (Baytop, 1994; Tanur Erkoyuncu ve ark., 2015). Termiye, gavur baklası ve Yahudi baklası olarak da tanınır.(Hakkı ve ark. 2007). Acı bakla tohumlarının % 33-47 oranındaki protein içeriği, soya proteinine eşdeğerdir (Yorgancılar ve Atalay 2009) Ayrıca diğer baklagillerin % 50'ye kadar nişasta içermesine karşılık, acı bakla tohumlarında bu oran % 5' dir (Schuster-Gajzágó, 2004). Lüpen olarak da adlandırılan acı bakla, yüksek protein oranı, omega 3 ve omega 6 yağ asitleri, antioksidan, karbonhidrat ve yüksek lif içeriklerine sahip olması nedeniyle insan sağlığı üzerinde oldukça önemli kullanım alanına sahiptir (Hodgson ve Lee, 2008).
İnsan beslenmesine ve insan sağlığına yararları nedeniyle lüpen bitkisi ve tohumundan elde edilen ürünlerin gıda olarak tüketimi son yıllarda artış göstermiştir. (Sandoval-Muniz ve ark., 2018).
Dünyada ekmek, bisküvi, kek, makarna, şekerleme, soya sosu gibi ürünlerde hammadde olarak kullanılmasına rağmen Türkiye'de genellikle çerezlik olarak faydalanılmaktadır (Mülayim ve Acar, 2008). Lüpen taneleri acıdır. Bu nedenle haşlanıp, suda bekletilerek tatlandırılır ve tuzlanarak tüketilir. Yaygın olmamakla beraber, tohumlarının kavrulup öğütülmesi ile kahve olarak da tüketilmektedir. (Yorgancılar ve Bilgiçli, 2019).
Ülkemizde, hayvan beslemek amacıyla çoğunlukla yonca, fiğ, korunga, mısır ve üçgül bitkileri yetiştirilmektedir. Ancak, silajlık, yeşil yem ve dane yemi olarak kullanıma uygun olan lüpen bitkisi, hayvan beslemede alternatif yem kaynağı olarak değerlendirilmektedir (Okuyucu ve Okuyucu, 2008). Ayrıca, lüpen tohumları, kanatlı hayvan ve balık yemi rasyonlarında da kullanılma potansiyelinde bir baklagildir.
Lüpen tohumlarında bulunan yağ, oleik ve linoleik asitlerce oldukça zengindir. Aynı zamanda tohumları, önemli miktarda polifenoller, karotenoidler, fitosteroller, tokoferoller, antimikrobiyal, anti-kanserojen ve antienflamatuar aktivitelere sahip peptitler içerir (Khan ve ark. 2015). Alkaloit olarak ise lupinin, lupanin, spartein, hidroksilupanin ile angustifolin ve glikozit olarak da lupinil ve vernin içermektedir. Bünyesinde bulunan bu bileşikler sayesinde lüpen, farmakolojik olarak da büyük değer taşımaktadır (Tüzün 2013).

Doğal ve sağlıklı beslenme amacıyla yürütülen organik tarım uygulamalarında, lüpen bitkisi toprak iyileştirici, bitki koruyucu (biyo insektisit) ve büyümeyi teşvik edici (biyo stimülatör) özelliklerinden dolayı tercih edilmektedir.
Bu çalışmada lüpen bitkisinin kullanım olanakları başlıklar halinde incelenmiştir.

Lüpen Bitkisinin Gıda Olarak Tüketimi

Lüpen tohumunun protein içeriği (%33-47) diğer baklagillerden daha yüksektir ve soya proteini içeriğine yakındır (Dervas ve ark. 1999). Diğer baklagiller %50'ye kadar nişasta içerirken lüpenin nişasta içeriği (%0-5) oldukça düşüktür (SchusterGajzágó, 2004).
Genel olarak %5-20 yağ içermekte olup, bu yağ oleik ve linoleik asitlerce zengindir (Yorgancılar ve Bilgiçli, 2014). İstenen oranlarda omega 6, omega 3'e sahip yağ asitleri, oligosakkaritler, antioksidanlar, düşük karbonhidrat ve %30-40 lif oranıyla insan sağlığına oldukça yararlı bileşenlere sahiptir (Gorecka ve ark. 2000). Yüksek protein ve düşük karbonhidrat içeriğine sahip olan lüpenin, bu bağlamda sporcu diyetlerinde proteinli bar olarak kullanım potansiyeli bulunmaktadır (Adıgüzel, 2018).
Lüpen bitkisinden bulgur üretimi üzerine çalışmalar yapan Yorgancılar ve Bilgiçli, 2010, tatlı lüpen türlerinin bulgur üretimi açısından daha üstün teknolojik ve duyusal özellikler gösterdiğini bildirmişlerdir. Bu bulgurun çölyak hastalarının tüketimine sunulmasının önemli bir adım olduğunu bildirmişlerdir.(Yorgancılar ve Bilgiçli, 2013).
Geleneksel bir gıda olan tarhanada, lüpen unu bileşenlerden biri olarak kullanılmıştır (Çevik ve Ertaş, 2019). Ayrıca, fermente edilen yoğurt tarhana yapımında da kullanılmış ve damak tadına uygun olduğu bildirilmiştir (Ertaş ve ark. 2014).

Lüpen Bitkisinin Hayvan Beslenmesinde Kullanım Olanakları

Lüpenin hayvan beslemede kullanımını sınırlayan en önemli etken içerdiği alkaloit ve glikozitlerdir. Acı lüpen taneleri alkaloit olarak lupinin, lupanin, spartein, hidroksilupanin ile angustifolin; glikozit olarak da lupinil ve vernin içerirler. Söz konusu alkaloitler hayvanlar tarafından yüksek seviyede tüketildiklerinde "lupinus" denilen bir hastalığa sebep olurlar. Ancak günümüzde kültürü yapılan lüpen çeşitleri daha önceki yıllarda üretilen lüpen çeşitlerine oranla genetik olarak çok daha üstün kompozisyondadır ve alkaloit içeriği de azaltılmıştır(Leeson ve Summer, 1997). Bu özelliklere sahip lüpen çeşitleri, kontrollü olmak koşuluyla, hayvan beslemede güvenle kullanılmaktadır.
Aalkaloit oranları düşük, tatlı olarak adlandırılan, ak lüpen (*L. albus* L.), sarı lüpen (*L. luteus* L.) ve mavi lüpen (L. *angustifolius* L.) gibi orijinini Akdeniz ülkelerinden alan türler hayvan beslemede önemli rol oynamaktadır. (Okuyucu ve Okuyucu, 2008).
Lüpen tohumları tek yıllık bitkilerle karışık ekilerek otlatmak suretiyle veya otsu gövdesi çiçeklenme öncesi biçilmek suretiyle yeşil yem olarak veya hasat olgunluğundan 3–4 hafta önce hasat edilmek suretiyle silaj olarak veya tohumları yem rasyonlarına katılmak suretiyle çeşitli hayvanların beslenmesinde kullanılmaktadır. Örneğin, protein bakımından zengin olan lüpen tanelerinin etlik piliç beslenmesinde kullanılabileceği belirtilmiştir (Tüzün, 2013). Balık yemi rasyonlarında ise lüpenin alternatif ürün niteliği taşıdığı bildirilmiştir.(Yiğit ve Koca, 2011). Tanelerinin arzulanan düzeyde protein, yağ, mikro elementler ve vitaminler içermesi nedeni ile bazı kriterlere uyulmak şartıyla hayvan beslenmesinde güvenilir biçimde kullanılması mümkündür.

Lüpen Bitkisinin İnsan Sağlığı Açısından Önemi

Lüpen tohumları önemli miktarda polifenoller, karotenoidler, fitosteroller, tokoferoller, antimikrobiyal, anti-kanserojen ve antienflamatuar aktivitelere sahip peptitler içerir (Khan ve ark. 2015). Bünyesinde bulunan lupanin, spartein ve anagyrine gibi alkaloitler lüpenin hem sağlık açısından hem de farmakolojik olarak değerini artırmaktadır (Bilgiçli ve ark. 2012; Tüzün 2013; Yorgancılar ve Bilgiçli, 2014).
Acı baklanın günlük tüketiminin hipertansiyon ve insülin direnci gibi sorunlara olumlu etkide bulunduğu gözlenmiştir (Arnoldi 2005). Yüksek oranda içerdiği arginin aminoasidi sayesinde kandaki şeker ve kolesterol seviyelerinin düşürülmesine yardımcı olmaktadır (Yorgancılar 2013).
Öğütülmüş tatlı lüpen tanelerinin, yüksek tansiyon, şeker hastalıkları, kemik erimesi ve kalp hastalıklarında iyileştirici özelliklere sahip olduğu saptanmıştır (Wink, 2006). Tohumlarında bulunan alkaloitlerin kolorektal kanser, meme, prostat, deri ve karaciğer kanseri gibi birçok kanser hücrelerinde gösterdiği sitotoksik etkiden dolayı antikarsinogenik olduğu belirlenmiştir (Okuyucu ve ark. 2004). Lüpenin magnezyum ve potasyum içeriği kalp - damar sağlığını korumakta olumlu etkide bulunmaktadır. Obezite sorunundaki olumlu rolünün yanı sıra lif ve protein içeriğinin yüksek oluşu diyabeti de kontrol etmede yardımcıdır. Lüpen, prebiyotik özelliğiyle düzensiz bağırsak sendromu gibi bağırsak komplikasyonlarının giderilmesine, bağırsak hareketliliğine destek olmaktadır (Akalın ve ark 2009). Olgun tohumları kaynar suda haşlanarak tüketildiğinde, kurt düşürücü etki yapar. Ayrıca, idrar söktürür ve idrar yollarını temizler. Böbrek iltihabını giderir, böbrek taş ve kumlarının düşürülmesine yardımcı olur. Baş ağrılarını dindirir. Romatizma, lumbago ve siyatik ağrılarını keser. Albümin miktarını düşürür ve vücutta biriken tuzu atar.

Lüpen Bitkisinin Organik Tarım Uygulamalarında Önemi

Artan dünya nüfusunun beslenme ihtiyacının karşılanması tarımsal üretimin artırılmasıyla mümkündür. Ancak, yeterli üretimin sağlanması sentetik kimyasal tarım ilaçlarının kullanılma zorunluluğunu da beraberinde getirmektedir. Toprak ve su kirliliğine neden olan kimyasal yabancı ot öldürücüler, zararlılara karşı kullanılan insektisitler, sentetik besin maddeleri ve gübre kullanımı, büyüme düzenleyiciler ve hormonlar, son yıllarda insan sağlığı ve doğaya olumsuz etkilerde bulunmaktadır.

Baklagil bitkileri, toprağı havalandırması yanında köklerindeki rhizobium bakterileri yardımıyla havanın serbest azotunu toprağa tespit etmekte ve toprağı azotça zenginleştirmektedir. Lüpen bitkisi de kazık köke sahip bir baklagil bitkisi olduğundan, toprak yapısını iyileştirir, toprağın havalanmasını sağlar, toprak derinliklerinden alınması zor besin maddelerinden yararlanabilir (Hanett, 2006). Bu nedenle lüpen, son yıllarda güncel olan organik tarımda bitkisel ürün elde edilmesi bakımından geniş kullanılma olanağı bulmuştur (Okuyucu ve ark., 2004)

Bilinçli toplumlarda doğal ve sağlıklı beslenme amacıyla bitkisel ürün yetiştirmede kimyasal içeriklerden uzak durulmaktadır. Bu amaçla yapılan, organik tarım uygulamalarında lüpen (*Lupinus sp*.) tohumlarından elde edilen ekstraktın toprak nematodlarına ve böceklere karşı bitki koruma amacıyla biyo-insektisit (biyolojik kökenli böcek öldürücü) olarak uygulanmasının öldürücü etki yaptığı bildirilmiştir (Yıldız, 2011). Yine biyo-insektisit niteliğindeki lüpen tohumu ekstraktı, çeşitli dozlarda Brukus (*Callosobruchus maculatus* F.) ergini bulunan tohumlara uygulanmış ve kontak etki sonucu böceklerin hemen hemen tamamını öldürdüğü görülmüştür (Elmalı ve Cetin, 2018) Böylece, doğaya zarar vermeden ve ürün üzerinde kalıntı riski olmadan zararlı mücadelesi sağlanabilmektedir (Yorgancılar, 2013).

Ayrıca, lüpen tohum ekstraktı marul, havuç, pancar ve lahanada yapraklara püskürtülmüş, lahana dışında diğer bitkilerde büyümede olumlu etki yapmıştır (Van der Watt ve Pretorius, 2011). Bu da organik tarımda büyümeyi teşvik edici madde (biyo-stimülatör) olarak kullanımına olanak tanımaktadır.

Sonuç

Acı bakla (*Lupinus angustifolius* L.), zengin protein ve yağ içeriğinin yanı sıra zengin besin bileşenleri ile insan ve hayvan beslenmesine olan olumlu katkıları ve aynı zamanda toprak ıslah etmedeki değeri dolayısıyla son yıllarda oldukça önem kazanan bir baklagil bitkisidir Bu durum, özellikle alkaloit içeriği ıslah yoluyla azaltılmış, üstün kompozisyona sahip türlerin geliştirilmesi ve yetiştirilmesi, alternatif kullanım alanlarının artırılması, toplum düzeyinde gıda olarak tüketimi konusunda farkındalık oluşturulması ve sağlık üzerine olan olumlu etkileri konusunda bilinçlendirme çalışmaları yapılmasının önemini göstermektedir.

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Overall assessment of the efficiency of nitrification and urease inhibitors

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Abstract
Nitrogen is an essential plant nutrient and is one of the production limiting elements. With the increase in the use of nitrogen fertilizers in agriculture, the yield of agricultural products has been increased worldwide and the food increase needed by the rapidly increasing population has been provided. Nitrogen fertilizers have increased the yield in agricultural production, but have also led to the release of greenhouse gases. This has not only reduced the effectiveness of nitrogen use, but also caused climate change and loss of biodiversity. It has been reported that the use of nitrification and urease inhibitors, which have become increasingly important in recent years, can increase the efficiency of nitrogen use and reduce the emission of greenhouse gases. In addition, nitrogen cycle inhibitors are applied with nitrogen fertilizers as they slow the conversion of urea to ammonium and the conversion of ammonium to nitrate, minimizing nitrate leaching and gas losses through nitrification and denitrification. This situation reduces the damage to the environment by reducing nitrogen leakage and increasing the efficiency of nitrogen use, as well as increasing the profits of the farmers.
Key Words: *Nitrogen, Fertilizer, Inhibitor, Nitrification, Urease*

Nitrifikasyon ve üreaz inhibitörlerinin etkinliğinin genel değerlendirmesi

Özet
Azot, temel bir bitki besin maddesidir ve üretimi sınırlayıcı elementlerin başında gelmektedir. Tarımda azotlu gübrelerin kullanımının artmasıyla dünya çapında tarımsal ürünlerin verimi arttırılmış ve hızla artan nüfusun ihtiyacı olan gıda artışı sağlanmıştır. Azotlu gübreler tarımsal üretimde verimi arttırmış ancak aynı zamanda sera gazlarının salınımına da yol açmıştır. Bu durum azot kullanımının etkinliğini azaltmakla kalmamış, aynı zamanda iklim değişikliğine ve biyolojik çeşitliliğin kaybolmasına da neden olmuştur. Son yıllarda önemi giderek artan nitrifikasyon ve üreaz inhibitörlerinin kullanımının, azot kullanım etkinliğini artırabileceği ve sera gazlarının emisyonunu azaltabileceği bildirilmiştir. Ayrıca, azot döngüsü inhibitörleri, ürenin amonyuma dönüşümünü ve amonyumun nitrata dönüşümünü yavaşlatarak nitratın sızmasını, nitrifikasyon ve denitrifikasyon yoluyla gaz kayıplarını en aza indirdiğinden azot gübreleri ile birlikte uygulanmaktadır. Bu durum, azot sızıntısını azaltıp azot kullanım etkinliğini arttırarak çevreye verilen zararı da azalttığı gibi çiftçilerin karını da arttırmaktadır.
Anahtar Kelimeler: *Azot, Gübre, İnhibitör, Nitrifikasyon, Üreaz*

Giriş

Azot, temel bir bitki besin maddesidir ve üretimi sınırlayıcı elementlerin başında gelmektedir. Tarımda azotlu gübrelerin kullanımının artmasıyla dünya çapında tarımsal ürünlerin verimi arttırılmış ve hızla artan nüfusun ihtiyacı olan gıda artışı sağlanmıştır (Burney ve ark., 2010). Dünya nüfusu artmaya devam ederken azotlu gübrelerinin küresel kullanımının düşmesi olası değildir (Bakken ve Frostegard, 2017).

Dünya çapında, yılda baklagiller tarafından atmosferden sabitlenen tahmini 33-46 milyon ton N' ye ek olarak (Herridge ve ark. 2008), mevcut üretim seviyelerini sürdürmek için dünya genelinde bitkisel üretimde yaklaşık 115 milyon tondan fazla N' u gübre uygulanması yapılmaktadır (Heffer ve Prud'homme, 2012). Yıllar geçtikçe atmosferik nitrojen kullanımını en üst düzeye çıkarma stratejisi olarak Baklagil bitkileri ile ürün rotasyonundan, daha yüksek verim elde etmek için hem organik hem de sentetik formlarda azotlu gübre kullanımına geçiş önemli ölçüde artmıştır (Lassaletta ve ark., 2014). Bunun başlıca nedeni, dünya nüfus hızındaki artışın ardından, hızla artan küresel gıda talebi ve iklim değişikliğinin tarımsal üretim üzerindeki etkisinin artmasıdır. Her yıl, artan dünya nüfusuna ayak uydurabilmek için ticari azot üretimine yaklaşık 44 milyar dolar harcanmaktadır. Bitkiler tarafından azotlu gübrenin geri kazanımı düşüktür. Örneğin, dünyada en önemli yetiştirilen çeltik, buğday ve mısır gibi tahılların yetiştirme döneminde uygulanan azotun sadece % 30-50'si (Herrera ve ark., 2016), sonraki yıllarda kalıntı azotun ise < %10'u (Ladha ve ark., 2005) geri kazanılmaktadır. Topraklardaki azot dönüşümünün karmaşık doğası, optimal olmayan gübre yönetimi uygulamalarıyla birleştiğinde, birçok durumda düşük azot kullanım etkinliğine yol açmaktadır. Azotlu gübrenin sistemden nitrat (NO_3^-) olarak veya amonyak (NH_3), nitröz oksit (N_2O) ve moleküler nitrojen (N_2) gibi gaz halindeki kayıpları, üreticiler için büyük ekonomik kayıplara neden olmaktadır. Düşük maliyeti ve erişilebilirliği nedeniyle en yaygın kullanılan ticari azotlu gübreler üre ve üre içeren gübrelerdir. Üre, dünya da azotlu gübre üretiminin yaklaşık %56'sını oluşturmaktadır (Suter ve ark., 2016). Üre, yüksek Azot içeriğine (%46) sahip katı bir gübredir. Depolanması ve bitkilere uygulanması kolaydır ve diğer azotlu gübrelerle

birlikte toprağa kolaylıkla uygulanabilir. 2017 yılında, dünya çapında tarımda uygulanan azotlu gübrenin yaklaşık %72'sini üre oluşturmuştur (FAO, 2019). Bununla birlikte, azotun büyük bir kısmı çevreye kaybının yüksek olması nedeniyle üre ile gübreleme oldukça verimsizdir. Üre özellikle amonyak (NH_3) şeklinde buharlaşarak kaybolmaktadır. Bunun nedeni, toprakta üre, üreaz enzimi aracılığıyla amonyum (NH_4^+) oluşturmak üzere hızla hidrolize olur. Bu reaksiyonda, üre granülünü çevreleyen alanın toprak pH'ını artıran protonlar tüketilir. Böylece, NH_3 ve NH_4^+ arasındaki denge, NH_3 formuna yönlendirilir, bu nedenle gaz halinde kaybolmaya karşı hassastır. Dünyada üre şeklinde uygulanan azotun yaklaşık %10-19'unun NH_3 buharlaşması yoluyla kaybolduğu tahmin edilmektedir (Bouwman ve Boumans, 2002). Bununla birlikte, özellikle yüksek sıcaklık ve/veya yüksek pH'lı topraklarda bu kayıplar koşullara bağlı olarak yaklaşık % 30'a kadar artabilmektedir (Silva ve ark. 2017; Cantarella ve ark., 2018). Bu, yalnızca gübrelere yapılan yatırımın üçte birinin buharlaşma yoluyla kaybolması değil aynı zamanda önemli ekonomik kayıpların olması anlamına gelmektedir. Ayrıca, NH_3 biriktiğinde asitleşme, ötrofikasyon ve nitröz oksit emisyonlarına neden olabilmektedir (Zhu ve ark., 2016).

Üreaz ve nitrifikasyon inhibitörlerinin kullanımı, tarımda gübre etkinliğini arttırmak ve üre ve azot kirleticilerinin emisyonunu azaltmak için benimsenen bir yaklaşımdır. Nitrifikasyon ve üreaz inhibitörlerinin geliştirilmesi, özellikleri nedeniyle zaman alıcı ve pahalı bir süreçtir. Fakat, yeni nesil gübrelerin, tarımsal sistemlerden azot kayıplarını azaltma potansiyeline sahip olduğu bilinmektedir (Chen ve ark., 2008).

Üreaz İnhibitörleri

Üre, yüksek azot içeriği ve birim azot başına nispeten düşük maliyeti nedeniyle dünya çapında en yaygın kullanılan azotlu gübrelerden biri olarak kabul edilmektedir (Papangkorn ve ark., 2008). Topraktaki üreazın ardından üre, üreaz enzimi veya buharlaşma yoluyla hidrolize olmaktadır. Bu şekilde, granülleri çevreleyen toprağın pH'ını arttır ve dünya çapında uygulanan azotun %16'sına kadar NH_3 kayıplarına neden olur. Hatta, NH_3 kayıpları, sıcak ve nemli koşullarda %40'a veya daha fazlasına ulaşabilmektedir (Cantarella ve ark., 2018). Üreaz, ürenin hidrolizini iki mol amonyak ve bir molar karbon dioksite (CO_2) katalize eden nikele bağımlı bir enzimdir. İlk aşama, bitkilerin onları alabilmesi için toprak suyunda amonyuma dönüştürülen NH_3 sağlayan ürenin hidrolizidir; ikinci aşama, azotun NH_3 olarak buharlaşmasıdır (Artola ve ark., 2011). Üreaz inhibitörlerinin etkisi, ürenin NH_4^+'ya dönüşümünü yavaşlatmak ve NH_3'ün uçuculuğunu azaltmaktır. Sonuç olarak, uygulanan ürenin önemli bir yüzdesi bu şekilde toprağa yayılabilmektedir (Saggar ve ark., 2013). Fiziksel ve kimyasal birçok bileşik, toprak üreaz aktivitesini inhibe etme potansiyelleri açısından araştırılmıştır (Singh ve ark., 2018). En başarılı ve en sık kullanılan üreaz inhibitörü tiyofosforik-triamid (NBPT) (Kakabouki ve ar., 2020) olarak belirtilmiştir. Son 10 yılda NBPT pazarı, üre ile karşılaştırıldığında önemli ölçüde düşük NH_3 kayıpları nedeniyle yılda %16 büyüme göstermiştir (Cantarella ve ark., 2018). Etkinliği onaylansa da, araştırmacılar NBPT ile takviye edilen ürenin inhibisyon süresini ve raf ömrünü artırma konusunda çalışmalarını sürdürmektedir (Cantarella ve ark., 2018). NBPT kullanımı, üreden NH_3 kaybını %66'ya kadar azalttığı bildirilmiştir (Panel, 2015).

Nitrifikasyon İnhibitörleri

Nitrifikasyon inhibitörlerinin rolü, ilk olarak amonyumun nitrata dönüşümünü azaltmaktır, bu da tarımda nitrat sızıntısını önlemenin önemli bir yolu olarak kabul edilmektedir. İkinci olarak, bir sera gazı olarak kabul edilen nitröz oksit emisyonlarının atmosfere indirgenmesidir. Ancak, nitröz oksit emisyonu, düşük nitrojen kayıp miktarları nedeniyle bitki besleme için önemli bir faktör değildir (Soares ve ark., 2016). Nitrifikasyon inhibitörleri normal olarak NH_3 buharlaşmasını arttırır ve üreaz inhibitörleri ile karıştırıldığında NH_3 kaybındaki azalma kısmen dengelenmektedir (Cantarella ve ark., 2018). Yapılan bir çalışmada, üreaza nitrifikasyon inhibitörlerinin eklenmesiyle buğday tarlasındaki NH_3 kayıplarını % 38 oranında azaldığı belirlenmiştir (Pan ve ark., 2016). Çeltik tarlalarında gaz halindeki azot emisyonu, uygulanan azotlu gübrenin %10-60'ı kadar olduğu bildirilmiştir (Xu ve ark., 2013). Çeltik tarlasında kontrollü salımlı üre kullanılarak amonyak ve azot oksit %90'a kadar düşürülmüştür (Yang ve ark., 2013). Ayrıca, nitrifikasyon inhibitörleri toprak asitleşmesini azaltabilmekte; bu düşüş nitrifikasyonu bloke ederek NH_3 kaybını azaltmaya yardımcı olmaktadır (Soares ve ark., 2012). 3,4-Dimetilpirazol fosfat (DMPP), üre veya diğer katı azotlu gübrelerle harmanlanan düşük ekotoksik, oldukça avantajlı özelliklere sahip yeni bir nitrifikasyon inhibitörüdür.

Dünyada yaygın olarak kullanılan iki inhibitör, nitrifikasyon inhibitörü 3,4-dimetil pirazol fosfat (DMPP) ve üreaz inhibitörü N-(n-butil) tiyofosforik triamiddir (NBPT). DMPP ve NBPT içeren yavaş salınımlı gübreler, azot kaynağı ile ürünün azot talebi arasındaki uyumu artırarak azotlu gübrenin geri kazanımını artırmak ve azot kayıplarını azaltmak için geliştirilmiştir. Bu etki, amonyumun bakteriyel oksidasyonunu veya ürenin hidrolizini geciktirerek elde edilmektedir.

DMPP, amonyumun (NH_4^+) NO_3'e mikrobiyal dönüşümünü ve nitrifikasyon ve denitrifikasyon yoluyla gaz halindeki azot formlarının üretimini yavaşlatır. Bir dizi inhibitörün bu dönüşümü geciktirebileceğini ve böylece N_2O emisyonlarını azaltabileceğini gösteren bazı çalışmalar bildirilmiştir (Menéndez ve ark., 2012). NBPT'nin kullanımı, özellikle mera altındaki yüksek karbonlu topraklarda bol miktarda bulunan üreaz enzimini engellemeyi amaçlamakta (Chen ve ark., 2008), böylece ürenin NH_4^+'ya dönüşümünü yavaşlatmakta ve uçuculuk yoluyla N kayıplarını en aza indirmektedir (Watson ve ark., 1994).

Azot Kullanım Etkinliği

Yaygın olarak kullanılan azot kullanım etkinliği, azot kullanımının nasıl artırılacağını, yani ürüne ne kadar azot uygulandığını ve bitkiler tarafından ne kadar kullanıldığını gösteren bir göstergedir. Azot verimliliği iklim koşulları, bitki hastalıkları, gaz olarak topraktan azot kayıpları, azotun sızması veya azotun organik formlarda hareketsizleştirilmesi nedeniyle azalmaktadır. Azot kayıplarını ve maliyetini azaltmanın en etkili yolu azot kullanım etkinliğinin geliştirilmesidir (Raza ve ark., 2018). Azotlu gübre kullanımının artmasıyla azotlu gübrelerin etkinlik derecesi azalmış ve bu artan uygulamanın zararlı etkileri ortaya çıkmıştır (Shi ve ark., 2012). Ayrıca, sel, toprak sıkışması gibi birçok faktör azot kullanım etkinliğini etkilemektedir (Lian ve ark., 2020). Bitki ıslahçıları geliştirdikleri yeni çeşitlerin azot kullanım etkinliğini iyileştirerek (Kumar ve ark., 2019) verimi arttırmayı amaçlamaktadır. Baklagiller, atmosferik azotufikse edebilme yeteneklerinden dolayı yüksek azot kullanım etkinliğine sahiptirler (Hocking ve Reynolds, 2012). Yapılan farklı çalışmalarda azot kullanım etkinliğinin mevsime, kuraklığa, sıcaklığa, infiltrasyona, sulama şekline, yağış miktarına, yağışın rejimine, ön bitkiye, toprak işlemeye bağlı olarak değiştiği bildirilmiştir (Attia ve ark., 2015; Chilundo ve ark., 2016; Lu ve ark., 2019). Son yıllarda birçok üründe azot kullanım etkinliği artmış ve bunun sonucu olarak tarımsal üretimden kaynaklanan azot kaybı azalmıştır. Özellikle son yıllarda, inhibitörlü gübrelerin sisteme dahil edilmesiyle azot kullanım etkinliğinin arttığı da belirlenmiştir.

Azot kullanımının çevreye etkisi

Yoğun tarımın iklim değişikliği ve çevre üzerinde önemli bir etkisi olduğundan, son birkaç yılda daha çevre dostu uygulamalar benimsenmiştir. Bitkisel üretimde verim ve kaliteyi artırmak için ekim nöbeti uygulamaları, arazi ve doğal kaynak yönetiminin iyileştirilmesi gerekmektedir (Bouwman ve ark., 2002). Aynı zamanda, gübre sanayisi önemli ölçüde değişmiş olmasına rağmen, azot ticari gübrelerde kullanılan ana element olmaya devam etmektedir (Ravishankara ve ark., 2009). Bununla birlikte, sürdürülebilir tarım sistemleri tasarlamak için ürünlerde geliştirilmiş azot kullanım etkinliğine duyulan ihtiyaç zorunludur (Lassaletta ve ark., 2014). Artan nüfusun sürdürülebilir beslenmesini sağlarken, istenmeyen ve zararlı çevresel bozulmayı en aza indirmek için azot yönetimi iyileştirilmelidir. Uygulanan azotun verimliliği bölgeler, iklimler ve ürünler arasında büyük farklılıklar gösterir (Fan ve ark., 2018). Genellikle toprak-bitki sistemlerinde azot fazlalığı ne kadar fazlaysa, çevreye verdiği zararın da o kadar büyük olduğu kabul edilmektedir. Çevresel sonuçlar arasında, su yollarının ötrofikasyonu (NO_3^- sızıntısı ve NH_3 birikimi), sera gazı emisyonları (N_2O) ve ozon tabakasının incelmesi (Ravishankara ve ark., 2009) yer almaktadır. Amonyak ve nitröz oksit, küresel ısınmaya doğrudan ve dolaylı katkıları ile bilinen iki büyük zararlı azot kirleticidir (Recio ve ark., 2018). Bu azot emisyonlarının yaygın nedeni, yüzeye uygulanan gübre ile üre ve amonyum bazlı gübrelerdir. Sonuç olarak, azot sızıntısını azaltmak ve azot kullanımını artırmak için küresel pazarda inhibitörlü yeni gübreler ve yeni teknolojiler kullanımı arttırılmıştır (Giltrap ve ark., 2010).

Sonuç

Son 50 yılda dünya nüfusu neredeyse iki katına çıkarken öngörülen gıda talebini karşılamak için tarımsal üretimde de bir artış gerekmektedir. Bu nedenle bitkisel üretimde verimin arttırılması gerekmektedir. Son yıllarda, aşırı miktarda azot uygulaması yoluyla ürün veriminin arttırılması sağlanmıştır. Şu an için birçok araştırmacı, bitkilere uygulanan azotlu gübrenin yarısından fazlasının çevreye kaybolduğunu gözlemlemiştir. Gübre inhibitörleri, gübre pazarının ayrılmaz bir parçası olarak kabul edilmektedir. İnhibitörler uzun zamandan beri, topraktan yıkanma ve denitrifikasyon nedeniyle azot kayıplarının önlenmesi ve NH_4^+ iyonlarının toprak pH'sı üzerindeki etkinliğinin uzun süre devam etmesi amacıyla, üre ve amonyum formunda azot içeren gübrelere nitrifikasyon inhibitörü olan bileşikler eklenerek kullanılmaktadır. Kullanılan inhibitörler ile üre uygulanan topraklarda, ürenin NH_4^+formuna dönüşmesinde etkili olan üreaz enzimi aktivasyonu; NH_4^+formunda uygulanan azotun ise nitrifikasyon olayı ile nitrata dönüşerek yıkanması engellenmektedir. Azot arzı talep eden ürünlerin büyüme aşaması, düzensiz veya yanlış gübreleme ve uygun olmayan gübre ürünlerinin kullanımı, işletme maliyetlerini yükseltmekte ve çiftçilerin net kârını azaltmaktadır. Üreaz ve nitrifikasyon inhibitörlerinin, azot kullanım etkinliğini artırma potansiyeli ile birlikte azotun etkin kullanımı sağlanarak kârın arttırılmasına olanak sağlayacaktır. Ayrıca, inhibitörlü gübreler azot sızıntısını azaltılıp azot kullanım etkinliğini artırması nedeniyle çevreye zararı da azaltılmış olacaktır.

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Kütahya Bölgesindeki Sokak Kedilerinde Bulunan *Cryptosporidium* spp.'nin Mikroskobik ve Moleküler Yöntemlerle Saptanması

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Özet

Amaç: Bu çalışma da Kütahya bölgesindeki sokak kedilerin de bulunan *Cryptosporidium* spp. yaygınlığının mikroskobik ve moleküler yöntemlerle araştırılması amaçlanmıştır.

Materyal ve Metot: Çalışmanın hayvan materyalini Kütahya bölgesindeki 100 sokak kedisi oluşturmaktadır. Kedilerin dışkılamalarını takiben dışkı örnekleri alınarak dışkı kabına alındı. Dışkı örnekleri ilk olarak mikroskobik olarak carbol fuchsin boyama yöntemi ile *Cryptosporidium* ookistleri yönünden incelendi. Daha sonra 100 örneğin tamamından DNA ekstraksiyonu yapıldı. Ardından uygun primerlerle Nested PCR yapıldı. PCR ürünleri %1.5'luk agaroz jelde koşturulup jel görüntüleme cihazında görüntüleri elde edildi.

Bulgular: Mikroskobik inceleme sonucunda 100 örneğin 4 (%4)'ünde *Cryptosporidium* spp. ookistlerine rastlanıldı. Nested PCR sonucunda ise 100 örneğin 6 (%6)'sında pozitiflik saptandı.

Sonuç

Bu sonuçlar, insanı enfekte eden *Cryptosporidium* spp. için rezervuar konakçı olarak kedilerin rolünü vurgulamaktadır. Sokak kedileriyle temasta olan insanların bu zoonoz parazit hakkında bilgilendirilmesinin, Cryptosporidiosis'in kontrol altına alınmasında olumlu katkı sağlayabileceği düşünülmektedir.

Anahtar Kelimeler: *Cryptosporidium* spp, Kedi, Kütahya, Moleküler

Transformation and Expression Analysis of CEMB VIP3A Gene in Local Maize Inbred Lines

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Abstract

Maize is a plant of worth importance owing to its nutritional quality, medical applications and the capability to be transformed especially by Agrobacterium tumefaciens. Maize, third most important cereal crop, serves its benefits in the production of food, fuel and fodder. Maize grown in spring is of prime significance to Pakistan. The annual yield of maize grain is 3.037 million tonnes. The production of maize plant has to be increased in order to meet the ever increasing demands of fast growing population. The transformation efficiency of maize has been best reported by the utilization of Agrobacterium-mediated plant transformation method. There is a need to develop transgenic maize plants, with altered genome. For this purpose, VIP3A gene was integrated into maize genome that is resistant to insect pest mainly Lepidoptera. The source of VIP3A gene was a bacterium i.e. Bacillus thuringinesis. This bacteria produces Vegetative Insecticidal Proteins during the vegetative growth phase. The cry and cyt toxins produced by bacteria, exhibit resistance to a variety of insects. Among these toxins, VIP3A has the most potential of insecticide resistance. The confirmed transformed Agrobacteria having the VIP3A gene were then transformed in CEMB maize inbred line. Optimization of the medium was also done for enhanced transformation efficiency by augmenting with silver nitrate, L-Cystein, Acetosyringone and Cefatoxine. After multiple transformations, only 15 plants were able to survive. They were then screened for molecular tests for instance PCR, Immunostrips detection and ELISA. Out of 15 transgenic maize plants, 7 gave positive result for PCR. These 7 plants: PCV 2, PCV 4, PCV 5, PCV 6, PCV 7, PCV 9 and PCV 10 showed test line on immunostrips rendering them positive. They also gave absorbance greater than 0.3 for ELISA which was the marking for good protein concentration. Among these plants, PCV 9 has the best protein concentration and is a potential candidate for insect bioassay.

Key Words: *Agrobacterium mediated transformation, Maize, VIP3A , Insecticidal , Cry toxins*