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FULL TEXT BOOK

EDITORS

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1st INTERNATIONAL CONGRESS ON SUSTAINABLE AGRICULTURE AND TECHNOLOGY

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INCSAT-I
FULL TEXT BOOK
&
BOOK OF ABSTRACTS

EDITORS

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Dear Colleagues,

It is my great pleasure to welcome you to the First International Conference on Sustainable Agriculture and Technology (INCSAT-1) in the gastronomic city of Gaziantep.

Our goal is to provide a platform for researchers, engineers, academicians, institutions, communities, agencies and industrial professionals to present their research results and development activities in Sustainable Agriculture and Technology. At the same time, it is a great opportunity for all the delegates to exchange new ideas and application experiences, establish business and research connections and find global partners for future cooperation. We are honoured to welcome our valuable scientists working in these fields.

Research and innovation will play a vital role in improving the future prospects of the agricultural sector and rural areas. We need to keep producing enough healthy food for everyone. Farmers must be empowered to embrace research and innovation, working in collaboration with scientists and investors to generate knowledge at an early stage. We need to reduce agricultural emissions, while maintaining strong economies and productive and resilient sectors capable of meeting the food demand of an exponentially growing world population.

With the Congress of INCSAT-1, young researchers will gain insight into new study topics by taking advantage of the knowledge and experience of internationally renowned scientists specializing in their fields. In addition, new working groups from different universities are emerging and lead new studies in related fields. We strongly believe that the INCSAT-1congress will be successful and productive with your valuable supports.

I would like to thank you, experienced and young researchers, for attending and bringing their expertise and innovative ideas to our conference. I want to thank the International Scientific Board Members and all reviewers for their significant contribution to the high level of the conference. At the end I would like to thank to Gaziantep University Scientific Research Projects and all our supporter companies.

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ORAL PRESENTATIONS ABSTRACTS

Soil-Mycorrhizae and Carbon Relationship to Climate Change and Mitigation of Atmospheric Co_2 Under Long Term Field Experiments

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ABSTRACT

Agriculture in both developed and developing countries throughout the world is performed through the conventional and ecological forms which are important for future stability and sustainability of agriculture. At present modern agriculture depends heavily on inputs of fertilizers, pesticides, genetically modified seed, seedling and other inputs to maintain an economic level of productivity. These agricultural practices have been criticizing. Still, much attention is required to search for agricultural sciences by developing new technology to offset reduced fertilizer and pesticide use while maintaining a sustainable level of productivity. Since there is also a serious effect of climate change on agricultural practices more research is needed to mitigate the effects of global warming on sustainable agriculture. Very recently the importance of carbon (C) turnover is working extensively because of climate change. The research topic has a truly international dimension, as the changing climatic conditions will affect agriculture and forest ecosystems all over the world, most countries such as Turkey need to assess changes of belowground C stocks in agriculture and forests under the United Nations Framework Convention on Climate Change and the Kyoto Protocol.

Agriculture, natural vegetation (food supplier for animal) and forestry under good management strategy is an example of the management of a modified ecosystem to yield for optimal productivity. Also, management of the microbes that live in the rhizosphere soil around the roots of nearly all terrestrial plants is getting more attention as well. New innovative technologies including plants produce carbon compounds by means of photosynthesis, and part of that carbon is partitioned to the roots and microorganisms. Especially rhizosphere organisms are very important for plant growth. Using a friendly invasion of beneficial fungus such as mycorrhizae have been found to provide a great boost to the root systems of crops. Carbon demanded by plant root by free-living symbiotic microorganisms such as mycorrhiza and N-fixing bacteria is very important natural

mechanisms to be managed. Such as soil fungi and other associated soil microflora and micro fauna have co-evolved with plants to the present state.

At the moment photosynthesis is the most powerful mechanism/tool to mitigate the atmospheric CO_2 capturing. Mycorrhizal fungi can help the plant to capture more CO_2 and help in atmospheric CO_2 mitigation. The mycorrhizal state is one of the associated microbes with plant roots for better growth and survival of plants. The recent agricultural practices such as using fertilizers and pesticides are used, including soil fumigants that destroy much of the microflora and fauna, have damaged the microbial balance and the potential for microbial support of plant growth and health. To restore the beneficial microflora that can biologically provide in the arable land is the needed support, and to provide such microbes to farmers world-wide.

The main objective of this presentation is to give a piece of general information about soil-mycorrhiza and carbon research in Turkey, and also to give our research poverty for future. So far many long term field experiments were established in the cost of the Mediterranean part of Turkey. Effects of several soil management systems on soil organic carbon, mycorrhizal development, soil quality and plant nutrient uptake ware studied extensively. Regularly soil and plant C and N concentrations are calculated. In general soil management has significant effects on soil carbon contents.

This work was supported by TÜBİTAK-TOVAG-114O448 project.

Keywords: *Greenhous gasses, Climate changes, Soil organic carbon, Soil-crop management*

INTRODUCTION

“There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities.” This was expressed in Intergovernmental Panel on Climate Change, *Climate Change 2001: The Scientific Basis.”* Summary for Policy Makers, http://www.ipcc.ch/

It is clear that today there is a serious problem of climate change effects on our plants. Since 20000 years we are aware of our history in that time so many great civilizations were collapsed (Table 1.)

Table. The civilizing caused collapse and their reasons.

Civilization	Region	Era	Cause of collapse
Sumerian	Mesopotamia	10,000 BCE	Salinization
Harappan	Indus Valley	2800–2600 BCE	Desiccation
Inca	Andean Region	750–900 CE	Soil erosion
Maya	Central America	750–900 CE	Soil erosion
Axum	Northern Ethiopia	100–600 CE	Ecological degradation
Roman	Mediterranean	27 BCE – 395 CE	Exhaustion of soil

Since the onset of industrial revolution around 1850, the concentration of carbon dioxide (CO_2) has increased by 31% from 280 mg $L^{-1}$to 380 mg L^{-1} year in 2005, and (IPCC, 2007), presently is 412 mg L^{-1}. The increase in annual means on average growth rate for the past decade (~2.08 ppm yr–1).

Atmospheric carbon dioxide (CO_2) concentrations have significant effects on climate change and consequently have effects on sustainability of ecosystem. The factors affecting the CO_2 emission from agricultural practices are crucial for global warming. As can be seen in Figure 1, Since the Industrial revolution atmospheric CO_2, Methane and Nitrogen Oxide are speedily increased. This increase accelerated in the last century.

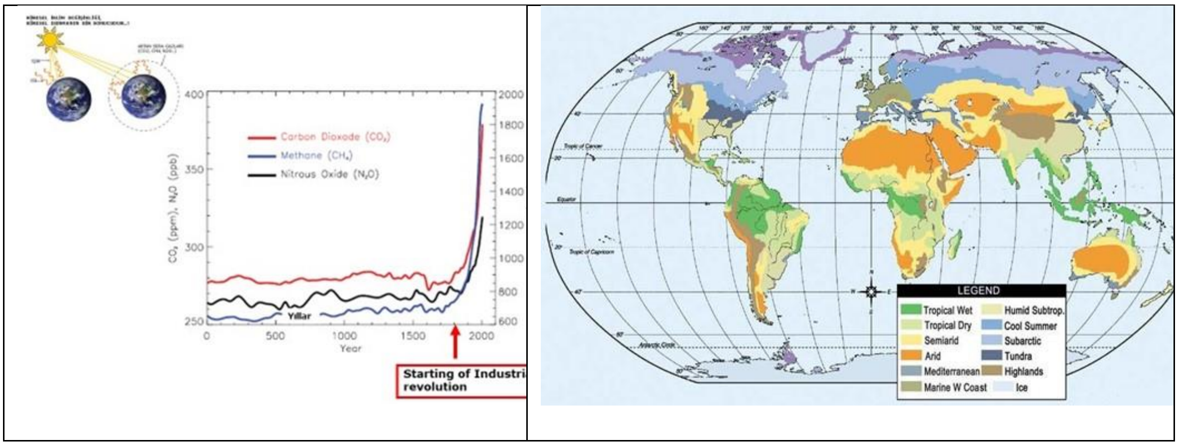


Figure 1. Greenhous gases emissions to atmosphere with time (Anonymous 2019).

As a result, increasing CO_2 have a significant effect on climate change. Since the importance of atmospheric (CO_2) is caused the climate change, many nations are taking so serious measurements to reduce the CO_2 emission in the atmosphere. Greenhouse gas emissions by sectors were calculated in may times and it has been reported that in average agriculture have up to 12.5 % (Figure 2). Land use and biomass burning have up to 10 %. The biggest proportion is come from power stations and industry. In term of gases the biggest greenhouse gases is come from carbon dioxide nearly 72%.

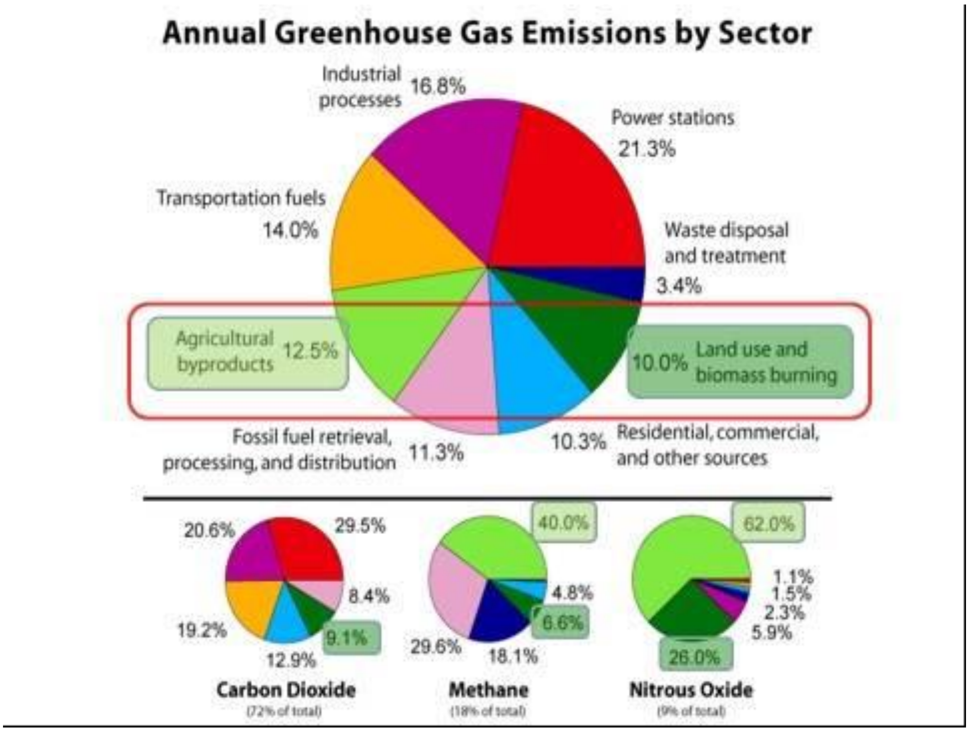


Figure 2. The proportion of greenhouse gases percentages in between sectors (Anonymous 2019).

The research topic has a truly international dimension, as the changing climatic conditions will affect agriculture and forest ecosystems all over the world, most countries such as Turkey need to assess changes of belowground C stocks in agriculture and forests under the United Nations Framework Convention on Climate Change and the Kyoto Protocol. Turkey submitted its Intended National Determined Contribution (INDC) on 30 September 2015, with a greenhouse gas reduction target (including land use, land use change and forestry (LULUCF)) of up to 21% below business as usual (BAU) in 2030.

Total Greenhouse Gases of Turkey and proportion of Sectors.

According to TUIK 2019, in 2017, total greenhouse gas (GHG) emissions were 526.3 Mt CO_2 equivalent. The biggest share of CO_2 emissions was received from energy-related emissions with 72.2%, it was followed by industrial operations with 12.6%, agricultural activities with 11.9% and the lowest was waste with 3.3%. As can be seen in Figure from 1999 to 2017 per person CO_2 GHG increase by 140.1%. In 1990, the CO_2 equivalent emission per capita was calculated as 4 tons /person, and in 2017, this value was calculated as 6,6 tons / person (Figure 3).

The CO_2 and SOC sequestration includes three stages

(i) the removal of CO_2 from the atmosphere via plant photosynthesis;

(ii) assimilation and allocation into biomass;

(iii) the relocation of carbon from plant to the soil as residue or exudates, where carbon is temporary stored in the form of SOC in labile and passive pool and inorganic carbonate (it is named CaCO3).

Carbon demanded by plant root by free-living symbiotic microorganisms such as mycorrhiza and N-fixing bacteria is very important natural mechanisms to be managed.

Since agricultural sustainability is under climate change and pollution, food security is questionable. Social and economic pressures demands for food security through agricultural practices which have a damaging impact on the environment and pose risk to the health of mankind.

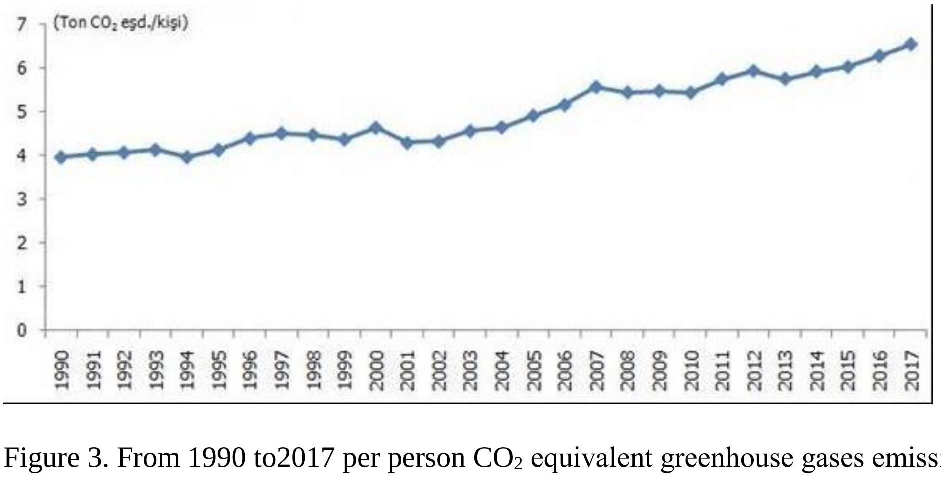


Figure 3. From 1990 to2017 per person CO_2 equivalent greenhouse gases emissions (TÜİK, 1019).

It is assumed that, microbial growth and activity are constrained due to low availability of C and nutrients, and the input of resources (via root exudation and fertilization) will enhance microbial growth and activity. Very recently using biological technology based on soil fertility is getting more attention. Such as using mycorrhiza, PGPR organisms, biochar, other organic fertilizers are getting more attention to sustainable farming.

It has been recognized that biological processes can control and steer the Earth system in a globally significant way. Increasing global warming, land use change, biodiversity and carbon sequestration, water problems, natural disasters and other problem are recently discussed. Key questions for the sustainable land future is the management system. Although special emphasis is given to the sub-tropical area other systems are also reflected. The objective of the work is to increase the knowledge about the effect of soil and crop management system on carbon sequestration and influence on climate change.

Terrestrial ecosystem release or absorb globally relevant greenhouse gases e.g. carbon dioxide (CO_2) which is thought to be the main sources of climate change. Feedback between the C cycle and the climate has recently received much attention, mainly because the atmospheric concentration of CO_2 is predicted to reach double. its current levels by next 2075 (Godbold et al., 2006). Since over 75% of the C in terrestrial ecosystems is stored in forests, with more than half of this C being in soil organic matter (SOM), which has the potential to sequester the largest amount of C for the longest period of time. In agriculture and forestry, all the chemicals and other unnatural substances added to the soil during the past 50 years have caused some serious environmental problems.

Natural habitats and highly diverse natural ecosystems which can maintain productivity without significant management have the ability to provide means for human survival and provide important ecological services. Agriculture, natural vegetation (food supplier for animal) and forestry under good management strategy is an example of the management of a modified ecosystem to yield for optimal productivity. Also, management of the microbes that live in the rhizosphere soil around the roots of nearly all terrestrial plants is getting more attention as well. New innovative technologies including plants produce carbon compounds by means of photosynthesis, and part of that carbon is partitioned to the roots and microorganisms. Through the process of photosynthesis, plants absorb atmospheric CO_2, transform it into plant carbon ($C_6H_{12}O_{6,\ as}$ a sugar), and sequester it in either shoot - or root-hyphae biomass and/or soil carbon. Especially using efficient organism's species may contribute to better soil and plant quality and productivity. Such as reducing soil microorganisms, in some areas biological fertility is very low. Especially rhizosphere organisms are very important for plant growth. Using a friendly invasion of beneficial fungus such as mycorrhizae have been found to provide a great boost to the root systems of crops. Mycorrhizal fungi are root symbionts that facilitate plant uptake of soil nutrients in exchange for plant carbohydrates and they grow in almost every terrestrial ecosystem on earth, form relationships with about 80% of plant species, and receive 10 to 20% of the total carbon fixed by their host plants (Treseder & Turner, 2007). AM play a key role in nutrient cycling in the ecosystem and also protect plants against environmental stresses as well as against drought and heat effects Figure 4).

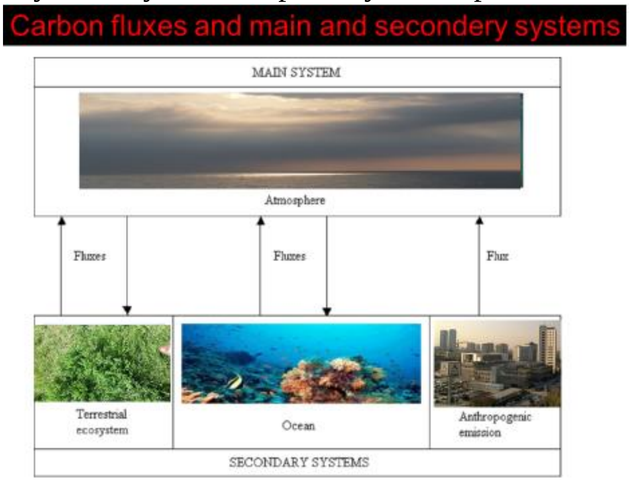


Figure 4. Main and secondary carbon flux systems

What is the direct effect of climate change on ecosystem and human life?

Increased C: N balance of plants

Decreased plant protein

Increased chemical defenses

Resulting in:

Reduced growth and /or

Increased compensatory feeding

Soil Management and Climate Change

Greenhouse gas emissions and capture are influenced by soil and crop management systems such as tillage, fertilizers using and cropping cultivation. Soil and crop management have significant effect on climate change. Also there is a strong relation in between climate change and soil quality. Soil quality is very important for atmospheric CO_2 elevation and mitigation of climate change.

The major problem for West Asia is water deficiency, low organic matter, erosion, salinization, degradation and desertification. Accelerated soil erosion depletes soil fertility and increases emission of CO_2 and CH4 from erosion –induced transport of SOC (Lal, 2003). Arid and semi-arid soils have low organic matter contents because of high temperatures and decomposition rates (Figure 5).

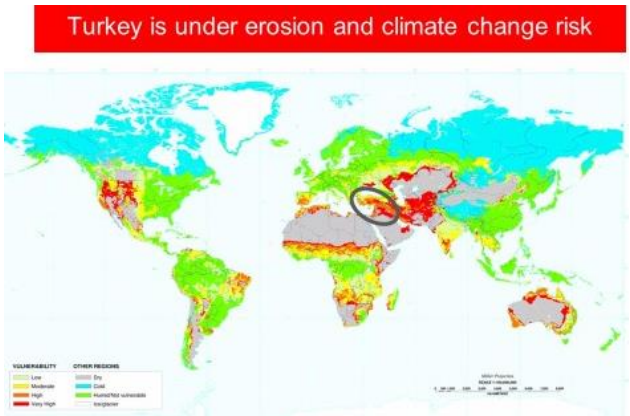


Figure 5. Erosion change risk map (Anonymous 2019).

Since the area's climate is harsh, and agricultural production depends on rainfall.

Possible climate change pressure, crop yields may decrease %11

Soil degradation, increasing atmospheric CO_2 level, can increase temperature and cause water deficiency and consequence the yield is supposed to be decreased within time. In a model work, it has been estimate that increase in air temperature 2-3 0C, by 2070 wheat and maize biomass will decrease by % 4 to % 17 and water demean will increase (Aydin, Yano, Korıyama, & Haraguchi, 2011).

There is a strong interest in stabilizing the atmospheric abundance of CO_2 in order to reduce it effect on the risks of global warming.

There are three strategies of lowering CO_2 emissions to mitigate climate change (Schrag 2007):

1) reducing the global energy use,

2) developing low or no-carbon fuel, and

3) sequestering CO_2 from point sources or atmosphere through natural (photosynthesis) and engineering techniques.

Agriculture management is very important measurement to reduce greenhouses emission to atmosphere. With an acceptable ecological soil-crop management is at the same time is a soil organic carbon managements. Through this management SOC content can be kept at an acceptable level.

Carbon sequestration

Soil keep carbon for long term is depend on soil organic carbon managements.

The size of terrestrial carbon pools has been calculated and according to Lal (2004) in ecosystem the biggest C pool is kept in organic carbon. Soil organic matter content and in soil C stock is varied an estimated that 1400-1600 Pg (Peter gram = 10-5 g=million metric tons) organic C and 700-900 Pg inorganic carbon (Lal, 2004). In generally the biggest C pool is in minerals (limestone, dolomite, etc.) form 65,000,000 Pg C. On the other hand, in the atmosphere 780 Pg C is exist. And per hectare land have 40 - 100 Mg/ha SOC. Since more carbon is kept in soil organic form, it is important to keep carbon in soil rather than biomass. Carbon remain in biomass for 10 years, remain in soil is about 35 years.

Also Lal, (2004) calculated the C pool in soil and atmosphere in which the soil organic C (SOC) pool is 3.3 times larger than the atmospheric pool and 4.5 times the biotic pool. On global C cycle, the amount of C in the atmosphere is increasing by 2.2 Pg per year. In cold and wet environment organic C pool are highest, however in desert and tundra soils C pool

(i)	**Minerals (limestone, dolomite, etc.)**	**= 65,000,000 Pg C**
(ii)	**Soil organic C**	**= 1550 Pg**
	Soil inorganic C	**= 750 Pg**
	Total	**= 2300 Pg**
(iii)	**Atmosphere**	**= 780 Pg**
(iv)	**Biota**	**= 560 Pg**
(v)	**Ocean**	**= 38,000 Pg**

SOC pool = 40 - 100 Mg/ha

is lowest. Also in deserts inorganic C stocks comparatively are greatest.

Paustian (2005) indicated that the significant deriver of soil C change, both past and future is depend on land use and management. With soil and crop management plant residue material make a significant contribution on SOC pool (Ortas, Akpinar, & Lal, 2012; Ortaş, Razzaghi, & Rafique, 2016). The SOC pool under the many regions is effected with the anthropogenic factors, and it is essential to estimate SOC pool to identify management practices to increase soil carbon content. Land use, climate, soil types, plant species have impact on the SOC content (Ortaş, 2017). It has been estimated the soil carbon density increases with increasing precipitation and also there is an increase in soil carbon with decreasing temperature (Post, Emanuel, Zinke, & Stangenberger, 1982).

Sanderman, Hengl, & Fiske, (2017) estimated since the 1850s, in between 60 to 150 Pg C held in SOM have been lost due to land use, agriculture and soil disturbance. This mean agriculture has significant effects on climate change. Degradation and carbon fixation is effected by precipitations and temperature (Batjes, 2019). As can be seen in Figure 6. temperature and water content have significant effects on soil organic carbon per.

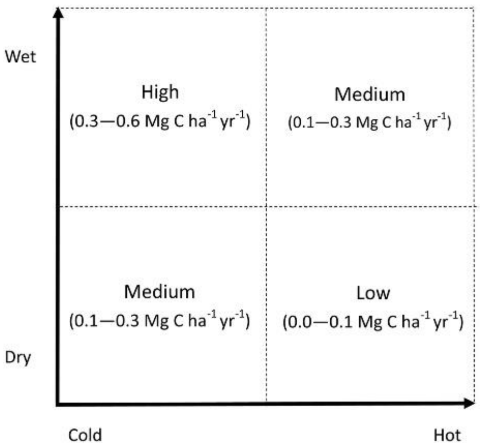


Figure 6. Schematic representation for scope for carbon sequestration in cropland as a function of temperature (x-axis) and rainfall (y-axis) (Batjes, 2019).

There is a strong interest in stabilizing the atmospheric abundance of CO_2 in order to reduce it effect on the risks of global warming. There are three strategies of lowering CO_2 emissions to mitigate climate change (Schrag 2007):

(i) reducing the global energy use,

(ii) developing low or no-carbon fuel, and

(iii) sequestering CO_2 from point sources or atmosphere through natural (photosynthesis) and engineering techniques. Fixing CO_2 from atmosphere to soil through photosynthesis is one of the powerful natural mechanisms.

How to increase soil organic carbon under field conditions? Keeping SOC is depends on the balance on SOC increases and decreases.

A. Increase

  (i) density of C in the soil

  (ii) depth of C in the profile

B. Decrease

(i) decomposition of C

(ii) losses due to erosion

(iii) Soil and crop management

Develop Agricultural Management Depended on;

C input can be enhanced by	C reduce can be done by losses of
Crop management	Soil tillage
Crop selection	Fallow management
Crop rotations	

Soil and crop management have significant effect on SOC accumulation. It has been calculated, irrespective of tillage management, with increasing cropping system SOC could be increased by 0.22 Mg ha^{-1} $year^{-1}$ (Franzluebbers, 2005). The results of Post et al. (2004) showed that with soil tillage in between 0.24 to 0.40 Mg C ha^{-1} yr^{-1} carbon is losses. In another work with no tillage (NT) SOC sequestration was 0.42 ± 0.46 Mg ha^{-1} $year^{-1}$ (Franzluebbers, 2005). The results of Tao, Palosuo, Valkama, and Mäkipää (2019) reported that on Chinese croplands area the implementation of the recommended management practices increase the SOC stock by ≥25.0 Tg C yr^{-1} or 0.63% yr^{-1}.

Factors Effects CO_2 Loos from Soil

When the crop is harvested and removed from the farm, carbon is lost.

If livestock consume the crop, the carbon may be returned to the soil in the form of manure.

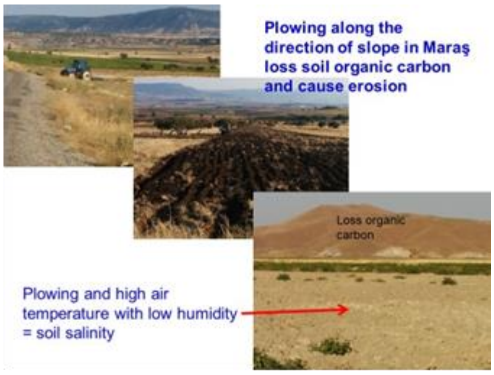
Crop residue, roots, and manure are a carbon (energy) source for microorganisms.

Converting organic carbon to CO_2 is mineralization of carbon.

When microorganisms respire, CO_2 is released to the atmosphere.

Sequestering CO_2 from point sources or atmosphere through natural (photosynthesis) and engineering techniques.

Agriculture is one of major source of greenhouse gases (GHG) and which can contribute to global climate change (Quéré et al., 2016). Batjes (2019) also reported that the agricultural GHG emissions come from land degradation, deforestation, use of fossil fuel-powered machinery, the manufacturing and distribution of chemical fertilizers, and methane emissions from livestock and irrigated rice land.



Land use and soil-crop management have significant on lend degradation and carbon losses. As can be seen in Figure 7. plowing direction of slope is one of the serious factors for CO_2 losses. Cover crops presence on the arable land and non-arable lands are also very important.

Figure 7. Effects of soil plowing directions of slope and carbon losses (Ortas. I. 2017).

In many ecosystems bed managements of grassland and monoculture agricultural treatments significantly reduced the SOC content (Figure 8).

As a results soil degradation is escalated. Also under high temperature and low humidity soil salinity is also increase in the many ecosystems. In Harran plane (Sanlıurfa) and Çukurova (Adana) are examples.

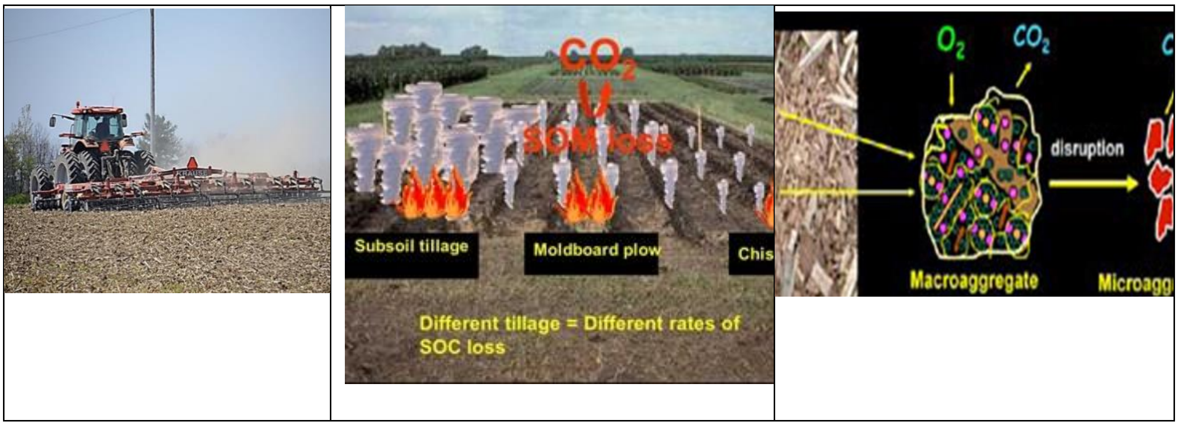


Figure 8. Representative effects of different tillage treatments on CO2 emission (Anonymous 2019).

Mechanized agriculture produces a substantial amount of CO_2 as a result of causing of plowing the soil and which is caused the degradation and erosion of soils. As can be seen in the Figure 8, with soil tillage macro aggregates are turned to micro aggregate. At the time CO_2 is release.

Heavy tillage caused the oxidation of organic material and as a results a large proportion of CO_2 is released to atmosphere. After heavy soil tillage usually CO_2 emission is higher than in less and zero tillage. Most of the farmers are aware of no-till benefit to organic matter content. For farmers under no-till or reduces till practices compared to other conventional tillage practices it is more economic because of low-input cost.

The type of land use and soil cultivation are important factors controlling organic carbon storage in soils (Figure 9). It is important to keep carbon in soil rather than biomass.

So there is a need to give importance to the new techniques for carbon sequestration.

Soil biotechnology can help to keep more carbon in soil rather than plant tissue.

Figure 9. Effects of no-till on SOC sequestration (Franzluebbers, 2005).

In generally protected land use and soil management improves soil organic carbon storage and can reduce the carbon emission and soil erosion. Gehring and Whitham (2002) predicted the carbon-*limitation* hypothesis in which removal of above ground biomass by clipping or mowing will reduce AMF growth because there is a reduced amount of photosynthate available for the symbionts.

There is a strong interest in stabilizing the atmospheric abundance of CO2 in order to reduce it effect on the risks of global warming.

There are three strategies of lowering CO2 emissions to mitigate climate change (Scagel, Bi, Fuchigami, & Regan, 2007):

1) reducing the global energy use,

2) developing low or no-carbon fuel, and

3) sequestering CO2 from point sources or atmosphere through natural (photosynthesis) and engineering techniques.

Fixing CO2 from atmosphere to soil through photosynthesis is one of the powerful natural mechanisms. Through the process of photosynthesis, plants absorb CO_2 from the atmosphere, transform it into plant carbon, and sequester it in either above- or below-ground biomass and/or soil carbon. In order to fix more atmospheric CO_2 to terrestrial land it is very important to increase surface with cover corps. Climate change caused CO2 will mitigate by cover crops fixation is an important strategy.

Conclusion

Increasing soil organic carbon is depending our soil-plant and atmosphere management. I present study effects of different environmental parameters and soil-crop managements on SOC pool, sequestration and climate change was evaluated. In the present time of globalization, the relation between soil/environmental scarcity and human conflict effects on soil carbon pool and climate change is complex. At the same time, it is obvious human impact have effect on soil and directly/indirectly on climate change. There is a strong need to work together universal, rather than local or regional. In order to reduce impact of CO_2 on climate change economic development and environmental enhancement must go hand in hand, and the highest priority must be given to development of the ecosphere (Lal, 2015). Also it is important they have a holistic approach to mitigate the CO_2 to atmosphere. According to Batjes (2019)'s assumptions, nearly 10% of annual atmospheric CO_2 emissions (in between 2006–2015) from fossil fuels and industry could be sequestered if degraded croplands and grasslands were to be subjected to widespread (100%) implementation of best management practices.

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Crabronidae (Hymenoptera: Aculeata) fauna of Adana province, Turkey

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ABSTRACT

This study is based on the examination of 331 specimens of Crabronidae collected from different localities of Adana Province between May and September 2017. The specimens were caught with a 25-30 cm of the aerial net and killed in killing bottles prepared with a mixture of potassium cyanide and gypsum. Their head, thorax, abdomen and morphological characters in their extensions were used for the identification of the species. For the identification and classification of the species, the studies of Tüzün et al. (1999), Tüzün and Gülmez (2005), Yıldırım et al. (2014, 2016) were referred. At the end of the study, 9 species and subspecies belong to Crabronidae family are; *Bembix bicolor* Radoszkowski, 1877; *Bembix oculata oculata* Panzer, 1801; *Cerceris arenaria arenaria* (Linnaeus, 1758); *Cerceris flavicornis* Brullé, 1833; *Cerceris sabulosa sabulosa* (Panzer, 1799); *Liris niger niger* (Fabricius, 1775); *Philanthus triangulum triangulum* (Fabricius, 1775); *Tachysphex fulvitarsis* (A. Costa, 1867); *Tachysphex pompiliformis* (Panzer, 1805). *Cerceris flavicornis* Brullé, 1833; *Bembix bicolor* Radoszkowski, 1877; *Tachysphex fulvitarsis* (A. Costa, 1867); *Tachysphex pompiliformis* (Panzer, 1805) belonging to the family Crabronidae are new records for Adana province. As a result, in this study, we have contributed to the knowledge of fauna of Adana Province, Turkey with the total of 9 specimens belonging to the family Crabronidae, 4 of which is new record. Determination of Crabronidae species occurring in agricultural areas with this study, food plants, phenology are intended observing the ecological properties and to contribute to Turkey Hymenoptera fauna.

Key words**:** *Insecta, Apoidea, Systematic, Diversity*

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ÖZET

Bu çalışma, 2017 yılı Mayıs ve Eylül ayları arasında Adana ilinden toplanan 331 Crabronidae örneğinin incelenmesine dayanmaktadır. Örnekler, 25-30 cm çapında böcek atrapı ile yakalanmış, potasyum siyanür ve alçı karışımı ile hazırlanan öldürme şişelerinde öldürülmüştür. Türlerin teşhisinde baş, göğüs, karın ve uzantılarındaki morfolojik karakterler kullanılmıştır. Türlerin tanımlanması ve sınıflandırılması için Tüzün et al. (1999), Tüzün ve Gülmez (2005), Yıldırım et al. (2014, 2016) çalışmalarından faydalanılmıştır. Bu çalışmayla Crabronidae familyasından tespit edilen 9 tür ve alttür; *Bembix bicolor* Radoszkowski, 1877; *Bembix oculata oculata* Panzer, 1801; *Cerceris arenaria arenaria* (Linnaeus, 1758); *Cerceris flavicornis* Brullé, 1833; *Cerceris sabulosa sabulosa* (Panzer, 1799); *Liris niger niger* (Fabricius, 1775); *Philanthus triangulum triangulum* (Fabricius, 1775); *Tachysphex fulvitarsis* (A. Costa, 1867); *Tachysphex pompiliformis* (Panzer, 1805). Çalışma sonunda tespit edilen 9 türden *Cerceris flavicornis* Brullé, 1833; *Bembix bicolor* Radoszkowski, 1877; *Tachysphex fulvitarsis* (A. Costa, 1867); *Tachysphex pompiliformis* (Panzer, 1805) olmak üzere 4 tanesi Adana ili için Crabronidae faunası için yeni kayıttır. Bu çalışmayla tarımsal alanlarda yayılış gösteren Crabronidae türlerinin tespit edilmesi, fenolojilerinin ve ekolojik özelliklerinin belirlenmesiyle Türkiye Hymenoptera faunasına katkı sağlanması amaçlanmıştır.

Anahtar Sözcükler: *Insecta, Apoidea, Sistematik, Çeşitlilik*

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INTRODUCTION

The order Hymenoptera includes over 153 000 extant species around the world, grouped in 132 families 8423 extant genera. Amongst them Ampulicidae, Sphecidae, and Crabronidae embrace 9697 species from 267 genera (Aguiar et al. 2013: 1).

The current knowledge of 13 Hymenopterous families: Chrysididae, Sapygidae, Mutillidae, Bradynobaenidae, Vespidae, Ampulicidae, Sphecidae, Crabronidae, Pompilidae, Tiphiidae, Evaniidae, Gasteruptiidae and Stephanidae fauna of Turkey were evaluated (Yıldırım, 2016: 1817)

A total 522 species and 15 subspecies in 65 genera of the subfamilies Astatinae, Bembicinae, Philanthinae, Pemphredoninae, Mellininae, Dinetinae and Crabroninae are recorded from

Turkey. The type localities of 69 species and 10 subspecies of this family are located in Turkey; 44 species and 6 subspecies are endemic for Turkish fauna (Yıldırım, 2016: 1819).

In Turkey, comprehensive faunistic studies on the family of Crabronidae are extremely limited. Ljubomirov & Yıldırım (2008) prepared annotated catalogue of the Ampulicidae, Sphecidae and Crabronidae (Insecta: Hymenoptera) of Turkey, and a total of 530 species and 19 subspecies belonging to 78 genera were recorded in this catalogue. But, Straka (2005) and Hepdurgun et al. (2007) are not evaluated in this catalogue. Later, Pulawski & Prentice (2008), Dollfuss (2008a, 2008b, 2013a, 2013b, 2015), Tüzün & Yüksel (2010), Japoshvili & Ljubomirov (2012), Yıldırım (2012, 2014), Bayındır et al. (2013), Çubuk & Gülmez (2013) and Gülmez & Can (2015) reported several new records from Turkey, and a total number was reached to 2 species of 1 genus of Ampulicidae, 69 species and 5 subspecies of 12 genera of Sphecidae and 502 species and 15 subspecies of 65 genera of Crabronidae are recorded. In total, 573 species and 20 subspecies belonging to 78 genera of Ampulicidae, Sphecidae and Crabronidae are recorded from Turkey. As a result of the current study, the total number of species recorded from Turkey up to now is raised to 594 species and 20 subspecies of 78 genera of Ampulicidae, Sphecidae and Crabronidae and the distribution of previously known species has broadened (Yıldırım et al. 2016: 2)

In this study, it was aimed a systematic evaluation of the Crabronidae species in order to contribute to existing knowledge on fauna, species distribution areas and biodiversity.

MATERIAL AND METHOD

This study is based on the examination of 331 specimens of Crabronidae collected from different localities of Adana Province between May and September 2017. The specimens were caught using insect nets between 09:00 AM and 06:00 PM during the day, and the captured specimens were place inside killing jars containing a mixture of potassium cyanide (KCN_3) and gypsum, which were then placed in cardboard boxes together with labels indicating the location, coordinates, altitude, date of collection and the name of the collector. For each species, the characteristics of the habitat as well as certain ecological features, such as the plant sources of nutrition, were noted. The specimens converted to museum material were examined based on their morphologies, color and patterns. Examinations were made using a LEICA (EZ4)-brand stereo microscope.

The control and identification of the specimens were carried out based on the methods applied in Tüzün et al. (1999), Tüzün and Gülmez (2005), Yıldırım et al. (2014, 2016). When noting the types of materials examined, information was provided for each species on the total number of specimens collected, the location and altitude at which they were collected, the date of collection, and the sex of the specimens. Furthermore, information was also garnered on the distribution of the relevant species in Turkey and the rest of the World and their phenologies.

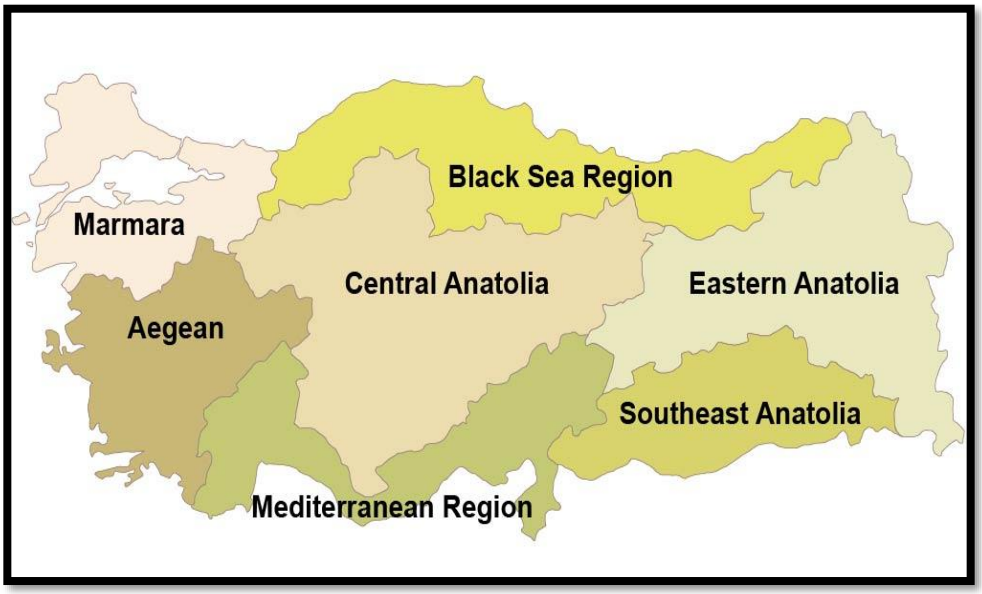

Figure 1. Map of administrative regions of Turkey (Anonymous, 2019)

RESULTS

Subfamily Bembicinae Latreille, 1802

Subtribe Bembicina Latreille, 1802

Genus *Bembix* Fabricius, 1775

Bembix bicolor Radoszkowski, 1877

Material Examined: (7 ♀♀, 3 ♂♂) Adana: Ceyhan, 33m, 22.vi.2017, 3♀♀, 1♂; Karataş, 8m, 27.vii.2017, 1♀; Kozan, 371m, 18.ix.2017, 1♀, 1♂; Feke, 364m, 19.ix.2017, 2♀♀, 1♂ (Totally 10 specimens, leg. Samet Eray Yalnız).

Distribution in Turkey: Black Sea, Eastern Anatolia, Central Anatolia, Mediterranean Regions (Figure 1) (Yıldırım et al., 2014: 7).

Distribution in the Palaearctic Region: Italy, Greece, Bulgaria, Cyprus, Turkey, Israel, Oman, Russia, Kazakhstan, Kyrgyzstan, Uzbekistan, Turkmenistan, Tajikistan, Iraq, Iran, Afghanistan, Mongolia, China (Nemkov, 2016: 9).

Phenology: June-September.

Remarks: This species is new record for Adana province.

Bembix oculata oculata Panzer, 1801

Material Examined: (46 ♀♀, 10 ♂♂) Adana: Kozan, 284m, 20.vi.2017, 4♀♀; Feke, 603m, 15.vii.2017, 6♀♀, 1♂; Kozan, 356m, 16.vii.2017, 5♀♀, 2♂♂; Ceyhan, 156m, 22.vii.2017, 5♀♀, 1♂; Feke, 580m, 14.viii.2017, 4♀♀, 1♂; Kozan, 371m, 16.viii.2017, 5♀♀, 2♂♂; İmamoğlu, 86m, 17.viii.2017, 2♀♀; Ceyhan, 72m, 26.viii.2017, 4♀♀; 1♂; Yüreğir, 65m, 29.viii.2017, 2♀♀; Ceyhan, 78m, 2.ix.2017, 6♀♀, 1♂; Karaisalı, 306m, 24.ix.2017, 3♀♀, 1♂ (Totally 56 specimens, leg. Samet Eray Yalnız).

Distribution in Turkey: Southeastern Anatolia, Eastern Anatolia, Central Anatolia, Mediterranean, Aegean, Marmara Regions (Figure 1) (Yıldırım et. al, 2014: 7).

Distribution in the Palaearctic Region: Europe, Canary Islands, Turkey, Syria, Israel, Turkmenistan, Uzbekistan, Tajikistan, Kazakhstan, north China, Arabian Peninsula, Iran, Afghanistan, North Africa, Sudan (Yıldırım et al., 2016: 20).

Phenology: June-September.

Subfamily Philanthinae Latreille, 1802

Tribe Philanthini Latreille, 1802

Subtribe Philanthina Latreille, 1802

Genus *Philanthus* Fabricius, 1790

Philanthus triangulum triangulum (Fabricius, 1775)

Material Examined: (51 ♀♀, 27 ♂♂) Adana: Karataş, 13m, 14.vi.2017, 2♀♀, 1♂; İmamoğlu, 85m, 21.vi.2017, 2♀♀; Ceyhan, 33m, 22.vi.2017, 3♀♀, 1♂; Kozan, 304m, 13.vii.2017, 4♀♀, 2♂♂; Feke, 557m, 14.vii.2017, 3♀♀, 1♂; Kozan, 356m, 16.vii.2017, 3♀♀, 2♂♂; İmamoğlu, 86m, 18.vii.2017, 3♀♀; Yumurtalık, 20m, 26.vii.2017, 3♀♀, 1♂; Karataş, 8m, 27.vii.2017, 1♀, 1♂; Feke, 580m, 14.viii.2017, 3♀♀, 3♂♂; Kozan, 342m, 15.viii.2017, 2♀♀, 2♂♂; Kozan, 371m, 16.viii.2017, 1♀, 2♂♂; İmamoğlu, 94m, 17.viii.2017, 1♀, 3♂♂; Sarıçam, 337m, 24.viii.2017, 3♀♀, 1♂; Yüreğir, 65m, 29.viii.2017, 2♀♀; Kozan, 371m, 18.ix.2017, 4♀♀, 2♂♂; Feke, 364m, 19.ix.2017, 5♀♀, 2♂♂; Karataş, 24m, 22.ix.2017, 2♀♀, 2♂♂; Aladağ, 225m, 23.ix.2017, 1♀; Karaisalı, 306m, 24.ix.2017, 3♀♀; 1♂ (Totally 78 specimens, leg. Samet Eray Yalnız).

Distribution in Turkey: Black Sea, Southeastern Anatolia, Eastern Anatolia, Central Anatolia, Mediterranean, Aegean, Marmara Regions (Figure 1) (Yıldırım et al., 2014: 8).

Distribution in the Palaearctic Region: Europe, Canary Islands, Turkey, Turkmenistan, Uzbekistan, Tajikistan, Kazakhstan, southern Siberia, north China, Arabian Peninsula, Iran, Afghanistan, North Africa (Yıldırım et al., 2016: 21).

Phenology: June-September.

Tribe Cercerini Lepeletier de Saint Fargeau, 1845

Genus *Cerceris* Latreille, 1802

Cerceris arenaria arenaria (Linnaeus, 1758)

Material Examined: (3 ♀♀, 1 ♂) Adana: Ceyhan, 156m, 22.vii.2017, 1♀; Ceyhan, 43m, 28.vii.2017, 1♂; Kozan, 371m, 16.viii.2017, 1♀; Ceyhan, 72m, 26.viii.2017, 1♀ (Totally 4 specimens, leg. Samet Eray Yalnız).

Distribution in Turkey: Black Sea, Eastern Anatolia, Central Anatolia, Mediterranean, Aegean, Marmara Regions (Figure 1) (Yıldırım et al., 2014: 8).

Distribution in the Palaearctic Region: Europe, Great Britain, Turkey, Armenia, Uzbekistan, Tajikistan, Kazakhstan, southern Siberia, north China, Iran, North Africa (Yıldırım et al., 2016: 21).

Phenology: July-August.

Cerceris flavicornis Brullé, 1833

Material Examined: (8 ♀♀, 9 ♂♂) Adana: Ceyhan, 33m, 22.vi.2017, 1♀, 1♂; Feke, 603m, 15.vii.2017, 1♂; İmamoğlu, 86m, 18.vii.2017, 2♀♀, 1♂; Yumurtalık, 20m, 26.vii.2017, 1♀; Kozan, 342m, 15.viii.2017, 1♀; Saimbeyli, 884m, 19.viii.2017, 1♂; Sarıçam, 337m, 24.viii.2017, 1♀; Ceyhan, 78m, 2.ix.2017, 1♀, 2♂♂; Kozan, 371m, 18.ix.2017, 1♂; Feke, 364m, 19.ix.2017, 1♀, 1♂; Karaisalı, 306m, 24.ix.2017, 1♂ (Totally 17 specimens, leg. Samet Eray Yalnız).

Distribution in Turkey: Black Sea, Southeastern Anatolia, Eastern Anatolia, Central Anatolia, Mediterranean, Aegean, Marmara Regions (Figure 1) (Yıldırım et al., 2014: 8).

Distribution in the Palaearctic Region: South Europe, Turkey, Turkmenistan, Uzbekistan, Kazakhstan (Yıldırım et al., 2016: 23).

Phenology: June-September.

Remarks: This species is new record for Adana province.

Cerceris sabulosa sabulosa (Panzer, 1799)

Material Examined: (6 ♀♀, 9 ♂♂) Adana: Ceyhan, 33m, 22.vi.2017, 1♀, 2♂♂; Feke, 603m, 15.vii.2017, 1♂; İmamoğlu, 86m, 18.vii.2017, 1♀; Kozan, 342m, 15.viii.2017, 2♀♀, 2♂♂; Saimbeyli, 884m, 19.viii.2017, 1♂; Ceyhan, 78m, 2.ix.2017, 1♀, 1♂; Kozan, 371m, 18.ix.2017, 1♀, 1♂; Feke, 364m, 19.ix.2017, 1♂ (Totally 15 specimens, leg. Samet Eray Yalnız).

Distribution in Turkey: Black Sea, Southeastern Anatolia, Eastern Anatolia, Central Anatolia, Mediterranean, Aegean, Marmara Regions (Figure 1) (Yıldırım et al., 2014: 8).

Distribution in the Palaearctic Region: Europe, Great Britain, Turkey, Iraq, Georgia, Armenia, Turkmenistan, Uzbekistan, Tajikistan, Kazakhstan, southern Siberia, north China, Arabian Peninsula, north Iran, North Africa (Yıldırım et al., 2016: 26).

Phenology: June – September.

Subfamily Crabroninae Latreille, 1802

Tribe Larrini Latreille, 1810

Subtribe Larrina Latreille, 1810

Genus *Liris* Fabricius, 1804

Liris niger niger (Fabricius, 1775)

Material Examined: (32 ♀♀, 14 ♂♂) Adana: Kozan, 304m, 13.vii.2017, 2♀♀, 1♂; Feke, 557m, 14.vii.2017, 3♀♀, 1♂; Karataş, 8m, 27.vii.2017, 2♀♀, 1♂; Yüreğir, 42m, 24.vii.2017, 1♀; Feke, 580m, 14.viii.2017, 3♀♀, 1♂; Kozan, 342m, 15.viii.2017, 4♀♀, 1♂; İmamoğlu, 94m, 17.viii.2017, 1♀, 1♂; Saimbeyli, 884m, 19.viii.2017, 1♀; Sarıçam, 337m, 24.viii.2017, 2♀♀; Ceyhan, 78m, 2.ix.2017, 1♀, 3♂♂; Feke, 364m, 19.ix.2017, 2♀♀, 1♂; Saimbeyli, 570m, 20.ix.2017, 2♀♀, 1♂; Seyhan, 326m, 21.ix.2017, 1♀; Karataş, 24m, 22.ix.2017, 2♀♀, 1♂; Sarıçam, 128m, 24.ix.2017, 3♀♀, 1♂; Karaisalı, 306m, 24.ix.2017, 2♀♀, 1♂ (Totally 46 specimens, leg. Samet Eray Yalnız).

Distribution in Turkey: Black Sea, Southeastern Anatolia, Eastern Anatolia, Central Anatolia, Mediterranean, Aegean, Marmara Regions (Figure 1) (Yıldırım et al., 2014: 11).

Distribution in the Palaearctic Region: Europe, Turkey, Iran, Israel, Turkmenistan, Uzbekistan, Tajikistan, Kazakhstan, Mongolia, Arabian Peninsula, Afghanistan, North Africa (Rezaei and Fallahzadeh, 2015: 8).

Phenology: July-September.

Subtribe Gastrosericina Ed. André, 1886

Genus *Tachysphex* Kohl, 1883

Tachysphex fulvitarsis (A. Costa, 1867)

Material Examined: (10 ♀♀, 2 ♂♂) Adana: Kozan, 304m, 13.vii.2017, 2♀♀; Feke, 603m, 15.vii.2017, 1♀; Feke, 580m, 14.viii.2017, 3♀♀, 1♂; Kozan, 342m, 15.viii.2017, 2♀♀, 1♂; Ceyhan, 78m, 2.ix.2017, 1♀; Kozan, 371m, 18.ix.2017, 1♀ (Totally 12 specimens, leg. Samet Eray Yalnız).

Distribution in Turkey: Black Sea, Southeastern Anatolia, Eastern Anatolia, Central Anatolia, Mediterranean, Marmara Regions (Figure 1) (Yıldırım et al., 2014: 11).

Distribution in the Palaearctic Region: Europe, Turkey, Israel, Jordan, Turkmenistan, Uzbekistan, Tajikistan, Kazakhstan, southern Siberia, Iran, Pakistan, Africa (Yıldırım et al., 2016: 34).

Phenology: July–September.

Remarks: This species is new record for Adana province.

Tachysphex pompiliformis (Panzer, 1805)

Material Examined: (67 ♀♀, 26 ♂♂) Adana: Ceyhan, 32m, 12.vi.2017, 3♀♀; Karataş, 13m, 14.vi.2017, 2♀♀, 3♂♂; Seyhan, 36m, 18.vi.2017, 1♀; Kozan, 284m, 20.vi.2017, 3♀♀, 1♂; İmamoğlu, 85m, 21.vi.2017, 2♀♀; Kozan, 304m, 13.vii.2017, 4♀♀; Feke, 557m, 14.vii.2017, 3♀♀, 4♂♂; Kozan, 356m, 16.vii.2017, 6♀♀, 3♂♂; Sarıçam, 312m, 19.vii.2017, 3♀♀; Seyhan, 33m, 20.vii.2017, 2♀♀; Ceyhan, 212m, 23.vii.2017, 3♀♀, 3♂♂; Yumurtalık, 17m, 25.vii.2017, 1♀, 2♂♂; Ceyhan, 38m, 29.vii.2017, 3♀♀; Feke, 580m, 14.viii.2017, 2♀♀, 1♂; Kozan, 342m, 15.viii.2017, 3♀♀, 3♂♂; Feke, 364m, 18.viii.2017, 2♂♂; Saimbeyli, 903m, 22.viii.2017, 2♀♀; Yumurtalık, 20m, 27.viii.2017, 1♀; Karataş, 42m, 28.viii.2017, 2♀♀; Yüreğir, 65m, 29.viii.2017, 3♀♀, 1♂; Çukurova, 48m, 30.viii.2017, 1♀, 1♂; Ceyhan, 37m, 3.ix.2017, 2♀♀, 1♂; Kozan, 371m, 18.ix.2017, 5♀♀; Feke, 364m, 19.ix.2017, 2♀♀; Saimbeyli, 570m, 20.ix.2017, 1♀; Seyhan, 326m, 21.ix.2017, 2♀♀, 1♂; Karataş, 24m, 22.ix.2017, 1♀; Karaisalı, 306m, 24.ix.2017, 4♀♀ (Totally 93 specimens, leg. Samet Eray Yalnız).

Distribution in Turkey: Black Sea, Southeastern Anatolia, Eastern Anatolia, Central Anatolia, Mediterranean, Aegean, Marmara Regions (Figure 1) (Yıldırım et al., 2014: 12).

Distribution in the Palaearctic Region: Europe, Great Britain, Turkey, Turkmenistan, Uzbekistan, Tajikistan, Kazakhstan, southern Siberia, north China, Mongolia, Russian Far East, Sakhalin Island, Korea, Pakistan, India, North Africa (Yıldırım et al., 2016: 37).

Phenology: June-September.

Remarks: This species is new record for Adana province.

CONCLUSIONS AND DISCUSSION

This is the first such comprehensive study of its kind to be conducted in the Adana province. The 331 specimens collected during the study were subjected to faunistic, systematic and ecologic evaluation, and a total of 9 species were identified that belong to the Bembicinae, Philanthinae and Crabroninae subfamilies of the Crabronidae family. According to the study results, two of these species were of the Bembicinae subfamily: *Bembix bicolor* Radoszkowski, 1877; *Bembix oculata oculata* Panzer, 1801; four species belong to the Philanthinae subfamily: *Cerceris arenaria arenaria* (Linnaeus, 1758); *Cerceris flavicornis* Brullé, 1833; *Cerceris sabulosa sabulosa* (Panzer, 1799); *Philanthus triangulum triangulum* (Fabricius, 1775) and three species belong to the Crabroninae subfamily: *Liris niger niger* (Fabricius, 1775); *Tachysphex fulvitarsis* (A. Costa, 1867); *Tachysphex pompiliformis* (Panzer, 1805).

Based on the study results, the following seven species of the Hymenoptera fauna were recorded for the first time in the province of Adana: *Bembix bicolor* Radoszkowski, 1877 from the Bembicinae subfamily; *Cerceris flavicornis* Brullé, 1833 from the Philanthinae subfamily; *Tachysphex fulvitarsis* (A. Costa, 1867) and *Tachysphex pompiliformis* (Panzer, 1805) from the Crabroninae subfamily.

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Studies on Vespidae species (Hymenoptera: Vespoidea) of Giresun province, Turkey

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ABSTRACT

This study is based on 566 specimens of Vespidae (Insecta: Hymenoptera: Vespoidea) collected from Giresun province and its districts in 2013 and 2014 during May and August. At the end of the study, 9 species and subspecies were collected from the subfamilies Vespinae, Polistinae and Eumeninae. 3 species belong to Vespinae subfamily: *Vespa crabro* Linnaeus, 1758; *Vespula* (*Paravespula*) *germanica* (Fabricius, 1793); *Vespula* (*Paravespula*) *vulgaris* (Linnaeus, 1758); 5 species belong to Polistinae subfamily: *Polistes* (*Polistes*) *associus* Kohl, 1898; *Polistes* (*Polistes*) *biglumis* (Linnaeus, 1758); *Polistes* (*Polistes*) *dominula* (Christ, 1791); *Polistes* (*Polistes*) *gallicus* (Linnaeus, 1767); *Polistes* (*Polistes*) *nimpha* (Christ, 1791) and 1 subspecies belong to Eumeninae subfamily: *Antepipona orbitalis orbitalis* (Herrich-Schaeffer, 1839) totally 9 species were identified. *Vespa crabro* Linnaeus, 1758*; Polistes* (*Polistes*) *associus* Kohl, 1898; *Polistes* (*Polistes*) *biglumis* (Linnaeus, 1758); *Polistes* (*Polistes*) *dominula* (Christ, 1791); *Polistes* (*Polistes*) *gallicus* (Linnaeus, 1767); *Polistes* (*Polistes*) *nimpha* (Christ, 1791) and *Antepipona orbitalis orbitalis* (Herrich-Schaeffer, 1839) are new records for Giresun province Hymenoptera fauna. Determination of Vespidae species occurring in agricultural areas with this study, food plants, phenology are intended observing the ecological properties and to contribute to Turkey Hymenoptera fauna.

Key words**:** *Social wasps, hornet, systematic, Vespinae, Polistinae*

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ÖZET

Bu çalışma 2013-2014 yılı Mayıs-Ağustos aylarında, Giresun il merkezi ve ilçelerinden toplanan 566 Vespidae (Insecta: Hymenoptera: Vespoidea) örneğine dayanmaktadır. Çalışma sonunda Vespinae, Polistinae ve Eumeninae altfamilyalarından toplam 9 tür ve alttür toplanmıştır. Vespinae alt familyasına ait 3 tür: *Vespa crabro* Linnaeus, 1758; *Vespula* (*Paravespula*) *germanica* (Fabricius, 1793); *Vespula* (*Paravespula*) *vulgaris*

(Linnaeus, 1758); Polistinae altfamilyasından 5 tür: *Polistes* (*Polistes*) *associus* Kohl, 1898; *Polistes* (*Polistes*) *biglumis* (Linnaeus, 1758); *Polistes* (*Polistes*) *dominula* (Christ, 1791); *Polistes* (*Polistes*) *gallicus* (Linnaeus, 1767); *Polistes* (*Polistes*) *nimpha* (Christ, 1791) ve Eumeninae altfamilyasından 1 alttür: *Antepipona orbitalis orbitalis* (Herrich-Schaeffer, 1839) olmak üzere toplam 9 tür belirlenmiştir. *Vespa crabro* Linnaeus, 1758; *Polistes* (*Polistes*) *associus* Kohl, 1898; *Polistes* (*Polistes*) *biglumis* (Linnaeus, 1758); *Polistes* (*Polistes*) *dominula* (Christ, 1791); *Polistes* (*Polistes*) *gallicus* (Linnaeus, 1767); *Polistes* (*Polistes*) *nimpha* (Christ, 1791) ve *Antepipona orbitalis orbitalis* (Herrich-Schaeffer, 1839) Giresun ili Hymenoptera faunası için yeni kayıttır. Bu çalışmayla tarımsal alanlarda yayılış gösteren Vespidae türlerinin tespit edilmesi, besin bitkilerinin, fenolojilerinin ve ekolojik özelliklerinin belirlenmesiyle Türkiye Hymenoptera faunasına katkı sağlanması amaçlanmıştır.

Anahtar Sözcükler: *Sosyal yaban arıları, eşekarısı, sistematik, Vespinae, Polistinae*

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INTRODUCTION

The current knowledge of 13 Hymenopterous families: Chrysididae, Sapygidae, Mutillidae, Bradynobaenidae, Vespidae, Ampulicidae, Sphecidae, Crabronidae, Pompilidae, Tiphiidae, Evaniidae, Gasteruptiidae and Stephanidae fauna of Turkey were evaluated (Yıldırım, 2016: 1817)

Vespidae maintain a cosmopolitan distribution, and are particularly prevalent in the tropics. The most prominent feature setting Vespidae aside from other Hymenoptera is that they fold their forewings longitudinally while at rest, and have a jugal lobe on their rear wings. In addition, the discoidal cells found on their forewings are longer than those observed in other families. The bodies of Vespidae species are predominantly clothed in black, brown or yellow colors. Vespidae are active in human residential areas during the spring and summer months, bringing many effects that are both beneficial and detrimental to humans and nature. In agricultural areas in particular, they can create a nuisance for workers through their stings, and may even cause death in people with allergies to insect stings. These insects have the ability to harm nature in several different ways, for example, by gnawing and opening cuts in ripe fruits from which fungus and bacteria spores may enter (causing the fruits to rot away while still in the garden or storehouse), and by gnawing tree branches and shoots, weakening seedlings and preventing new shoots from forming. Furthermore, certain species have the ability to raid honeybee hives, stealing honey and wiping out colonies (Yıldırım and Özbek, 1992: 227).

On the other hand, some Vespidae species hunt down the Lepidoptera and Coleoptera larvae that are the cause of extensive economic damage, thus playing an important role in the preservation of natural biological balance through integrated pest management (IPM). As adults hunt various insects (spiders, certain Coleoptera species) to feed their carnivorous larvae, they also help prevent the proliferation of harmful insects, playing a role in protecting natural balance through biological means. These insects also have beneficial uses in pharmacology and molecular biology (Yıldırım and Özbek, 1992: 228).

Vespidae species are represented by 250 genera and six subfamilies, and these subfamilies are Euparagiinae, Eumeninae, Masarinae, Stenogastrinae, Polistinae and Vespinae (Pickett and Carpenter, 2010: 5). A total of 298 species and subspecies in 53 genera of the subfamilies Vespinae, Polistinae, Eumeninae, and Masarinae have been recorded from Turkey. Of them, 65 species and subspecies, comprising 22% of Turkish vespids, are endemic (Yıldırım and Gusenleitner, 2012: 362).

In Turkey, comprehensive faunistic studies on the family of Vespidae are extremely limited. Tüzün and Tanyolaç (1987: 150) gave the records of the Aegean region Vespidae species and determined their distribution areas. Yıldırım and Özbek (1992: 230; 1993: 142; 1996: 190) conducted research on the species of Eastern Anatolia Vespinae and Polistinae. Erdoğan and Tüzün (2000: 772) Kayseri province, Kekillioğlu and Tüzün (2000: 130) Malatya province, Tüzün and Kekillioğlu (2003: 99) have determined the distribution areas of Vespidae species in and around Ankara province. Yıldırım (2012: 25) also gave a list of all of Turkey according to the distribution of species and species of Vespidae geographic region.

In this study, a systematic evaluation of the Vespidae species was aimed in order to contribute to existing knowledge on fauna, species distribution areas and biodiversity.

MATERIAL AND METHOD

This study evaluated 566 Vespidae specimens collected within the province of Giresun and its districts in 2013 and 2014 during May and August. The specimens were caught using insect nets between 09:00 AM and 06:00 PM during the day, and the captured specimens were place inside killing jars containing a mixture of potassium cyanide (KCN_3) and gypsum, which were then placed in cardboard boxes together with labels indicating the location, coordinates, altitude, date of collection and the name of the collector. For each species, the characteristics of the habitat as well as certain ecological features, such as the plant sources of nutrition, were noted. The specimens converted to museum material were examined based on their morphologies, color and patterns. Examinations were made using a LEICA (EZ4)-brand stereo microscope.

The control and identification of the specimens werre carried out based on the methods applied in Tüzün and Tanyolaç (1987: 150), Yıldırım and Kojima (1999: 20), Yıldırım and Gusenleitner (2012: 362), Schmid-Egger et al. (2017: 58), Fateryga (2018: 225). When noting the types of materials examined, information was provided for each species on the total number of specimens collected, the location and altitude at which they were collected, the date of collection, and the sex of the specimens. Furthermore, information was also garnered on the distribution of the relevant species in Turkey and the rest of the World and their phenologies.

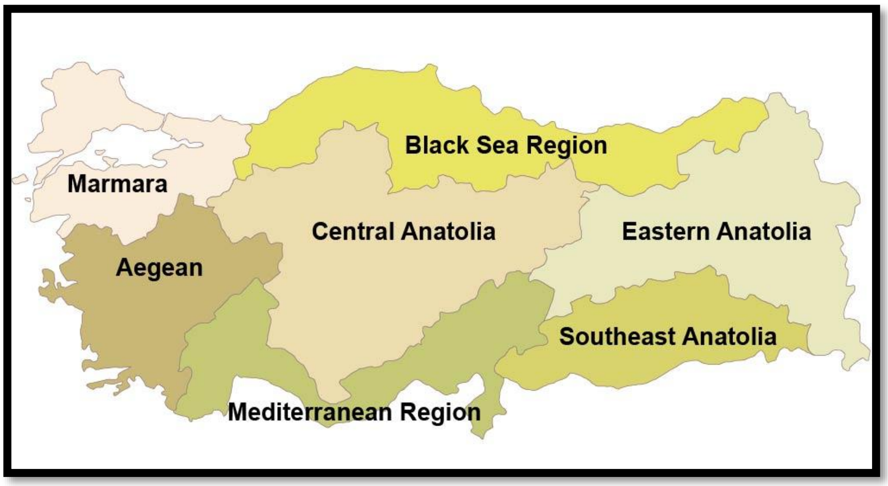

Figure 1. Map of administrative regions of Turkey (Anonymous, 2019)

RESULTS

Subfamily Vespinae

Genus *Vespa* Linnaeus, 1758

Vespa crabro Linnaeus, 1758

Material Examined: (355 ♀♀, 20 ♂♂) Giresun: Merkez, 220 m, 11.vii.2013, 47♀♀, 3♂♂; Bulancak, 712 m, 20.vii.2013, 27♀♀; Yağlıdere, 177 m, 07.viii.2013, 25♀♀; Dereli, 528 m, 05.viii.2013, 15♀♀, 6♂♂; Güce, 342 m, 17.viii.2013, 17♀♀; Piraziz, 1150 m, 22.viii.2013, 129♀♀, 8♂♂; Eynesil, 108 m, 27.v.2014, 11♀♀; Keşap, 96 m, 08.vi.2014, 22♀♀; Şebinkarahisar, 1373 m, 12.vii.2014, 28♀♀, 1♂; Tirebolu, 145 m, 23.vii.2014, 16♀♀, 2♂♂; Espiye, 172 m, 23.vii.2014, 18♀♀ (Totally 375 specimens, leg. Gözde Bilgili).

Distribution in Turkey: Black Sea, Eastern Anatolia, Central Anatolia, Mediterranean, Aegean, Marmara Regions (Figure 1) (Yıldırım, 2012: 27; Tüzün and Yalnız, 2018: 227).

Distribution in the Palaearctic Region: Europe, Caucasus, Turkey, Iran, Russia, Crimean Peninsula, Kazakhstan, Turkmenistan, Mongolia, China, Korea, Japan, Taiwan (Fateryga, 2018: 228).

Phenology: May-August.

Remarks: This species is new record for Giresun province.

Genus *Vespula* Thomson, 1869

Vespula* (*Paravespula*) *germanica (Fabricius, 1793)

Material Examined: (19 ♀♀) Giresun: Görele, 124 m, 19.vii.2013, 13♀♀; Tirebolu, 122 m, 23.vii.2014, 6♀♀ (Totally 19 specimens, leg. Gözde Bilgili).

Distribution in Turkey: Black Sea, Southeastern Anatolia, Eastern Anatolia, Central Anatolia, Mediterranean, Aegean, Marmara Regions (Figure 1) (Yıldırım and Gusenleitner, 2012: 363; Yıldırım, 2012: 27; Tüzün and Yalnız, 2018: 228).

Distribution in the Palaearctic Region: Russia, Europe, Northern Africa, Caucasus, Turkey, Syria, Jordan, Lebanon, Israel, Iraq, Iran, Afghanistan, Central Asia, Pakistan, Kazakhstan, Mongolia, China, Korea, Taiwan (Fateryga, 2018: 228).

Phenology: July.

Vespula (Paravespula) vulgaris (Linnaeus, 1758)

Material Examined: (12 ♀♀, 2 ♂♂) Giresun: Keşap, 511 m, 05.viii.2013, 4♀♀; Bulancak, 712 m, 15.vii.2013, 8♀♀, 2♂♂ (Totally 14 specimens, leg. Gözde Bilgili).

Distribution in Turkey: Black Sea, Southeastern Anatolia, Eastern Anatolia, Central Anatolia, Mediterranean, Aegean, Marmara Regions (Figure 1) (Yıldırım and Özbek, 1999: 592; Yıldırım, 2012: 27; Tüzün and Yalnız, 2018: 228).

Distribution in the Palaearctic Region: Russia, Europe, Caucasus, Turkey, Iran, Kyrgyzstan, Kazakhstan, Mongolia, China, Korea, Japan (Fateryga, 2018: 229).

Phenology: July-August.

Subfamily Polistinae

Genus *Polistes* Latreille, 1802

Polistes associus Kohl, 1898

Material Examined: (12 ♀♀) Giresun: Güce, 367m, 17.viii.2013, 12 ♀♀ (Totally 12 specimens, leg. Gözde Bilgili).

Distribution in Turkey: Black Sea, Eastern Anatolia, Central Anatolia, Mediterranean, Aegean, Marmara Regions (Figure 1) (Yıldırım, 2012: 27; Tüzün and Yalnız, 2018: 229).

Distribution in the Palaearctic Region: Southern Europe and Turkey, northwards to Switzerland, southwards to Israel, eastwards to Azerbaijan (Schmid-Egger et al., 2017: 80)

Phenology: August.

Remarks: This species is new record for Giresun province.

Polistes* (*Polistes*) *biglumis (Linnaeus, 1758)

Material Examined: (27 ♀♀, 6 ♂♂) Giresun: Çamoluk, 1000 m, 24.viii.2013, 12♀♀, 2♂♂; Alucra, 1473 m, 13.vii.2014, 15♀♀, 4♂♂ (Totally 33 specimens, leg. Gözde Bilgili).

Distribution in Turkey: Black Sea, Eastern Anatolia, Central Anatolia, Mediterranean, Aegean, Marmara Regions (Figure 1) (Yıldırım, 2012: 27; Tüzün and Yalnız, 2018: 230).

Distribution in the Palaearctic Region: Europe including Norway and Sweden south of 65° N to Turkey, Central Asia (Schmid-Egger, 2017: 89).

Phenology: July-August.

Remarks: This species is new record for Giresun province.

Polistes **(*Polistes*)** ***dominula*** (Christ, 1791)

Material Examined: (36 ♀♀) Giresun: Doğankent, 217 m, 19.vii.2013, 18♀♀; Çanakçı, 221 m, 20.vii.2013, 13♀♀; Eynesil, 88 m, 27.v.2014, 5♀♀ (Totally 36 specimens, leg. Gözde Bilgili).

Distribution in Turkey: Black Sea, Southeastern Anatolia, Eastern Anatolia, Central Anatolia, Mediterranean, Aegean, Marmara Regions (Figure 1) (Yıldırım, 2012: 27; Tüzün and Yalnız, 2018: 231).

Distribution in the Palaearctic Region: Europe, Northern Africa, Russia, Caucasus, Crimean Peninsula, Cyprus, Jordan, Israel, Iran, Pakistan, Afghanistan, Kazakhstan, Central Asia Mongolia, China (Fateryga, 2018: 226).

Phenology: May-July.

Remarks: This species is new record for Giresun province.

Polistes **(*Polistes*)** ***gallicus*** (Linnaeus, 1767)

Material Examined: (27 ♀♀) Giresun: Bulancak, 712 m, 05.vii.2013, 18♀♀; Görele, 286 m, 27.v.2014, 9♀♀ (Totally 27 specimens, leg. Gözde Bilgili).

Distribution in Turkey: Black Sea, Southeastern Anatolia, Eastern Anatolia, Central Anatolia, Mediterranean, Aegean, Marmara Regions (Figure 1) (Yıldırım, 2012: 27; Tüzün and Yalnız, 2018: 230).

Distribution in the Palaearctic Region: Europe, Northern Africa, Ethiopia, Caucasus, Turkey, Cyprus, Russia, Crimean Peninsula, Jordan, Israel, Iran, Afghanistan, Pakistan, Turkmenistan, Kyrgyzstan, Kazakhstan, Mongolia (Fateryga, 2018: 226).

Phenology: May-July.

Remarks: This species is new record for Giresun province.

Polistes **(*Polistes*)** ***nimpha*** (Christ, 1791)

Material Examined: (21 ♀♀, 4 ♂♂) Giresun: Çamoluk, 1123 m, 24.viii.2013, 6♀; Şebinkarahisar, 1373 m, 12.vii.2014, 15♀♀, 4♂♂ (Totally 25 specimens, leg. Gözde Bilgili).

Distribution in Turkey: Black Sea, Southeastern Anatolia, Eastern Anatolia, Central Anatolia, Mediterranean, Aegean, Marmara Regions (Figure 1) (Yıldırım, 2012: 27; Tüzün and Yalnız, 2018: 231).

Distribution in the Palaearctic Region: Europe, Northern Africa, Caucasus, Turkey, Russia, Crimean Peninsula, Jordan, Israel, Iran, Iraq, Pakistan, Kyrgyzstan, Kazakhstan, Mongolia, China (Fateryga, 2018: 226).

Phenology: July-August.

Remarks: This species is new record for Giresun province.

Subfamily Eumeninae

Genus *Antepipona* Saussure, 1855

Antepipona orbitalis orbitalis (Herrich-Schaeffer, 1839)

Material Examined: (21 ♀♀, 4 ♂♂) Giresun: Çamoluk, 1123 m, 24.viii.2013, 6♀; Şebinkarahisar, 1373 m, 12.vii.2014, 15♀♀, 4♂♂ (Totally 25 specimens, leg. Gözde Bilgili).

Distribution in Turkey: Black Sea, Eastern Anatolia, Central Anatolia Regions (Figure 1) (Yıldırım, 2012: 34).

Distribution in the Palaearctic Region: Europe, Turkey, Russia (Fateryga, 2017: 6).

Phenology: July-August.

Remarks: This species is new record for Giresun province.

CONCLUSIONS AND DISCUSSION

This is the first comprehensive study of its kind to be conducted in the Giresun province. The 566 specimens collected during the study were subjected to faunistic, systematic and ecologic evaluation, and a total of 9 species were identified that belong to the Vespinae, Polistinae and Eumeninae subfamilies of the Vespidae family. According to the study results, three of these species were of the Vespinae subfamily: *Vespa crabro* (Linnaeus, 1758); *Vespula* (*Paravespula*) *germanica* (Fabricius, 1793); *Vespula* (*Paravespula*) *vulgaris* (Linnaeus, 1758); five species belong to the Polistinae subfamily: *Polistes* (*Polistes*) *associus* Kohl, 1898; *Polistes* (*Polistes*) *biglumis* (Linnaeus, 1758); *Polistes* (*Polistes*) *dominula* (Christ, 1791); *Polistes* (*Polistes*) *gallicus* (Linnaeus, 1767); *Polistes*

(*Polistes*) *nimpha* (Christ, 1791); and one species belong to the Eumeninae subfamily: *Antepipona orbitalis orbitalis* (Herrich-Schaeffer, 1839).

A phenological evaluation of the collected specimens revealed that specimen density was lowest in the month of June and highest in the months of July and August due to the low-precipitation to humid Black Sea climate. Since Vespinae and Eumeninae species generally prefer warm and moderately humid environments, they had the longest period of activity between the months of June and September. Polistinae species are generally found in warmer and more arid environments, for this reason they tend to be more active from June to August. The Vespinae, Polistinae and Eumeninae species were observed to have the highest species diversity and population density in the month of July. The field studies also revealed a higher prevalence of female individuals, indicating that the females engaged in flight more often than males. While Vespidae species are generally encountered at altitudes of between 50–1473 meters, the highest frequency of specimens was observed between 220 and 937 meters. These species generally prefer plants that are 1.5–2.0 meters from the ground, such as *Malus sylvestris*, *Echinops* sp., *Morus* sp., *Helianthus* sp., *Cerasus avium moench*, *Polygonum* sp., *Vitis vinifera*, *Mentha* sp., *Astragalus* sp., and *Populus* sp. Samples were also collected from *Quercus* sp. and *Pinus* sp.

Giresun province is notably rich in vegetation because Giresun is one of the most rainy areas in Turkey, most parts of this city consist of forests; especially hazelnut, chestnut, hornbeam, oak and various fruit trees are abundant. Pine forests are found between 1000-2000 m and Alp plants are found above 2000 m.

Based on the study results, the following seven species of the Hymenoptera fauna were recorded for the first time in the province of Giresun: *Vespa crabro* Linnaeus, 1758 from the Vespinae subfamily; *Polistes* (*Polistes*) *associus* Kohl, 1898; *Polistes* (*Polistes*) *biglumis* (Linnaeus, 1758); *Polistes* (*Polistes*) *dominula* (Christ, 1791); *Polistes* (*Polistes*) *gallicus* (Linnaeus, 1767); *Polistes* (*Polistes*) *nimpha* (Christ, 1791) from the Polistinae subfamily; and *Antepipona orbitalis orbitalis* (Herrich-Schaeffer, 1839) from the Eumeninae subfamily.

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Pathogenic Variations of *Fusarium oxysporum* f. sp. *ciceris*

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ABSTRACT

Fusarium oxysporum f. sp. *ciceris* causes Fusarium wilt in chickpea, and it is very serious pathogen that affects chickpea production in our country and all over the world. The agent results serious yield losses in chickpea production areas. Pathogen is seed and soil-borne and can be controlled by breeding resistant varieties. However, the pathogenic diversity and large geographical distribution of the agent restrict the effectiveness of this strategy. For this reason, characterization of *F. oxysporum* population is quite important in conducting breeding programs. Aim of this study was to determine the pathogenic variance of *F. oxysporum* f. sp. *ciceris* that causes wilting and yellowing symptoms in chickpea. *F. oxysporum* f. sp. *ciceris* isolates were collected from infected chickpea plants during surveys in 2015-2016 from four provinces (Mersin, Isparta, Adıyaman, Çanakkale) of Turkey. The chickpea variety ILC 482 was inoculated with isolates under controlled conditions for pathogenicty assays. Differences in disease development and disease severity among infected and healthy plants were determined. The plants were adversely affected by wilting and yellowing pathotypes and that wilting affected the plant more than that of yellowing group of isolates. The data obtained will shed light on future studies conducted on population characterization of *F. oxysporum* f. sp. *ciceris*.

Key Words: *Chickpea, pathogenicity, Fusarium wilt and yellowing*

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Introduction

Legumes have many genera and species, including cultivated and wild types (Doyle, 1994: 325). From ancient times until now, grain legumes have important role as a nutrient source. The most important reason is the protein content of legumes that ranges between 18-35% (Şehirali, 1988: 314). It is also known to have enormous benefits to the soil fertility. It is an undeniable fact that grain legumes are alternative group of plants in crop rotations (Akçin, 1988: 377; Şehirali, 1988: 314; Avcı et al., 2004). Nowadays, ecological farming factors have attracted great attention, and the ability to fix free nitrogen of the air is increasing the importance of legumes (Sepetoğlu, 1988: 71; Ceyhan, 2007). Chickpea, lentil, bean, pea, broad bean and cowpea have an important place in human nutrition for thousands of years. The most cutivated legumes in Turkey are chickpea, lentil, bean, pod, cowpea and pea (TUIK, 2017). The origine of domestication center of chickpea and lentil are reported to be the Fertile Crescent including Southeastern region of Turkey (Ladizinsky, 1975: 201; Van der Maesen, 1987: 11).

Fungal plant pathogens are among the most important factors causing serious yield losses in agriculture every year (Ekundayo et al., 2011: 418). *Fusarium oxysporum* Schlecht. emend. Snyd.&Hans. f. sp. *ciceris* (Padwick, 1940: 241; Haware, 1990: 61; Cunnington et al., 2007; Jiménez-Fernández et al., 2011: 860) causes wilting in chickpeas, as in the world it is widely seen in Turkey in the chickpea production areas (Trapero-Casas and Jiménez-Díaz, 1985: 1146; Maden, 1987: 1; Dolar, 1996: 33; Nene and Sheila, 1996: 28; Bayraktar, 2006: 100), and seriously affects its production. *F. oxysporum* f. sp. *ciceris* can survive in the soil and crop residues as chlamydospores for up to six years in the absence of susceptible host and can be spread by soil and infected seed (Haware et al., 1978: 1364; Trapero-Casas and Jiménez-Díaz, 1985: 1146). In addition, according to the symptoms of *F. oxysporum* f. sp. *ciceris* disease have two forms namely yellowing and wilting (Trapero-Casas and Jiménez-Díaz, 1985: 1146; Jimeńez-Gasco et al., 2004: 95; Jiménez-Díaz et al., 2015: 16), and depending on pathotype classification, creates late or young period plant deaths (Jiménez-Fernández et al., 2013).

The most effective method of controlling Fusarium wilt is to use resistant varieties (Singh et al., 1993: 137; Haware et al., 1992: 147; Kaiser et al., 1994: 962; Mahmood et al., 2011: 55). Development of resistant chickpea genotypes are hindered because of the high pathogenic diversity and wide geographic distribution of *F. oxysporum* f. sp. *ciceris* (Jiménez-Díaz et al., 1993: 7). In this regard, identification of pathogenic races exist within the population is an important source of information for improvement of breeding efforts and the effective use of existing varieties. It is also assumed that it will shed light with testing wild varieties against the disease, the pathogenic structure of the pathogen in the natural ecosystem as well as understanding the host-pathogen interactions. This study aimed to understand pathogenic structure of *F. oxysporum* f. sp. *ciceris* in chickpea growing areas of Turkey.

MATERIALS and METHODS

1. Inoculum preperation

Infected chickpea plants were collected during 2015-2016 survey studies in different provinces of Turkey and used for formation of single colony collections of *F. oxysporum* f. sp. *ciceris*. This stocks were used as inoculum source in this study (Can et al., 2003; Dolar, 2006: 17). The isolates were cultured on PDA (Potato Dextrose Agar) 2 weeks before inoculation. The chickpea plants (ILC 482) were grown at 25±2°C, 12:12 photoperiod and 25-50% humidity in controlled climate chamber (Dolar, 1995: 15) (Figure 1).

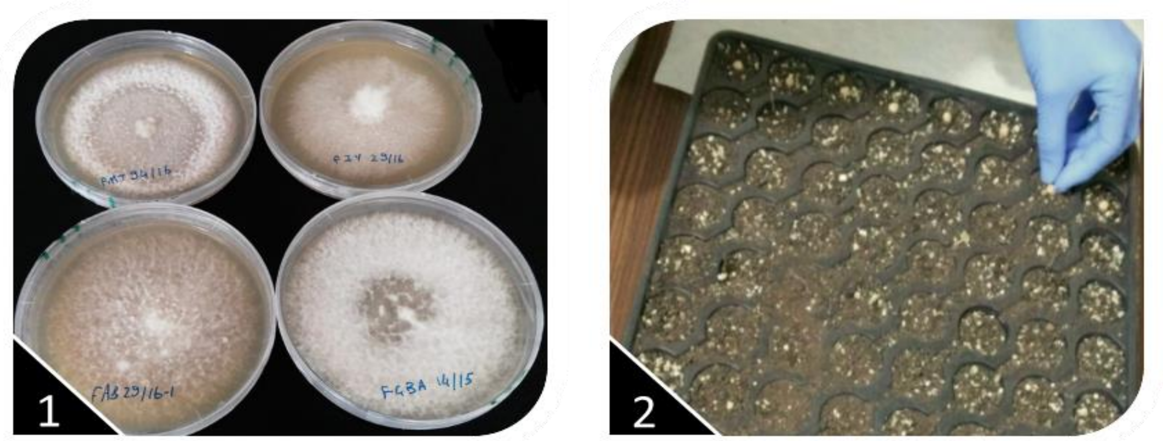

Figure 1. Preparation for inoculation

1: Collection of *Fusarium oxysporum* f. sp. *ciceris*; **2:** Plant cultivation at viols

2. Inoculation

Two weeks after sowing, fungal inocula was applied to seedlings according to the root dip protocol of Biles and Martyn (1989: 856). The chickpea seedlings, which were removed from the viols without damaging their roots, were cleaned from its soil by washing under the tap water (Altınok, 2006: 141). 50 ml sdH_2O (sterile distilled water) was added to the fungal cultures and then scraped with a sterile scalpel. The agar fragments and mycelia were removed by filtration through sterile gauze. The concentration was set to $1x10^6$ conidia/ml by counting with Thoma slide (hemocytometer) (Altınok, 2006: 141). The root ends of the seedlings were slightly damaged with the help of sterile scissors. These roots were then incubated in the prepared spore suspension for 5 minutes. Control plants were applied with sterile distilled water (Altınok, 2006: 141). After inoculation, chickpea seedlings were carefully planted to opened pits into the pots containing a mixture of soil, peat and vermiculite (1:1:1) without damaging the roots (Dolar, 2006: 17). Four plants were placed in every pot with 5 replicate in controlled conditions (Altinok et al., 2013: 651). The climate chamber was set to 14 hours of light (12000-15000 lux), 10 hours of dark photoperiod, 50-90% relative humidity and 25-28ºC daytime, 60-100% relative humidity and 18-24ºC at night (Trapero-Casas and Jiménez-Díaz, 1985: 1146). The plants were checked everyday and was watered if necessary (Hoagland and Arnon, 1950: 31) (Figure 2).

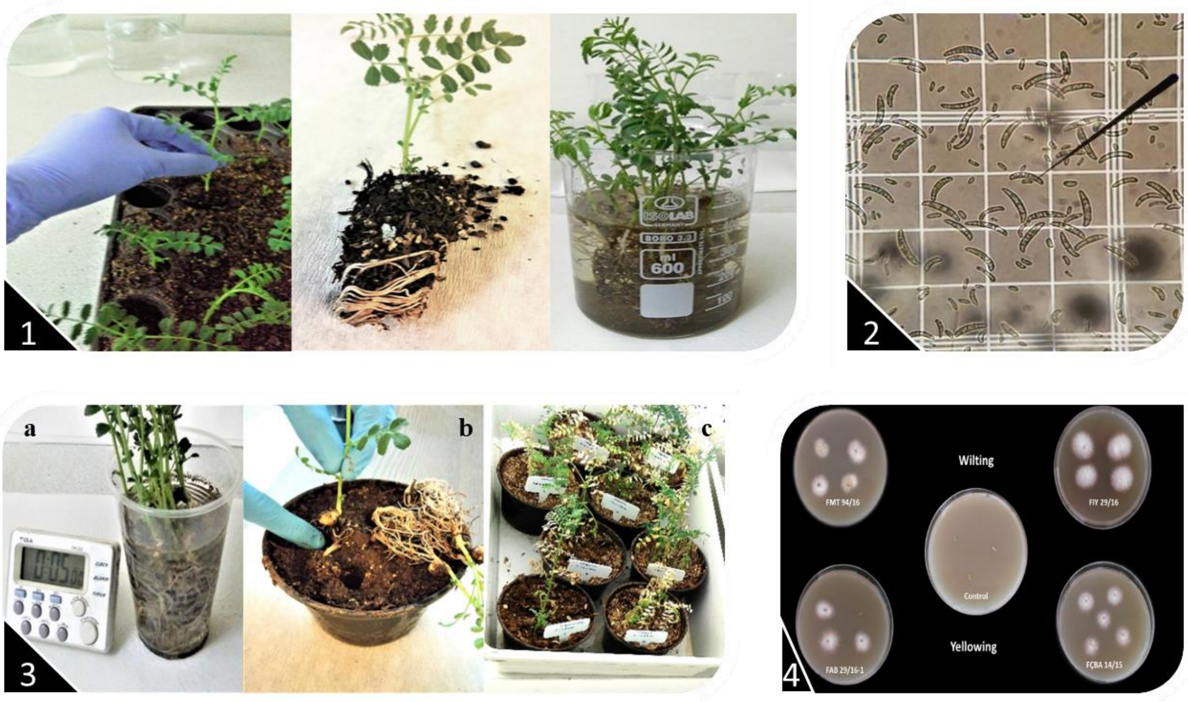

Figure 2. Plant inoculations

1: Preparation for inoculation; **2:** Preparation of spore solutions; **3:** a) Plant inoculation process, b) Infected seedling cultivation and c) Plants in a climate chamber; **4:** Koch postulate after inoculation

3. Scoring

During first 3 days after the inoculation, scoring was performed every day until the 6th days after inoculation and after that the scroings were continued every three days (6, 9, 12, 15, 18, 21, 24, 27 and 30). Each plant was evaluated according to 0-4 scale (Trapera-Casas and Jiménez-Díaz, 1985; Altinok et al., 2013: 651). The disease severity data were obtained by using the formula of Disease Severity Index (DSI) of Townsend-Heuberger (1943: 340) (Bora and Karaca, 1970: 167, Wilhelm et al., 1974; Trapera-Casas and Jiménez-Díaz, 1985).

In order to determine whether or not the symptoms in the chickpea plants was caused by *F. oxysporum* f. sp. *ciceris*, re-isolations were made from infected plant tissues. Subsequently fungal cultures were identified by macroscopic and microscopic examination (Can et al., 2003; Dolar, 2006: 17). All collected plant samples were stored at -80°C. Based on virulence of the isolates, the different forms and virulence levels were identified and the SPSS22 program was used for statistical analysis.

RESULTS and DISCUSSION

Chickpea is a grain legume that originates from the Fertile Crescent including Turkey (Van der Maesen, 1987: 11). *F. oxysporum* is a fungal species comprising large and different complexes of anamorphic fungi (O'Donnell et al., 1998: 2044). Fusarium wilt of chickpea caused by *F. oxysporum* f. sp. *ciceris* is known to be an important disease (Dolar, 1996: 33) and the most effective method of controlling is to use of resistant varieties (Singh et al., 1993: 137). Development of resistant varieties requires understanding of the pathogenic variability (Jalali and Chand, 1992: 429). In the present study, single spore collections of the isolates of *F. oxysporum* f. sp. *ciceris* collected from four provinces (Mersin, Isparta, Adıyaman, Çanakkale) of Turkey were analysed for their pathogenic variability. Isolates that was collected from these four provinces exhibited different virulence levels (high and weak virulent). Khan et al. (2015: 1324), tested ten isolates for pathogenicity and identified three groups based on their virulence as less, moderately and highly virulent. Susceptible chickpea variety, ILC 482, was used for pathogenicity test. According to reported studies (Martin, 2004: 15), sixteen registered chickpea variety were tested (Aydın92, Küsmen, İzmir92, Canıtez87, Menemen92, Uzunlu99, Sarı98, Diyar95, ILC195/2, ILC482, Damla89, Aziziye94, Cevdet Bey, Er99, Gökçe, Akçin91) against four races (0,2,3,5) and Uzunlu99 and ILC482 were identified as the most sensitive varieties. In addition to the different races, symptomatic differences indicated that the disease composes of two forms (wilting and yellowing). These differences might be due to different levels of susceptibility and resistance that can be clearly observed during pathogenicity tests. In our study, we observed that ILC482 genotype exhibited variable reactions against different isolates of the pathogen. After that, the isolates of *F. oxysporum* f. sp. *ciceris* were grouped into two categories and also each category contained of different virulence levels (high and low). In addition, the differences in form have resulted in differences in the degree of pathogenicity in chickpea, and it has been determined that wilt causes more severe virulence than yellowing. Of the agent due to this variability in their reactions, isolates were placed into different groups. The present results was complied with the findings of Bayraktar et al. (2008: 146), who reported that the virulence level of *F. oxysporum* f. sp. *ciceris* isolates were mostly variable. They used 108 isolates of *F. oxysporum* f. sp. *ciceris* and ILC482 as susceptible genotype of chickpea and they have identified that the aggressiveness of these isolates generally took place in the moderately virulent group. In addition to this; Erper et al. (2016: 15), have calculated the disease severity% of the species with Townsend-Heuberger formula by using disease scale values and then have determined the agressiveness level groupings according to Martyn and McLaughlin (1983). In their study they have observed that the disease severity scale (DSS) of *F. solani* f. sp. *cucurbitae* (F-42) isolates in the winter squash genotypes ranged between 1.83-2.0 and their virulence was low. *F. solani* f. sp. *cucurbitae* which was used as a positive control, was reported to have DSS between 2.67-3.5. In the scope of these results, they have determined that DSS of the control was high according to *F. solani* f. sp. *cucurbitae* (F-42). In our research 0-4 scale grades was used to define the degree of virulence and then recorded varying disease grades was used to calculated disease severity% with formula of Townsend and Heuberger (1943: 340). When the data obtained from pathogenicity was examined, it was determined that the severity of the disease is different for all days. The result was zero through the first two days and differences was observed on the other days. The disease severity% graph was plotted according to the sampling days (Figure 3). It was clear from the results of pathogenicity test that there was difference in disease severity between two forms and wilting symptom caused more damage than yellowing (Figure 4). Variance analysis (One-Way ANOVA) and Tukey test (Tukey, 1949: 99) was used to statistically analyse the data obtained from pathogenicity test (Tables 1, 2, 3).

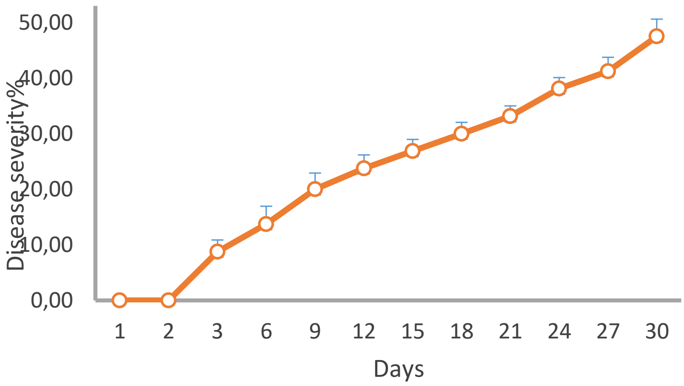

Figure 3. Disease severity values of *Fusarium oxysporum* f.sp. *ciceris* isolates

Days after inoculations	Disease Severity%
1	0.00±0.00^{a}
2	0.00±0.00^{a}
3	4.58±4.39^{a}
6	10.83±4.02^{ab}
9	18.33±2.89^{bc}
12	23.33±1.91^{cd}
15	26.04±2.01^{cde}
18	27.92±2.60^{cde}
21	29.79±3.45^{cdef}
24	32.92±5.32^{def}
27	36.46±5.013^{ef}
30	40.42±8.32^{f}

Table 1. Multiple variance analysis of disease severity% (Tukey HSDa)

$p<0.05$ (Forms denoted by the same letter in the same column are not significantly different according to Tukey test (α= 0.05))

Based on mean of disease severity% of all isolates it was observed that all scoring days were statistically different (Table 1) and they formed different groups (Figure 3) (F= 36.944; p= 0.000).

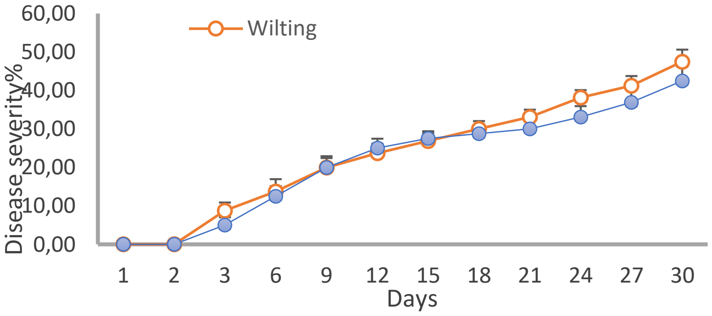

Figure 4. Disease severity % of yellowing and wilting groups

Days after inoculations	Disease Severity%
1	0.00 ± 0.00^{a}
2	0.00 ± 0.00^{a}
3	4.38 ± 6.19^{ab}
6	10.00 ± 5.30^{abc}
9	17.50 ± 3.54^{abcd}
12	22.50 ± 1.77^{bcde}
15	25.31 ± 2.21^{bcde}
18	27.50 ± 3.54^{cde}
21	29.69 ± 4.86^{cde}
24	32.81 ± 7.51^{de}
27	36.25 ± 7.07^{de}
30	39.38 ± 11.49^{e}

Table 2. Multiple variance analysis of disease severity (Tukey HSDa)

$p<0.05$ (Forms denoted by the same letter in the same column are not significantly different according to Tukey test ($\alpha=0.05$))

Days after inoculations	Disease Severity%
1	0.00 ± 0.00^{a}
2	0.00 ± 0.00^{a}
3	2.50 ± 3.54^{a}
6	9.38 ± 4.42^{ab}
9	17.50 ± 3.54^{bc}
12	23.13 ± 2.65^{bcd}
15	25.63 ± 2.65^{cd}
18	26.88 ± 2.65^{cd}
21	28.13 ± 2.65^{cd}
24	30.31 ± 3.98^{cd}
27	34.06 ± 3.98^{d}
30	36.88 ± 7.96^{d}

Table 3. Multiple variance analysis of disease severity (Tukey HSDa)

$p<0.05$ (Forms denoted by the same letter in the same column are not significantly different according to Tukey test ($\alpha = 0.05$))

When disease severity% of both forms were analysed individually, significant difference was observed (Table 2, 3) and different groups were formed for every scoring day (Figure 4) ($F_{wilting} = 12.89$; $p = 0.00$ and $F_{yellowing} = 25.59$; $p = 0.00$).

Pouralibaba et al. (2015: 399), have reported that the area under disease progress curve (AUDPC) calculation is a useful formula for evaluating not only the last symptoms of the disease, but also the progression rate of the disease. They also used AUDPC% to normalize the data. They have reported that the disease ranged from 0% to 0.45% in the control plant groups and fromed 0% to 100% for infected group. The calculation of the AUDPC, which is shown as a measure of quantitative disease resistance is made by using a mathematical formula with two data points, and facilitates the determination of disease progression rate (Ferrandino and Elmer, 1992: 208). In our study, we determined the disease progression level for wilting and yellowing forms (Figure 5). The progression of wilting and yellowing forms were evaluated and the highest AUDPC belonged to wilting form (wilting 26.08%, yellowing 24.24%). Also, the variance analysis (One-Way ANOVA) was used to determine the difference of the forms according to the AUDPC% data, and the Tukey test was applied to determine the significance of this difference (Table 4).

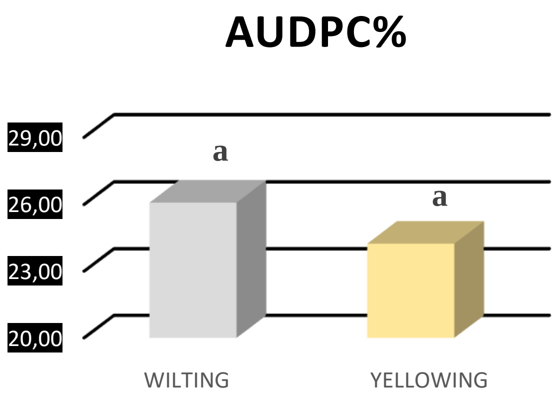

Figure 5. AUDPC% values of wilting and yellowing forms

Forms (N=12)	AUDPC%
Wilting[a]	26.08±5.44
Yellowing[a]	24.24±5.74

Table 4. Multiple variance analysis of the AUDPC% for wilting and yellowing forms (TukeyHSDa)

$p<0.05$ (Forms denoted by the same letter in the same column are not significantly different according to Tukey test (α= 0.05))

As a result of the variance analysis (One-Way ANOVA) test, it was determined that there was not significant difference between the forms and AUDPC% at the level of $p<0.05$ (F= 4.24; p= 0.62). Based on this result, it was assumed that both forms were in the same group, and the precision of this was supported by the Tukey test (Table 4). Cultivation conditions (light intensity, light duration, humidity, precipitation, soil nutrient content, dry weight of the plant, root growth, etc.) effect the morphological characteristics and physiological characteristics of the plant. However phytopathogenic factors are known to adversely hinder plant growth and cause detrimental effect in physiology (Kotasthane et al., 1976: 257; Sugha et al., 1994). Symptoms of the disease (browning), that was seen in the transmission bundle of the plant, characteristically indicate Fusarium wilt. In our study, yellowing-like symptoms were observed on the control plants, but with the help of the Koch postulate and vascular tissue investigations it was determined to be the result of physiological stress.

CONCLUSIONS

Fusarium wilt disease that causes yellowing and wilting syndromes is common in chickpea growing area of Turkey. Two forms of the disease have been obtained during surveys. Pathogenecity test was applied to determine the disease severity. Disease severity values were determined by using 0-4 scale. Firstly, it was observed that all scoring days were statistically different according to disease severity%. Secondly, a significant difference was observed when the disease severity of both forms was analysed separately. In addition it was determined that there was not significant difference between the forms according to AUDPC% and this event have been thought to be linked to the biological predisposition.

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Supportability of Energy With Agricultural Products: Example of Gaziantep

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ABSTRACT

As the world population and technological products increase, energy use increases in a linear proportion. In order to meet the energy need, people are interested in researching renewable sources that can replace fossil resources. One of the most natural and usable resources among these resources is biomass. Regional feasibility studies are important in terms of producing biomass correctly and evaluating correctly in energy production. Wood based products, industrial wastes of natural origin and all kinds of agricultural production can support energy production with biomass.

In this study, the recent data have been investigated to plant-based biomass potential from renewable energy sources for the Gaziantep province in Turkey. To obtain plant-based production data, literature surveys and statistics are researched for Gaziantep province in last years. These obtained data are used as input. Theoretical and economic biomass values are calculated by analysis. As a result, this study aims to provide awareness in Gaziantep province about its biomass potential. Gaziantep province can support to contribute significantly to Turkey's energy economy through biomass.

Keywords: *Biomass, Renewable energy, Sustainable energy, Agricultural Potency, Economics*

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INTRODUCTION

To meet the energy requirement, countries have used fossil-derived energy sources such as coal, natural gas and oil from past to present. However, all the countries are concerned that these energy resources will not be able to meet the demands due to the reduction and depletion of energy, and that an energy bottleneck will be reached in the near future (Acaroğlu and Aydoğan, 2012: 69). To prevent the energy crisis, it is necessary to determine the sustainable energy sources together with the fossil energy sources and to be activated to support the energy use. The lives of future generations are also threatened by the deplete of nonrenewable energy resources. Second problem is the damage to nature by the people (Balo and S.Sua, 2018). Therefore, academic studies on the sustainable energy sources' use have increased in recent years. Turkey also use of distressed coppice forests to contribute to the improvement and evaluation of energy. In this issue, studies are available for configuring (Balo, 2015: 161). Plant-based sources are one of the most widely used sustainable energy sources in order to generate energy in the process from the early ages of human beings to the present day and they are generally called biomass. Briefly, biomass is the general name given to the living mass that organisms have in a certain process in a society composed of one or more different species. In other words, it can be defined as the energy-containing form of organic based carbon (Balo, 2015: 336; Balo, 2011: 280). Biomass can be obtained from two different sources based on vegetable and animal origin. In this study, plant-based group was investigated. The main biomass waste that comes first to mind when it comes to plant origin is mushroom wastes, fibrous vegetable wastes produced by paper production, vegetable wastes obtained through processing, vegetable wastes obtained from agriculture and forestry etc. (Fernandes and Costa, 2010). Biomass energy is obtained by burning the wastes from biomass or passing through different processes. Among the sources of biomass energy is one of the most potent sources and one of the cleanest sources of energy among sustainable energy sources (Rahman and Paatero, 2012: 153). Biomass energy has two different usage types. The first one is the use of classical biomass energy and is derived from direct burning of wood and waste wood. In other modern biomass energy use, energy is produced through energy forestry products, urban wastes and herbal product wastes from the agricultural industry (Klavon, 2013: 36). The herbal origin resources' variety used to obtain energy is very large. For this reason, the energy's amounts obtained depending on the products are varied. For example; There are many different tree species within the forest ecosystem. Accordingly, it is different the amount of energy gained from the products produced by processing the trunks of the trees of different characteristics (industrial wood, poles, logs, etc.) and the wastes of these products (shell, body parts, branches, leaves and roots).

Likewise, the products' properties produced are different in different geographical areas. In other words, different energy potentials can be obtained from agricultural products of the same sex. The biogas yield and methane ratios obtained from some plant products are given in Table 1. The cycle of biomass of agricultural origin is shown in Figure 1.

Herbal product name	Biogas yield (l/kg)	Available methane ratio by total volume (%)
Wheat straw	200-300	50-60
Rye straw	200-300	59
Barley straw	290-310	59
Egyptian waste	380-460	59
Linen	360	59
Hemp	360	59
Grass	280-550	70
Vegetable waste	330-360	shows variability
Agricultural wastes	310-430	60-70
Peanut shell waste	365	unavailable
Waste of spilled tree leaves	210-290	58

Table 1. Biogas Yield and Methane Ratios Obtained from Some Plant Products (https://www.enerjibes.com/organik-atiklar-nelerdir/).

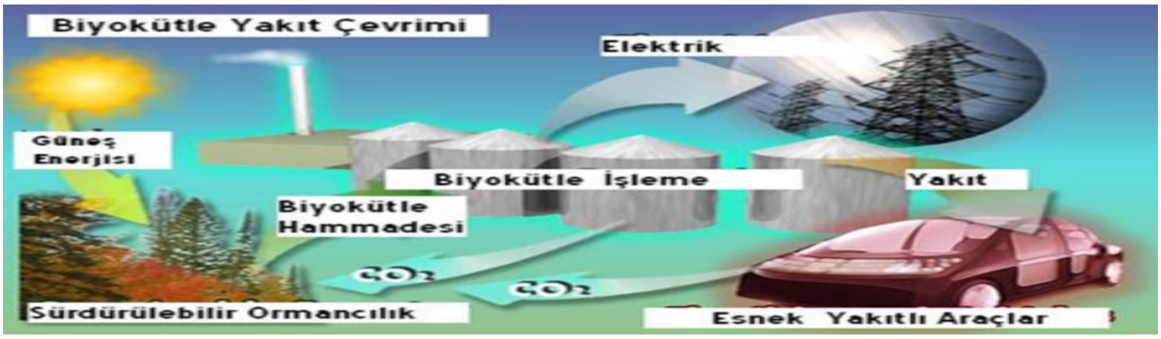


Figure 1. Conversion of biomass from agricultural origin (http://www.yegm.gov.tr/yenilenebilir/biyokutle_cevrim_tekno.aspx)

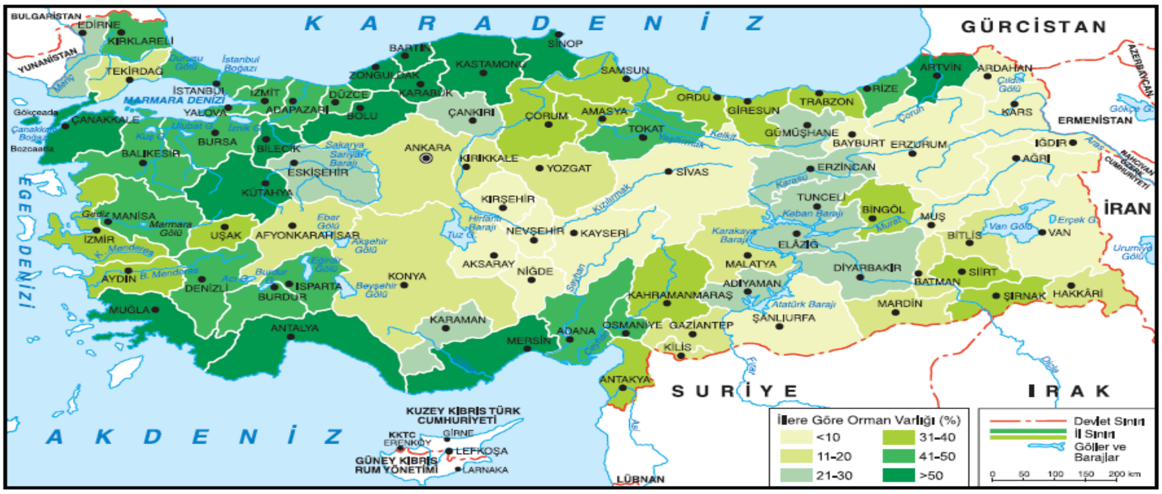


Figure 2. Map of forests inTurkey (http://www.cografyaci.gen.tr)

In 2018, Turkey forests' map is given in Figure 2. In the same year, the biomass-based power generation plants licensed (MWe) in Turkey is shown in Figure 3.

Figure 3. The Biomass-based Power Generation Plants Licensed (MWe) in Turkey (MWe) (https://www.enerji.gov.tr/tr-TR/Anasayfa)

Biomass is one of the most economical energy sources in terms of investment costs. It provides the added value. Besides, agricultural wastes which cause environmental pollution after biomass production and disposed as garbage can be used as natural fertilizers. In other words, the wastes can be used to recreate the nature after the energy is obtained. It is a logical choice to reduce the damage to the environment and human health through the exhaust emissions of energy and to the damages caused by the fossil resources to the nature and also to benefit from the biomass in terms of the technological and economic development of the rural areas. The value added can be increased by taking down all the costs by integrating feed production with fodder crops and waste assessment within the agricultural potential. Similarly, those who make agricultural investments above a certain limit can achieve the same benefit by turning product waste into fertilizer and energy. Because biomass is an energy source that provides three different investments in agriculture, environment protection and energy production. It is possible to produce both electric energy and heat energy with biomass. For this purpose, the different technologies' use to ensure the agricultural products' recycling-wastes is becoming increasingly widespread. For example, different techniques can be used to produce biofuel by looking at the variety of biomass product. Liquid, gas and / or solid biofuels can be obtained by suitable technique. By considering the products' variety, different technologies are important in terms of developing different types of fuel. By mixed with fossil fuels, the biofuels have increased to produce with the different technologies' help to reduce the fossil fuels' harmful in recent years. Today, three main methods are used to provide energy from biomass. These are thermal methods, physical methods, biochemical-microbial methods.

For biomass energy generation methods and areas of use from agricultural potential;

- By airless digestion, the forest products-wastes can be converted to biogas and this gas can be used in electricity production.

- By the pyrolysis method, the ethanol produced from agricultural wastes can be used for heating purposes.

-The so-called energy plants such as soybean, rapeseed, canola, etc. oilseed products can be used either directly by burning them or to produce biofuels-hydrogen. These products also can be used for heating water in technological systems

- By using the gasification method, methanol produced can be used in the aircraft.

-Diesel fuel can be obtained from the energy forests, which is a popular subject in recent years, thanks to the biophotolysis method.

In this sense, biomass fuels between sustainable, renewable and clean energy sources will be of significant importance in the future (https://www.enerjibes.com/organik-atiklar-nelerdir/). Biomass production from renewable energy sources is require different technologies to be installed by looking at the natural resources' variety in different geographical areas. It is important to investigate the geographical regions where agricultural potential can be obtained most efficiently. In this way, after the feasibility study is carried out, encouraging the people of the region and supporting the entrepreneurs will prepare a more reliable investment. The facilities that can be established in the region are useful to support both the region and the country's economy-energy. In addition, when the agricultural products' cultivation and spread increases, the amount of oxygen released to nature will also increase. The contribution to the energy imports' reduction will be contributed to the reduction of dependence on fossil resources. In addition to this, it will be supported to use less consumable energy resources and to protect existing resources. The biomass, which is a storable and then usable source. It has a wide variety of products. It is an energy source that does not cause greenhouse effect and does not cause acid rains. On the contrary, it supports the protection of ecological balance. With the people living's socio-economic development' support in rural areas, it is a tool to obtain all the advantages of agricultural mobility that can be spread throughout the country. It provides extensive business opportunities from the field to the site locally. Studies on the use of biomass-based sources to contribute to energy production have increased with increasing environmental awareness in recent years (Zarilli, 2006). Hemstock mentioned the possibility of evaluating biomass products that can be obtained locally at different potentials as energy source. He stated that biomass products and energy production are very important for rural-economic development of the region (Hemstock and Hall, 1995: 151). In Turkey, biomass studies are increased related to energy production in recent years. By Kaygusuz, biomass resources were investigated through the survey in terms of available in Turkey (Kaygusuz, 2001: 775). Sevim is stated that the existing biomass has a significant potential for reducing the dependence on foreign countries in terms of energy if it is evaluated (Sevim, 2009: 93). In addition to obtaining energy directly from the biomass, it can also be used as indirect support to reduce energy use. In recent years, many academic studies have been conducted on the biomass's availability in materials that can reduce indirectly the energy's use. For this purpose, all the technical specifications that are demanded with the materials produced, as well as being organic, non-toxic, light, environment-human friendly and functional, are increasing their attractiveness every day compared to fossil based materials. Several researches have been reported in our country that offer attractive materials. The researches of Yapraklı (Yapraklı and Bayramoğlu, 2013: 1174), Bayramoğlu- (S.Sua and Balo, 2017: 2306; Balo, 2015: 161; Balo, 2015: 336; Balo, 2011: 280), Aydoğan-Acaroğlu (Acaroğlu and Aydoğan, 2012: 69) and Balo can be given as examples. For example; The technical results obtained by the biomass sources' use in the insulation-building materials' production yielded almost comparable technical characteristics with those produced by fossil origin sources. These materials reduce energy use thanks to their contribution to energy efficiency. It contributes to support the regional-national economy through these productions. At the same time, it is possible to design living spaces that are both environmentally friendly and suitable for human health.

In this study, the energy potential which can be obtained directly or indirectly is searched with respect to sustainable energy in Gaziantep province. Biomass energy obtained by means of vegetable-based sources has been investigated. In recent years, data obtained through statistical researches has been used in the analysis. The total production of the plant can be evaluated in terms of energy. Then, the vegetative potential of the province was determined by means of calculations. In this study; It aimed to draw attention to the returns of regionally supported supports in terms of controlled consumption of energy supplied from fossil sources consumed by day by day. In this way, the contribution of global warming to environmental mitigation (eg disruption of the ecosystem) can be reduced. Awareness about the availability of biomass, which is one of the renewable - sustainable energy sources that can create a quality and healthy living space, has been tried to be created.

1. General Structure of Gaziantep Province

1.1. Climatic and Geographical Conditions

Fig. 4. The Location of The Gaziantep Province in Turkey

Gaziantep is the eighth most populous province of Turkey. According to the data in 2017, it has a population of 2 005 515 people. Gaziantep has an important place in terms of commerce-industry in Southeast Anatolia Region in Turkey. The province is located between the Middle East and Anatolia. The port is close to the provinces. There is no natural lake in Gaziantep. But, dams and artificial lakes were built in many areas of the province. The Euphrates River and its branches pass through Gaziantep. In the province, the main mountains are the Nur Mountains to the west of the province and the Sof Mountains. It is a depression formed as a result of the plate movements between the Nur and Sof Mountains. In the province, the highest mountain is Büyük Sof Mountain with a height of 1496 meters. In the province, the main plains are Islahiye, Barak and Tilbasar plains. In Gaziantep, earthquake regions are Nurdağı-Islahiye at first degree, Yavuzeli-Araban at 2nd degree and Oğuzeli-Nizip-Karkamış at degree. The climate of the province of Gaziantep shows the transition between the Eastern Anatolian and Mediterranean regions. However, the climate of the Mediterranean region has a greater impact. In the winter it is not too cold but the summer is dry and hot. Snow is generally seen in two months of the year. The soil can stay under snow for about 15 days. Precipitation is not very stable. Some years can rain up to 2 times the previous year. The average annual rainfall is 550 mm. Seasonal temperatures range between -17 ° C and 48.8 °C. Almost all of the Gaziantep province is suitable for agriculture. When the distribution of these lands is examined, cultivated area covers 63%, shrubbery and forest 22%, pasture and meadow 14%. So the forest area (about 14%) is not much (http://www.cografya.gen.tr/tr/gaziantep/iklim.html). The forests in the province contain more red pine and oak trees. Most of the forests that host the red pine tree are artificial forests.

All forests that contain oak trees are under protection. The northern and western surroundings of the province are forested and the pasture is surrounded by steppes. Most of the lands in Gaziantep are pistachio, olive, fruit trees and vineyards and vegetable gardens. (http://www.mapnall.com/tr/Harita-Gaziantep_312554.html) The areas of shrubs are spread over large areas. Mountains, plain, forest and highland areas are located in the grassland view http://www.cografya.gen.tr/tr/gaziantep/iklim.html).

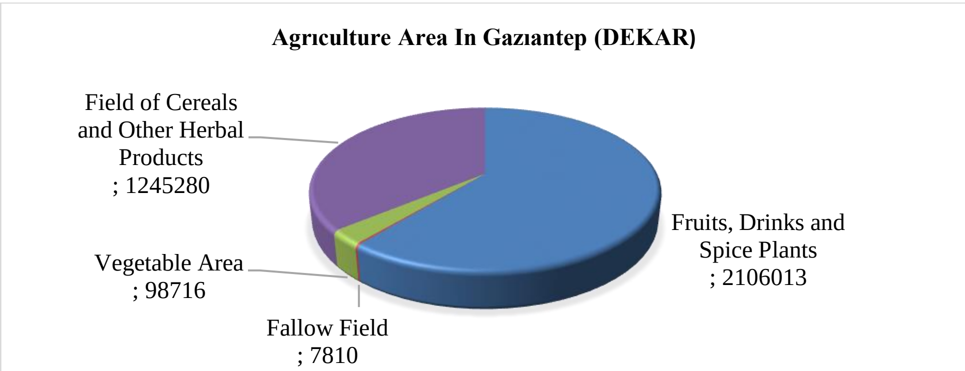


Fig. 5. Distribution of Agricultural Land in Gaziantep City of 2018

2. Agricultural Biomass Potential for Gaziantep Province in Terms of Energy Economy

2.1. Plant Production Amount in Gaziantep Province

In Gaziantep province, the amount of crop production obtained from TUIK is given in Table 2 according to 2018 year's data *(www.tuik.gov.tr).* The climate of Gaziantep is quite suitable for the production of fruits, vegetables, grains and energy plants. Agricultural strategies that can be developed based on energy plants need to be planned-implemented correctly. For this purpose, support programs should be developed for the people engaged in agriculture. Rural areas should be revitalized by producing more energy plants. In this way, energy economy can be supported. Furthermore, it is also important to evaluate the wastes of produced herbal products. With the right assessment, the converting products' potential into energy can be assessed exponentially. The added value supply to evaluate biomass can be achieved significant in economic terms with an agricultural country like Turkey.

Cereals and Other Crop Products		**Vegetables**		**Fruits Beverage and Spice Plants**	
Case Wheat	94155	Bean, fresh	311	Grapes (core)	83631
Wheat (Other)	192171	Pea	1595	Grapes (without core)	5716
Corn	13200	Mint	9720	Grapes (winemaking)	7310
Barley (brewers)	4078	Cress	5	Grapes(drying)	46968
Barley (Other)	61824	Watermelon	42893	Fig	1992
Soybean	78	Melon	26753	Apple (Golden)	9220
Bean (Dry)	19	Lettuce (roundabout)	3150	Apple (Starking)	2755
Chickpea (Dry)	13164	Spinach	30	Pomegranate	19376
Lentil (Red)	11638	Radish (Red)	36	Apple (Granny)	625
Lentil (Green)	8	Pepper,	12324	Apple (Other)	1066

		(Sauce), Kapya			
Peanut	1200	Pepper (filling)	5732	Persimmon	1181
Cotton core	23115	Cucumber	6834	Pear	571
Cotton (no Çırçır)	38525	Pepper (pointed)	983	Quince	2
Cotton (with leaf)	14640	Cucumber Table	10777	Apricot	949
Sunflower seed oil	905	Cucumber (pickling)	248	Zerdali	41
Potato (out of sweet)	3877	Okra	103	Cherry	6674
Sugar beet	87469	Eggplant	30603	Sour cherry	110
Tobacco	7	Tomato (Sofralık)	9771	Peach	402
Vetch Greenweed)	10840	Tomato (Sauceboat)	245	Pistachio	90183
Clover (Greenweed)	3000	Pumpkin (Gum)	3089	Pepper (dry)	59100
Corn	303250	Honey Pumpkin	1	Table olives	6501

		Carrot	294	Olive Oil	63500
		Garlic(Fresh)	4871	Plum	2551
		Garlic (Dry)	20726	Walnut	3152
		Onion (Fresh)	2239	Strawberry	45
		Onion (Dry)	27855	Dut	210
				Almond	2673

Table 2. The Amount of Herbal Production in Gaziantep Province

2.2. Determination of Biomass in Terms of Energy Economy in Gaziantep Province

Biomass energy obtained with agricultural-based products can be calculated by using formulas. These basic calculations can be determined so as to obtain the economic and theoretical biomass potential.

The theoretical biomass potential refers to the biomass potential that can be derived from all of the plant based biomass produced within a given area. Economic biomass potential is also available from herbal-based biomass, which cannot be exploited in economic sense. For this reason, while determining the biomass potential of the plant based on economic and theoretical waste amounts were calculated. Then the analysis is complete. Table 3 provides the formulas and parameters based on their calculations. In Gaziantep province, these formulas have been shown in the literature review of energy biomass calculations (S.Sua and Balo, 2017: 2306 ; *www.tuik.gov.tr*). The results found through the calculations are presented in Figure 6-8 through the current graphs. In Gaziantep province, the total plant potential for supporting the energy is given in Table 4.

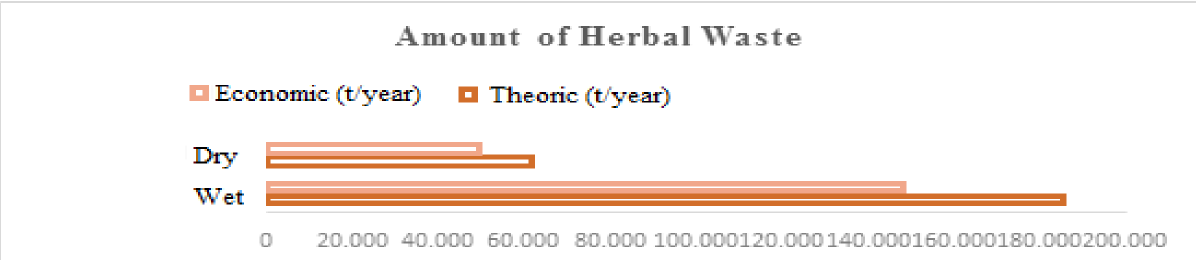
Amount of dry herbal waste	Amount of wet herbal waste * 0.33	
Average thermal value when evaluated in terms of amount of dry herbal waste	for 1 ton = 4050	(kcal)/kg
1kcal/kg	$1*10^{-7}$	[TEP] (tons of equivalent oil) Biomass energy value
1 TEP	0.001163	[MW]
Average amount of dry biomass	*27.5*Area*	[ton]
Average dry biomass thermal value	*4050* Average amount of dry biomass*	[(kcal)/kg]
Average dry biomass energy value	*1.10^{-7}* Average dry biomass thermal value*	[TEP]
Area = [ha]		

Table 3. Basic Parameters And Formulas Used In Biomass Calculation

	Herbal products, cereals, energy plants	Vegetable	Spice fruits and drink plants
Gaziantep city; Production (t/year)	877 163	221 188	416 504

(*)Energy Plants; sunflower and safflower plants.

Table 4. For Gaziantep Province, Total Plant Potential That Can Support Energy (*www.tuik.gov.tr*)



	Wet	Dry
Economic (t/year)	148.513	49.504
Theoric (t/year)	185.644	61.881

Fig. 6. Total Amount Of Herbal Waste To Support Energy In Gaziantep City

Rapeseed, cotton, safflower, sunflower, gras, palm oil, soybean, corn, etc. oil seeds are called energy plants. Biofuels, which can replace petroleum-derived fuels, are obtained from energy plants. Energy plants can be subjected to a series of chemical processes to produce many energy-assisting production. In recent years, research on biomass energy production is supported in both World and Turkey has increased. In addition, research on the engineering materials' production, which may be beneficial for energy efficiency, is noteworthy (Balo, 2015: 336; Rahman and Paatero, 2012: 153).

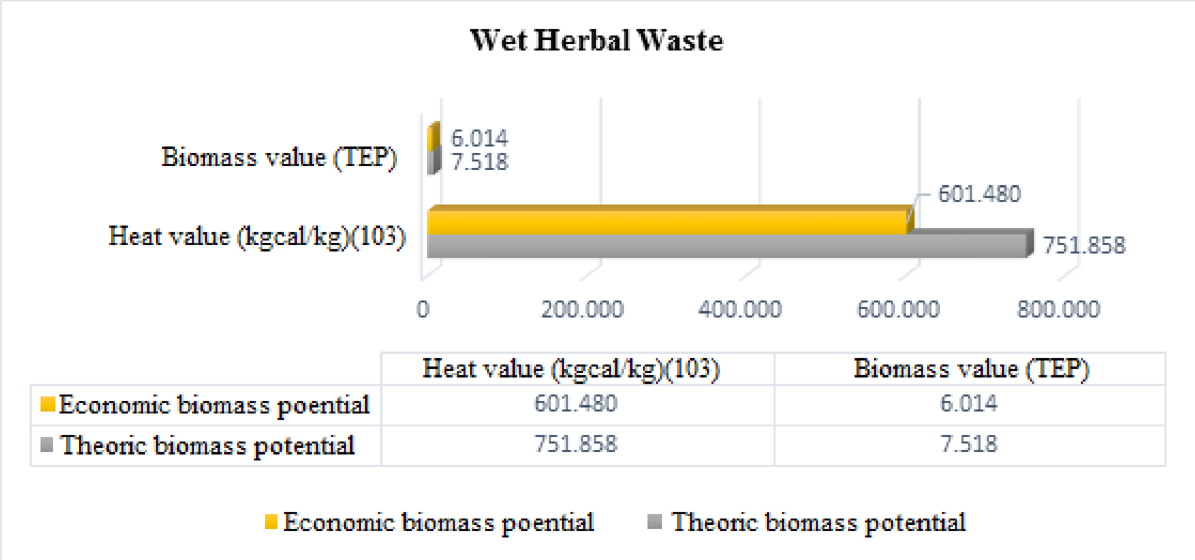


Fig. 7. Economic-Theoretical Biomass of Wet Vegetable Waste in Gaziantep Province

In 2018, the amount of herbal products is approximately 1 514 855 tons in Gaziantep province. When these products are investigated, the total amount of crop production in cereals-energy crops is 877 163 tons. Energy plants within this group are important. Biofuels from energy sources produced based on these products contain about 0.11O2 by weight. Apart from these, the CO_2 is discharged into the atmosphere during to the both biofuel's use-production and the vegetable oil's production. However, the ratio of waste CO_2 is very low. During the growing of the plant in which biofuel is produced, it can be taken from the atmosphere for one year.

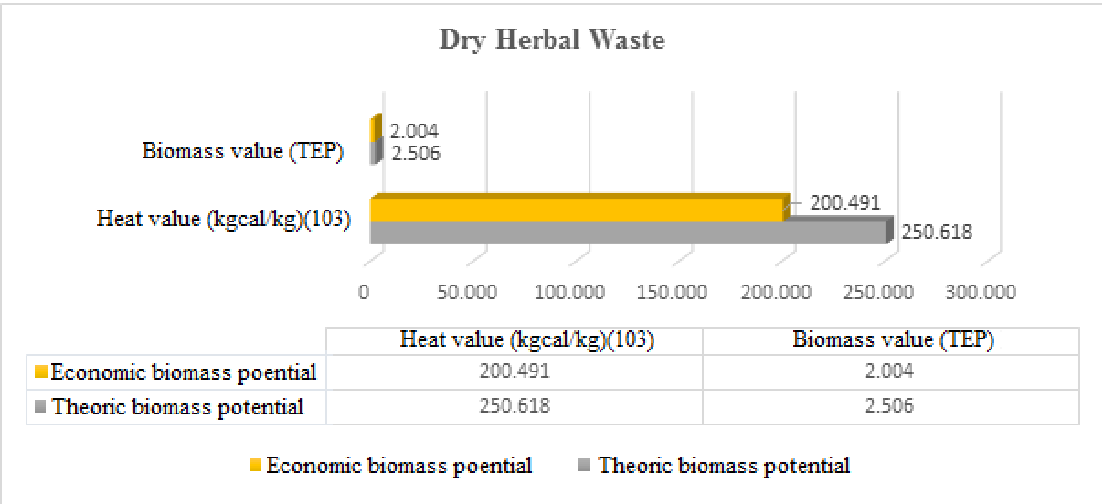


Fig. 8. Economic and Theoretical Biomass of Dry Herbal Waste in The Gaziantep Province

CONCLUSION AND SUGGESTIONS

In the last years, more effective studies have been carried out for planting crops. These are compatible with soil structure in arable agricultural areas. In addition, governments are making significant incentives to realize the most efficient production. Gaziantep province is suitable for agriculture in terms of land-climate. For this reason, it is located in an area suitable for the effective cultivation of plants that can support energy production. In other words, it is a province with high potential to obtain energy-supportable agricultural products of the country-region.

Analyzes should be made on the products that are best used in unused land. Farmers should be encouraged to produce this land. For economy-energy, the significant regional support can be obtained with agricultural planning. By making studies to increase the potential products’ production, biomass energy obtained can be increased.

With the energy produced by using renewable energy sources in Turkey, it is possible to reduce the dependence on foreign energy. Because Turkey is a location that allows the most renewable energy production with geopolitical position. Gaziantep province is one of the most important cities in Turkey. Biomass is a potential that can support its energy in a significant way with agricultural planning. For this reason, Gaziantep province is a convenient to be considered in terms of renewable energy. The evaluation of the region will contribute significantly to the energy economy in Turkey.

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Simulation Analysis of Wind Energy Powered Electrical Energy Production for Gümüşhane Province

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ABSTRACT

In Turkey, the energy need has also been increasing due to increasing population. Wind energy is one of the most popular among renewable energy sources in terms of applicability and efficiency in Turkey. Wind farm designers aim to establish the most efficient plant in the most suitable area by minimizing economic costs. Therefore, the feasibility studies conducted with the correct analysis of all regional data related to the wind distribution exchange are important.

In this study, the usability of the existing potential for electricity production has been investigated in Gümüşhane province. A current simulation program was used for analysis. In the analysis program, hourly wind speeds obtained from meteorological stations in certain latitudes and longitudes of Gümüşhane province and other data related to wind directions were loaded as input. As a result, total electrical energy and turbine systems that can support to the region are determined. In this study, it is aimed to raise awareness about the contributions of renewable energy supported electricity production to the region economically.

Keywords: *Wind energy, Renewable Energy, Gümüşhane, Simulation, Wind farm feasibility*

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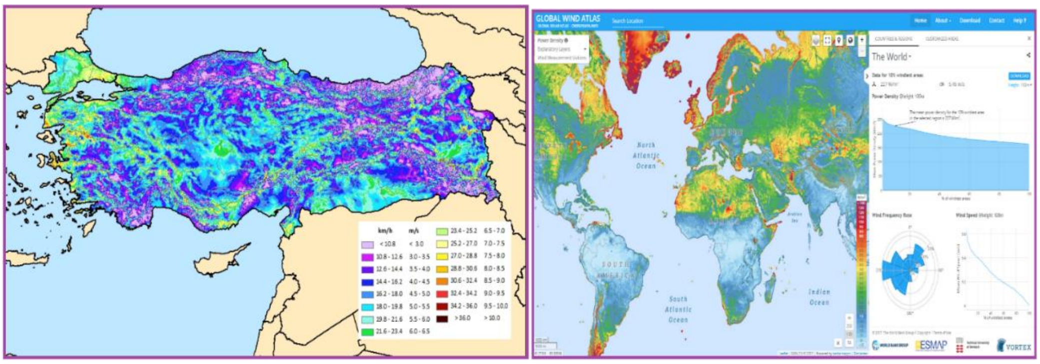
INTRODUCTION

Aerology researches the weather. For this reason, a key element in the environmental sustainability's area. Most of the modern search related to the aerological implementations in maintainability is focused on the solar and wind source evaluations (Jacobson and Delucchi, 2011: 1154; Welch and Venkateswaran, 2009: 1121; Delucchi and Jacobson, 2011: 1170). Actually, these 2 sustainable resources of power are the primary warriors against continuing climatic alterations. These green energies' usability relies upon the exploitation site's geolocation. Of the many people activities that generate greenhouse gases, the sustainable power's utilize is by far emissions' the biggest resource (Waarudkar, Sharma and Ahmed, 2019: 1223). To safe next power and preserve the ecology, it would be significant to contemplate the wind source's potential for the electricity's supply. The wind power is a sustainable power resource that has been improved mondial, accomplishing a level of significance in the power matrices of many diverse countries. it is not only the ecological benefits driving wind power (Jung, Schindler and Laible, 2018: 403) and other sustainable power sources outgrowth (Aderinto and Li, 2018:1250), but the economic advantages (Wiser and Bolinger, 2018: 1798) were also important driving elements (Kumar et al., 2016: 209). In this reason, sustainable power as wind is highly interesting to financier and searchers in many countries around the World because the wind power can be transformed to electric by wind turbine systems.

Therefore, wind energy, which is one of the most important renewable energy sources in our country, should be evaluated as much as possible. For this purpose, academic studies with technically reliable data are important. At the same time, it is also important to conduct feasibility studies in areas with sustainable wind potential. Wind energy is one of the energy technologies that environment-climate friendly, sustainable, renewable, and clean. It is necessary and mandatory to be put into operation in order to support the economy in Turkey. Turkey is quite lucky compared to many other countries in terms of wind energy.



(a) (b)

Fig. 1. In 2019, The Wind Energy Capacity (a) In Turkey (b) In World

In 2019, the wind energy capacity is anticipated to access 8 GW with an addition of 600 MW in Turkey. In Turkey and the World, the wind energy capacities are given Fig. 1 (Akat, 2015). The present capacities are designed to rise in direct proportion to the rise the sustainable power percentage in total amount of electrical generation. In Turkey, the capacity of electricity is shown in Fig. 2a. For operational wind energy station, the cities according to installed capacity (%) is displayed in Fig. 2b. According to the regions, wind energy stations' distribution in Turkey is given in Fig. 2c.

According to the Wind Atlas of Turkey, Canakkale in Marmara Region; Izmir, Manisa in the Aegean Region and Hatay in the Eastern Mediterranean region are positioned intensive evaluation of wind energy or wind power plants. In Turkey, the Marmara region is ranked 1st with 1664.5 MW electricity generation in terms of wind power plants.

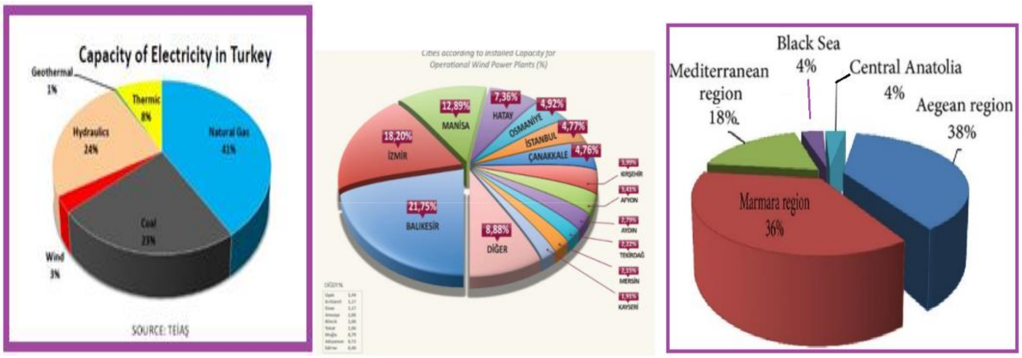


Fig. 2. a. In Turkey, the capacity of electricity

b. For operational wind energy station, the cities according to installed capacity (%) (Akat, 2015)

c. According to the regions, wind energy stations' distribution in Turkey (Ata, 2013: 8)

Available value ranges for annual wind energy density and annual wind speed and total capacity in Turkey are given in Table 1. As seen Table 1, total capacity is about 47,849.44 MW in Turkey.

Wind potential of Turkey²:

Resource potential	Wind class	Annual wind power density (W/m2)	Annual wind speed (m/s)	Total capacity (MW)
Good	4	400 – 500	7.0 – 7.5	29,259.36
Excellent	5	500 – 600	7.5 – 8.0	12,994.32
Outstanding	6	600 – 800	8.0 – 9.0	5,399.92
Superb	7	> 800	> 9.0	195.84

Table 1. Available value ranges for annual wind energy density and annual wind speed and total capacity in Turkey (Ata, 2013: 8)

The wind is a factor whose work demonstrates to be greatly complicated, its qualification being a few parameters' a function among which its direction, its speed, the location's roughness' impact, the obstacles' impact, the atmosphere's stability's impact etc. (http://www.iea.org/publications/freepublications/publication/, 2017; Mahamat et al., 2016). The most important first step that should be taken before planning a wind energy project on any scale is to determine where the best wind resources are and to understand the characteristics of this resource. While determining the potential of wind energy, wind speed is stated as one of the most important parameters. It is important to determine where the turbines will be installed when wind farm design is done. In determining the wind turbine design, one of the most important parameters is the average speed of the sustainable wind. In wind speed measurement, the error of near 1% may cause an error of about 2% in the output of energy (Ucar and Balo, 2009:1864). The new generation of wind energy potential atlases provide these facilities and contribute significantly to the development of the wind energy sector. Potential atlases of previously available wind energy; they were showing either too high or very little because of the wind resources they used for any specific site. The spatial variation of the wind source was expressed according to some micro-scale flow models based on meteorological measurement information that were not frequently available and according to some topographic features (flat, mountainous, plain, plateau, valley, etc.). Computer techniques and meteorological models used to prepare new wind energy potential atlases can provide valuable information about the wind regime on hourly, daily, monthly, seasonal and annual time scales to determine the most suitable wind resource areas. The new generation of wind energy atlases that can be integrated with geographic information systems (GIS) can provide both time and material benefits in identifying the most suitable areas for wind energy applications. For example, many parameters such as substations, network infrastructure and transportation facilities which are important for wind energy applications are examined together with wind sources. It eliminates the first study of the most suitable place. Therefore, it provides time and material savings. In addition, the spatial and temporal change of the wind source can be provided through information storage devices and the web. In this way, the demands of the sector actors can be answered in order to benefit from the high rates of wind energy (Malkoç; Akat, 2015).

Wind energy have been studied extensively over the past two decades (Machefaux et al., 2016: 1785), creating mathematical models to be applied in optimization methods (Naderi and Torabi, 2017:1346). These models have been developed and validated by diverse tools, such as satellite remote sensing (Hasager et al., 2014: 2035), light imaging, detection, and ranging (Lidar) (Iungo and Porté-Agel, 2014:2035), Computational Fluid Dynamics (CFD) (Nedjari, Guerri and Saighi, 2017:224), 3D numerical simulation (Jamieson, 2018), and Doppler and aerial imaging (Li and Yu, 2017: 252). Wake 3D simulation models have not been applied for layout optimization analysis yet (Mortensen et al., 2001), due to the time-consuming computational evaluations required to calculate diverse wind turbine models on diverse wind speeds and wind direction conditions for changing layouts (Burton et al., 2001). As simulation computational model technology improves, they will be considered to evaluate potential optimization models in future research (Mortensen et al., 2012: 356).

In recent years, the studies on simulation of wind energy supported by many programs have come to the fore. WAsP, WindPro, WindFarmer, WindSim, Windographer, Homer and RetScreen are the commonly programs used. From these programs, Windographer, Homer, and RETScreen analyze with only linear methods. WAsP, WindPRO, WindFarmer, and Openwind analyze with flow field modeling. WindSim and Meteodyn analyze using computational fluid dynamics (CFD).

The pre-feasibility and feasibility reports can be made with the help of the programs used for wind energy. For the investments to be made, economic and technical compliance rates can be determined. Investors can contribute to a more secure and rational movement in this direction.

For the realistic values, analysis can give the front results. It is important to work with the experts and the right techniques. One of the most important disadvantages of wind farm designs is the high initial investment cost. With an incorrect feasibility study, the installations may be located in unsuitable areas. In this case, serious financial losses may arise as a result of wrong investments (Güzel, 2014). Most generally utilized for wind source estimates is the Wind Atlas Analysis and Application Program (WAsP) (Mortensen et al., 1993; Lange and Højstrup, 2001: 271) . The commercial wind energy software, such as Wasp (Mortensen et al., 2001) are capable of modeling wind farm layout. By Carvalho et al., this working model was also utilized to evaluate the Portugal's wind potency at 2 diverse sites. the data produced by the WRF working model utilized as input data to the WAsP simulation programme. In this study, the authors compared these two models' combination' conclusions with the conclusions determined by the studied sites' direct measurements (Carvalho et al., 2013: 493). In India, Mariappan and Mathew executed wind potency evalution by WAsP simulation programme integrated to geographic ınformation system, multicriteria analysis tools and aeronautical reconnaissance coverage (Mathew and Mariappan, 2019: 666). Ayala et al. performed both the wind map calculational code WAsP and Urba-Wind to work the wind energy source in complicated land wind enegy station and obtained that both the analysis conclusions underrated the real nearly generation (Ayala, et al., 2016).

The aim of this study is to evaluate the feasibility of wind energy potential for Gumushane province by using WAsP simulation program which is one of the popular research subjects of recent years.

1.The WAsP Wind Energy Simulation Programme

The WAsP simulation programme prepared in the Riso Meteorological Laboratory of the Danish Meteorological Organization and developed by the Technical University of Denmark (Sajan and Mariappan, 2014:666).

For wind farms and wind turbines, it is the industry standard for wind source evaluation, energy field computation and siting. The WAsP simulation programme is utilized for regions established in terrain's all types in the whole world countries

* Characteristic WAsP package implementations:

* For one wind farms and wind turbines, energy field's computation

* Wind farm performance's computation

*Turbulence mapping and wind resource

* Complicated terrain regions

* Off-shore wind energy stations

For individualistic wind turbines, the wind conditions' computation for IEC region evaluation in a wind energy station, e.g. wind flow pitch angle, wind shear, extreme wind, ambient turbulence, and average wind speed. The WAsP simulation programme includes a few physical frameworks to define the wind flow and wind climate over diverse lands and near to sheltering impediments. Also, The WAsP simulation programme includes a lookout framework for wind energy station lookout effectts and a consistent framework for mean thermal flux terms. For vertical and horizontal extrapolation, The WAsP simulation programme utilizes the built in lineal IBZ framework, which will implement efficiently for flatness to middle complicated land. If the land is too complicated with numerous perpendicular slopes, The WAsP simulation programme contains easy reach to the art CFD model’s an exterior state too.

The data utilized by WasP simulation programme for power field computations and wind source come from diverse resources. The wind climatological entry may come from wind mensurations at a nearby aerological mast or may be reproduced from mesoscale modelling conclusions. The height determination is reproduced immediately from space shuttle height input or other input sets, while the land covering determination and close to sheltering impediments can be removed from secondary planet imagery (Google-Earth), topographical atlases, or databases, (Sajan and Mariappan, 2014:666).

2. Detection Of Wind Energy Potential With Wasp Program In Gumushane Province

The province of Gumushane has a surface area of 6,575 square kilometers. It is located in the inner part of the Eastern Black Sea Region of the Black Sea Region. The neighboring provinces are Bayburt in the East, Giresun in the West, Trabzon in the North and Erzincan in the South. The average height of the province from sea level is 1210 meters. Gumushane province is a rapidly growing province, but the need for electricity is constantly increasing as it develops continuously in terms of industry. Therefore, one of the various alternative solution methods to meet the energy needs is to evaluate the existing wind potential in the production of electricity. Izohips dem map for Gümüşhane province is display in Fig. 3. As shown in Figure 3, this study was carried out at 40.22872 North latitude, 39.37479 East longitude.

The area where the anemometer is located at the center of Gumushane has been drawn as isohypsum with an interval of 100 meters. Gumushane area reached 3324 altitudes, while the highest altitude in the center of Gumushane was found as 2000 meters. In this study, 1-year-old wind data at an elevation of 10 meters was used as input. The data were entered into the program at 40.23 latitude and 39.37 longitude. Anemometer location is specified as 1493.5 meters. As a result, the general wind direction of the anemometer is modeled in the northeastern southwest orbit. The average wind speed was 1.59 m / s and the wind power passing through the unit area was 14 W /m^2. Estimated power density values calculated for air density of 1,225 kg /m³. Wind directions and velocities of anemometer at a height of 10 meters is displayed in Fig. 2.

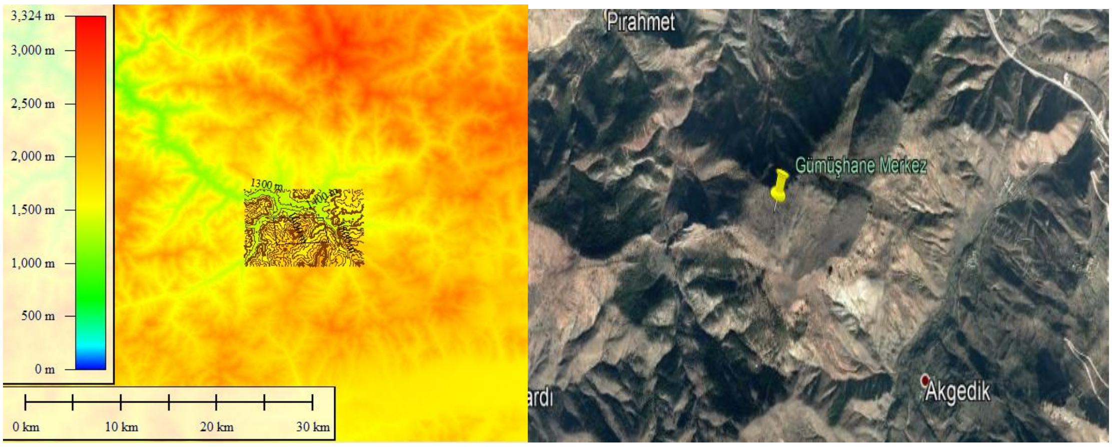


Fig. 3. Izohips Dem Map For Gümüşhane Province

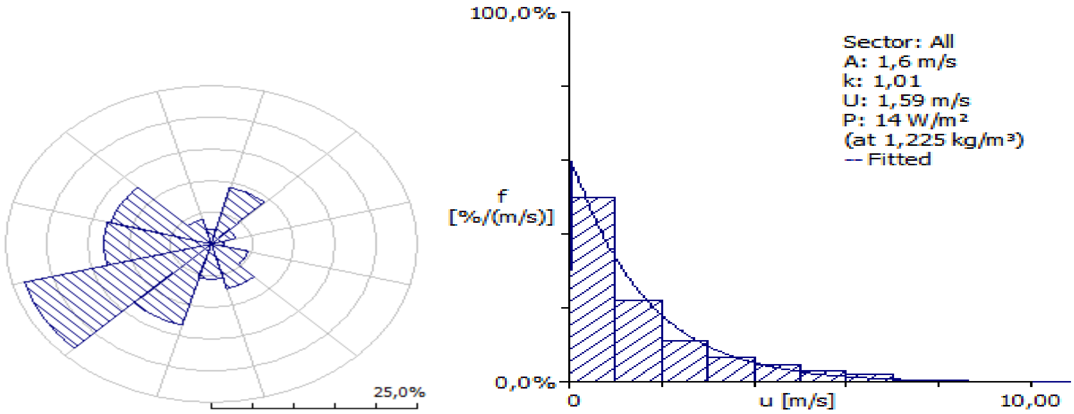


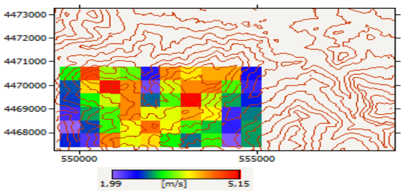
Fig. 2. Wind directions and velocities of anemometer at a height of 10 meters

Mean temperature	5,25 °
Ref. altitude for temperature a.s.l	1.844,0 m
Mean pressure	81.475 Pa
Ref. altitude for pressure a.s.l	1.842,0 m
Relative humidity	85,10207 %

Table 2. Barometric Reference Information

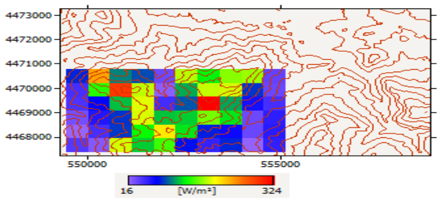
Barometric Reference information is given Table 2. As shown in Table 2; The temperature value was around 5,250C, while the relative humidity was 85,10207%. As a result of the calculations, the average speed [m / s], power density [W / m²], AEP [GWh], RIX [%] are presented in Table 3.

Maximum Value	5,15 m/s at (553155, 4469365)
Minimum Value	1,99 m/s at (549735, 4468225)
Mean Value	3,44 m/s



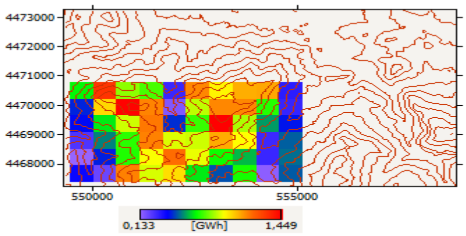
(a)

Maximum Value	324 W/m² at (553155, 4469365)
Minimum Value	16 W/m² at (549735, 4468225)
Mean Value	107 W/m²



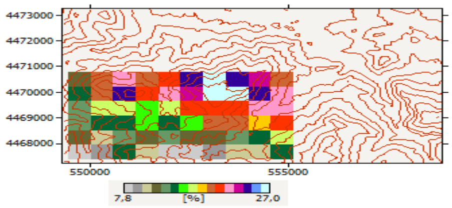
(b)

Maximum Value	1,449 GWh at (553155, 4469365)
Minimum Value	0,133 GWh at (549735, 4468225)
Mean Value	0,724 GWh



(c)

Maximum Value	27,0% at (553155, 4469935)
Minimum Value	7,8% at (549735, 4467655)
Mean Value	15,9%



(d)

Site	Location [m]	H [m]	A [m/s]	k	U [m/s]	E [W/m²]	RIX [%]	dRIX [%]
Turbine site 001	(553365,2, 4469930,0)	60,0	4,5	1,14	4,33	179	26,8	16,1

(e)

Site	Location [m]	Turbine	Elevation [m] a.s.l.	Height [m] a.g.l.	Air density [kg/m³]	Net AEP [MWh]	Wake loss [%]
Turbine site 001	(553365,2, 4469930,0)	Vestas V60-850 kW	2000,0	60,0	0,994	1103,244	0,0

(f)

Table 3. For Gümüşhane Province, (a) average speed [m / s], (b) power density [W / m²], (c) AEP [GWh], (d) RIX [%] (e) Site wind climate and (f) Site results

CONCLUSION AND SUGGESTIONS

Mostly, power need is an essential thing in people life being specially on energy production and transport industrial sector. The primary basic power resource mostly arises from fossil-based such as natural gas, coal, and crude oil. All the same, owing to global warming' concern the renewable-sustainable power is more significant power resource than the fossil-based in the next.

Our country is face to face important difficulties in satisfactory its increasing power need. To energy a quickly expanding economy, the electrical expenditure of country is rising by a mean of 8% everyyear, and important investments are required in, transmission, dispensation, and generation facilities to equilibrate demand and supply of the energy system. Turkey is a country that imported power. To become lesser depend upon other world countries, our country requires to utilize the renewable resources. From this point, wind energy is a too appealing selection, since it is environment friendly, sustainable, financial, and a known power resource in Turkey. This natural and clean energy source should be used until the end of the managerial, technical and infrastructure to fulfill the upheavals as soon as possible.

In this study, data of 10 meters in 1 year is taken from the General Directorate of State Meteorology for Gümüşhane province. The received data (wind density, wind direction etc.) was used as input in the WASP simulation programme. Thus, the main purpose of this research work is to evaluate wind power by using local weather data by meteorological stations. The raw data were analyzed by WAsP simulation programme.

As a result of the wind energy analysis, wind speed, wind power, continuous wind direction and the number of wind turbines were determined in Gümüşhane province. In Gümüşhane province, this study is important in terms of the pre-feasibility of the companies that design wind farms. For the same province. It also allows comparison of the results obtained with the simulation with the results obtained by different methods.

In addition, it has been determined that Gümüşhane province has a potential in terms of wind energy. Therefore, it has been reported that the people of the region can also benefit from the wind-related type of renewable energy. It is aimed to raise awareness that the establishment of wind farms in the region can contribute to the regional economy.

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Dairy sector in Republic of Benin: perspective for Wagashi cheese

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ABSTRACT

The aim of the study was giving information about dairy industry in Benin and a traditional cheese product Wagashi. In the Republic of Benin, livestock rearing especially milk production plays a major role in human nutrition, economic growth of local population and reduction of poverty, notably those living in rural areas. Findings showed that milk is mainly produced from cows and goats. The most popular and consumed traditional dairy products are the Peulh cheese known as Wagashi. Wagashi is produced traditionally with local fresh milk and plant coagulum isolated from Calotropis procera. In Benin, the latex from the leaves and stems of Calotropis procera is used to prepare Wagashi cheese; the extract however causes bitterness in the cheese due to its high proteolytic activity. After coagulation, the curd is filtered using cheese-cloth, and the curd is inserted into water or whey. It is delivered to the market as soon as possible after process immediately; the product is shipped with a plastic bucket including water or whey. Its shelf-life is not long and does not exceed almost three days. The cheese is a kind of semi-hard cheese, and its production in Benin has become a common sight without a considerable supervision or quality due to increase in population and demand. Recently, the consumer desire for healthy safe foods has been increased; therefore the producers have started to understand importance of producing the cheese in hygienic condition and packaging them correctly in order to increase both shelf life and safety.

Anahtar Sözcükler: *Benin, milk, wagashi cheese, Calotropis procera.*

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INTRODUCTION

Livestock is perceived as one of the important agricultural activities after crop production In Benin. Livestock plays an important role in the Beniness's economic, used to solve unemployment of local population especially youth, people living in rural area and socio-cultural integration of the rural community. Its production is estimed approximately at 15.55

percent of agricultural Gross Domestic Product in Benin (INSAE, 2015; Agossou et al., 2017a). Livestock is constitued of subsector among which a particular attention is given the improvment of milk production and dairy sector in oder to satifay the local demand with a production of standard quality and safe product which will able to ensure the well being of consumers, whereby also access the international market (Souaibou et al., 2012). Despite, the important natural resources (water, forestry and land) that the country has, which should foster the development of agriculture and animal production, the livestock sector is still facing the difficulties related to its development. In Benin, the more quantity of milk is produced by cattle remain low. However this production is low in term of local. In order to solve this situation, several researches, program and development projects have been set up by successive governments; however the general observation is that Benin's national dairy sector remains undeveloped almost unknown. This paper aims: to provide information about dairy industry in Benin and a traditional cheese product Wagashi.

Dairy production system in Benin

The dairy production system in Benin is characterized by systems based on the agro-ecological zones' features, socio-ethnical groups and the animals' rearing practices. The different traditional systems principally pastoral, agro-pastoral and sedentary system are used to keep the dairy animals production. However in urban or peri-urban area across the country some semi-intensive farms are also encountered.

Pastoral system

The pastoral is a old system, widely developed in the northern and central-northern region of Benin. Mostly practiced by the Peulh and Gando ethnical groups generally less educated, whose livestock keeping is principal food (milk, cheese) for familial consumption and income source (Alkoirt et al., 2009; Chabi Toko et al., 2015, Agossou et al., 2017a). According to Alkoirt et al. (2009) and Missohou et al. (2016), animals are grouped in large size herds ranging between 15-30 heads and are taken every morning by children or young men to pasture made of natural forage resources. Rainfall is the depending factor of this system, which is the most important limiting factor in grassland growth when all factors related to soil, light and the environment are fixed (Sintondji 1988). In this system, the calves are separated from cows during the night (Alkoirt et al., 2009) while animals are housed in open air on night parks located around the camp, either tethered to a fixed stake, or tethered together in pairs. Animals may not be offered sufficient feed, clean water and health care. Most of time dairy female greatly produce only in the rainy season. Dairy products (melted butter, curd, cheese) are traditionally processed before being sold on the local market (Boukary et al., 2007). This system is the source of repeated conflicts between pastoralists and farmers because of the damage that herds cause to crops by grazing. This system is actually being turned into a mixed farming system in which producers combine animal production with agriculture notably cultivation of cotton and some food crops (Agossou et al., 2017a).

Agropastoral system

This system associates cropping and animals rearing. Agro-pastoralists are sedentary but sometimes practice transhumance on natural range over short distances. During the cropping season, animals are grazed on fallow lands and areas of natural vegetation. In the dry season, they are brought back to cultivated areas where they graze in swamps, crop fields (cotton, sorghum, maize etc.) and various areas which they cannot graze during the rainy season. In this system, animals are housed under sheds in the village or at the farm. They received partially little medical treatment and agricultural or agro-industrial by-products as feed complement. It is practised by crops farmers and non rural people who entrust their animals to sedentary keepers. It is the predominant system in central, southern and West-Atacora regions of the country.

Urban or Peri-Urban system

These dairy systems recently developed in urban and peri- urban areas are driven mainly by the increasing demand for milk and dairy products in urban centres. They are semi intensive dairy farms owned by "new agro entrepreneurs" i.e. traders, officials, retirees having great financial means. Breeders have a small number of dairy cows (an average of five cows) and production is spanned all seasons of the year (Boukary et al., 2007). In these systems, feeding of animals is based on, crop residues, industry by-products feedstuffs and sometimes on cultivated fodder. Animals are also taken to grasslands around cities. Unlike other systems, these systems apply improved management practices such as good housing of animals, supplementation of concentrate, appropriate breeding programs, selection of best reproductive animals, and health monitoring of animals (Agossou et al., 2017b). They sell the produced milk in the city through various channels including direct sales, or mini dairy processing industries or small milk processors. This milk, appreciated for its quality superior to that reconstituted milk from imported milk powder. With urban industries, these periurban farms constitute what can be described as "periurban agro-industrial dairy complex".

Technology of traditional milk processing

To avoid the rapid degradation of milk due to the lack cold chain during the marketing and elevated ambient temperature has brought some actors to be involved in developing techniques for processing milk for long conservation including the preparation of cheeses. In Benin, the most popular dairy products are the Peulh cheese also known as Wagashi, yogurt, curd, melted butter, and a traditional beverage made by mixing steamed dumplings or pellets of cereals, originally millet (Pennisetum glaucum) with fermented milk. Wagashi and Deguè are the most important traditional dairy products highly produced and consumed in Benin. The local Fulani cheese also known as Wagashi remains the most widespread and consumed (70.8%) in urban areas (Mohamed et al.m 2018). The traditional processing, which is found in pastoral households, involves using the remaining milk after direct consumption as drinking milk to make some dairy products, particularly cheese (Fig 2), which is sometimes colored (Fig 1) using colored water with dried sorghum leaves to extend it shelf life (Sessou et al.,2013). This processing is mainly practiced by the women i.e. wives of breeders so as not to lose the milk (Dossou et al., 2006).

Figure1. Colored Wagashi cheese

Figure2. Wagashi cheese

Techniques of Waragashi processing

Wagashi is one of the well appreciated and consummated consumed dairy product across the country. This dairy product is produced following the techniques described in the following figure. Waragashi is a traditional cheese produced with cow’s milk and vegetable coagulum named calotopine, extracted from plant Calotropis procera. Cow’s milk is essentially used during manufacturation manufacture of Waragashi because it represents the most abundant milk locally produced in Benin (MAEP, 2014). Other factors like food habit and organoleptic characteristics may likewise explain the use of cow's milk during the traditional cheese processing. Nonetheless, Alpine goat's milk has been successfully experimented (Vissoh et al., 2015). 5 and 5.3 liters of milk are needed to produce one kilogramme of cow's milk Waragashi and goat's milk Waragashi, respectively (Kees, 1996; Vissoh et al., 2015). Recently, a mixture of coconut milk and cow's milk at the proportions of 1:9 has been tested and the resulted Waragashi showed good nutritional value and acceptable sensory properties with no coliforms (Okon and Ojimelukwe, 2017). Factors affecting Waragashi processing are mainly amount of Calotropis procera extract and temperature of activation of enzyms (Ogundiwin and Oke, 1983). Indeed, a range of 5 to 20g of Calopris procera was suggested as suitable to clot one liter of milk (Egunleti et al., 1994; Kees, 1996; Dossou et al., 2006). Among different parts of Calopris procera, latex revealed to contain more enzyms with optimum activation temperature ranging from 65 to 70°C (Baba-Moussa et al., 2007). Wagashi cheese can be stained into red or light red, using extracts from panicles of Sorghum vulgaris, young leaves of Tectona grandis L. or bark of Vitellaria paradoxa. The coloration step is optional and makes the cheese more pleasant or attractive. It is also considered as preservartion means (Dossou et al., 2006). The use of these plants may confer some therapeutic properties to waragashi because these plants are used in traditional pharmacopoeia to prevent or treat many illnesses.

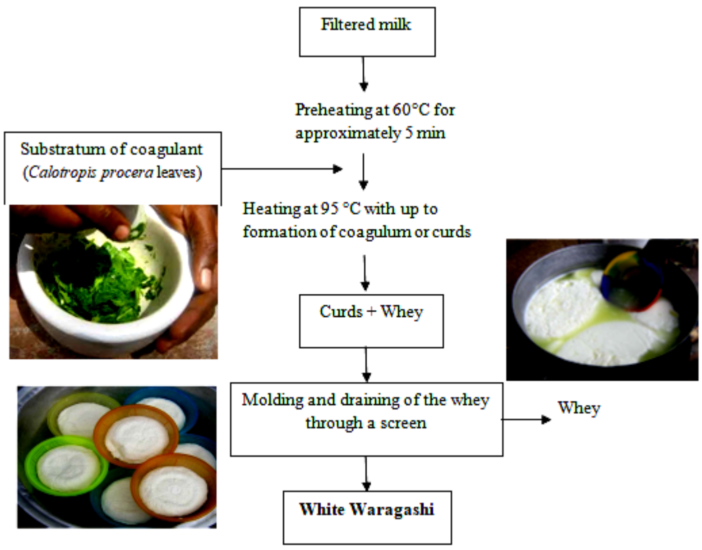

Figure3. Processing of fresh milk to local cheese Wagashi.

Qualitative and microbiological analysis of dairy products

According to Mohamed et al. (2018) some informations were collected about dairy sector development in South Benin during individuals and group discussion revealed that none of dairy units perform the microbiological, chemical (nutrient content) and sensory analysis of their dairy products. In the absence of appropriate mechanisms to the increasing demand for food, there is danger of starvation. For instance, in 2017, more than 1.09 million people of Benin population werefood insecure and 80000 were severely touchedby vulnerable to nutrition insecurity (Anonymous, 2017). The supply of healthy and nutritious food is a crucial element of food security. Dairy products needs to be carefully analysed in order to ensure food safety for public consumption which will further leads to the products been sold outside of Benin. Because these analyses are necessary characteristics that could reassure consumers, then from that moment the regulation of this sector becomes indispensable. This goal can be archived through increased rate of production, suitable processing and preservation.As such, information and training sections should be organized for stakeholders in dairy processing to bring them to understand the importance of these analyses.

Constraints and opportunities for dairy farm and industry

Several problems mainly related to milk supplying, storageing, its transportation to the collection points by farmers and the entire organization still need to be solved. The table 2 summaries the SWOT analysis of dairy sector in Benin.

Main problems faced by the dairy sector are:

•The low genetic value of native breeds characterized by a low productivity leads to shortage of milk supplying for processing units,

•Inadequate feeding of animals especially during drought season,

•Weak monitoring of animal health due to the insufficient of veterinary services and high cost of veterinary inputs.

•Poor technical background of farmers on modern techniques of production,

•Difficulty of famers to access loans which are at high interest rate.

•High price and lack of dairy processing equipments at the local market,

•Poor packaging and conservation of dairy products especially Wagashi cheese,

•Poor quality control and certification of dairy foods,

•Strong presence on the domestic market of imported dairy products sold at highly competitive prices,

•Lack of governmental support and subsidies.

On other hand, major asset hereafter deal with attractive opportunities for the development of dairy activities.

•Favourable natural conditions for the dairy cows keeping,

•High national and sub-regional demand for dairy products,

•Existence of a young and qualified workforce,

•Existence of programs and projects to support producers.

Strategies for development of dairy industry

Despite its significant economic potential, the dairy sector receives little attention in development strategies and policies, therefore futuristic actions should be oriented to promote its revolutionary industrialization.

Indeed, the public authorities should work towards:

•Strengthening the skills of dairy actors (farmers and processors) in technical and business management,

•Supporting actors for the construction of suitable infrastructure and equipments for dairy cows farming and processing,

•Implementation of an effective genetic improvement program of native breeds by promoting modern techniques of breeding such as artificial insemination,

•Providing subsidies to agricultural inputs (medicine, vaccine, concentrate feed etc.),

•The development and maintenance of roads in rural areas where animal products and foodstuffs are highly produced,

•The development of grazing areas (pastures) and transhumance corridors,

•The Strengthening of the analysis system and quality control of dairy foods,

•Implementation of labelling and certification policy to ensure the good traceability and protection of consumers' health,

•Facilitating the marketing of products that meet standards and support competition,

•Implementation of an effective mechanism for commodities' price stabilization,

•Facilitating access to information by farmers on commercial transaction of animal products and opportunities leading to greater economic benefits,

•Facilitate access to packaging by setting up a group purchasing system for package.

•Supporting the structural organization of professional breeders and processors" associations,

•Facilitating the access of players to banking loans at with better interest rate.

CONCLUSION AND SUGGESTIONS

Milk and dairy foods are one of the most important nutrients (energy, protein and fat) sources for human consumption. Wagashi cheese is produced traditionally in North Benin. Steps of production has not been standardized and some of important quality parameters has not been determined yet. Commercial production of the cheese needs integration of traditional production techniques into industrial scale. After that, geographical labeling should be done in order to protect the cheese. However to reach this objectif the recipe should be fomulated, be carried into industrial scale and find an ideal packaging system in oder to carry the standard cheese for the future generation.

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Journals Published in Agricultural Field in The Last Five Years Bibliometric Analysis

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Abstract

Today, scientific publications published in every field offer important contributions to both scientific activities and technological developments. As a matter of fact, access to information is fast and easy, and scientific activities can be observed and analyzed. The bibliometry, which performs the quantitative analysis of scientific publications, enables the analysis of publications published in a particular discipline or in all disciplines, as well as a general structure of the discipline in question. In this study, the development of agricultural and related published articles in WOS and Scopus database within five years is explained by bibliometric analysis. In this context, the results of the surveys on the subject of agriculture in WOS and Scopus were limited to five years. The obtained data were transferred to Excel and their graphics were prepared. In addition, data were analyzed in Bibexcel program for analyzing the number of authors of multi-author articles of this data. The findings were evaluated and evaluations were made about publications published in the literature related to agriculture within five years.

Introduction

Scientific activities such as online sharing of information resources and participation in international projects and conferences have accelerated cooperation between researchers. Prepared for sharing information, papers, etc. such as scientific studies, informs the reader with information and references (Polat, 2015). Thanks to the cooperation between the authors and the institutions, there has been an increase in the production of publications of countries and institutions, as well as the development of international scientific activities. The increasing number of authors and the number of interdisciplinary studies directly affect the number of authors of scientific publications and the number of scientific studies with multiple authors. In this study, it is aimed to give information about the development of articles related to agriculture in the last five years with the application of bibliometry which provides statistical analysis of scientific publications.

Bibliometrics

The term bibliometry, which is a quantitative analysis application of information sources in general, is based on the term Statistical Bibliometry (Bayram ve Zan, 2014; Frosman, 2008; Pritchard, 1969). The Statistical Bibliography term was used by E. Wyndham Hulme in 1922 at the University of Cambridge Sandars Reader in Bibliography, and courses were published as a book (Hulme, 1923; Pritchard, 1969). Hulme (1923) stated that he considered Statistical Bibliography as a practical application for compiling bibliographies and library studies. The term statistical bibliography was last used by Raising (Pritchard, 1969). According to Raising (1962: 450) statistical bibliography, collection of books and periodicals related to the collection and interpretation of statistics. Raising stated that this concept could also be used to show historical movements, to determine the national or universal research of books and magazines and to determine the general use of books and magazines in local situations. Pritchard defined bibliometry as the application of statistical and mathematical methods to books and communication media, stating that it would be better to use the term bibliometry instead of the term statistical bibliography (Pritchard, 1969; Bayram ve Zan, 2014: 225). Although books, theses, reports and patents are counted as elements of bibliometric analysis, the main component is scientific articles. On the basis of bibliometric measurement there are references to publications and authors. Bibliometric indicators are produced according to the number of publications, citations and authors (Karasözen, 2009: 3). Bibliometry deals with the statistical analysis of scientific studies such as the author, subject, cited author and cited sources, and enables the general structure of a particular discipline to be demonstrated in accordance with the statistical results obtained (Bayram and Zan, 2014: 225).

Method

In this study, the results obtained by scanning from the Web of Science (WOS) and Scopus database indexed articles on Agricultural area were analyzed. In order to determine the articles related to the subject, the topic Agricultural was searched from the advanced search option. The data were obtained from 173.413 from WOS database and 962.364 from the Scopus database. The results were transferred to Excel and their graphics were prepared. The graphs were interpreted and evaluated. Since the survey on the subject is made on different days between 01.03.2019 and 30.03.2019, the results obtained from the database can be seen according to the days.

Limitations

In this study, articles published in the last five years in the field of agriculture are examined. Since 2019 was not completed, it was not included in the study. As the year 2019 was not completed, the whole year was not included in the study. In this study, the contribution to world literature in the last five years with the world's literature in Turkey were also examined.

Research Problem

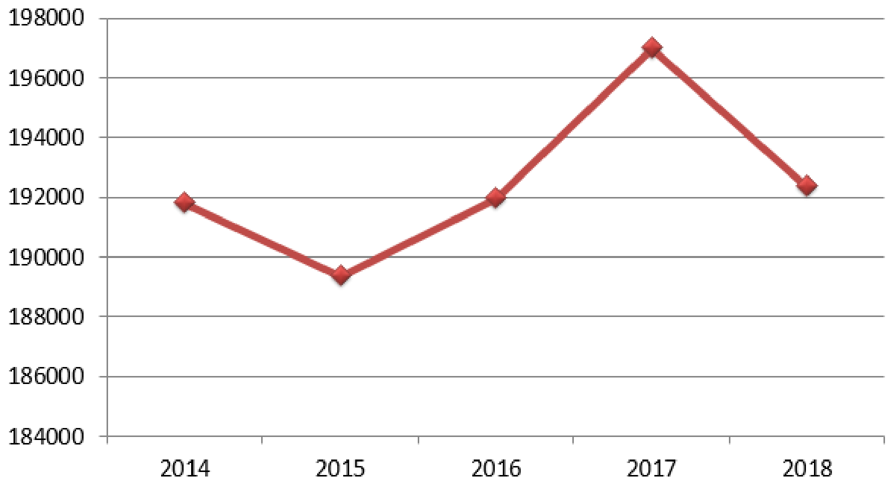
Recent developments in information and information technologies have made it possible to share information in every field in the world of science. Thanks to these developments, factors such as time and distance have been eliminated. In addition, interdisciplinary, interdisciplinary and inter-institutional scientific communication has enabled the world of science. Bibliometric methods are a way of monitoring and / or explaining these developments in the scientific world. In this study, articles related to the agriculture issue indexed in WOS and Scopus databases in the last five years have been examined. The study tried to find answers to the following questions.

- How many articles have been indexed in agriculture in the last five years?
- Which country contributed the most to the literature?
- Which universities contribute the most to the literature?
- What is the distribution of the increase of article publishing of countries in the last five years?
- How is that Turkey gained momentum over the years?
- Which university in Turkey most contributed to the world literature?
- How is the multi-authored article distribution of Turkey?

Results

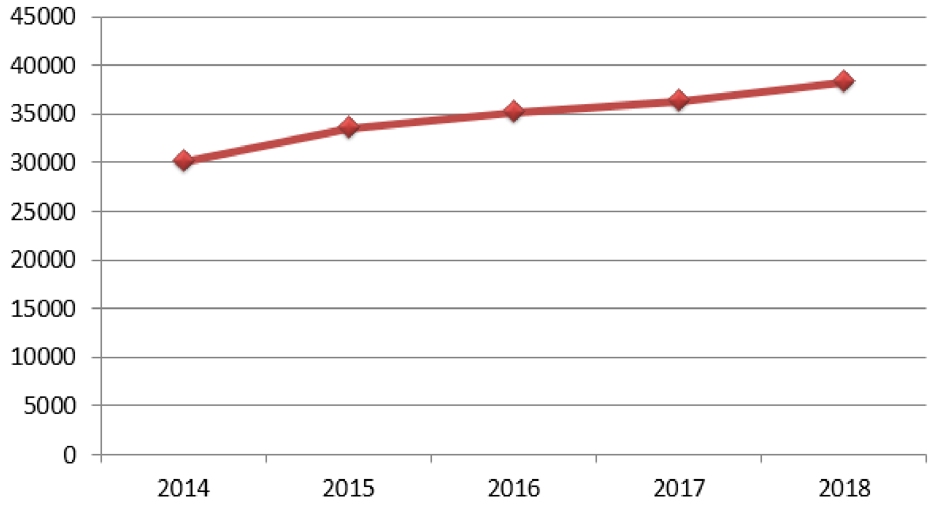
Distribution by Years

When Graph 1 is analyzed, it is indexed 962,364 articles in Scopus between 2014-2018 on Agricultural and Biological Science. When the five-year period is examined, it is seen that the least number of articles are published in 2015 and most of the articles are published in 2017. The average number of articles in the five-year period is 192.473.



Graph 1: Number of Publication by Years in WOS

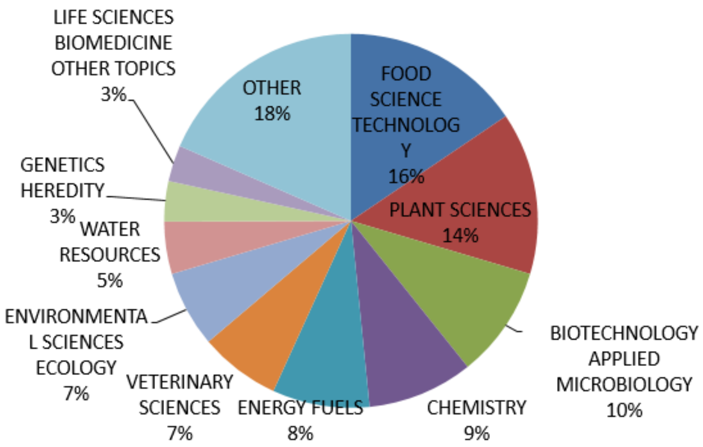
Graph 2 shows the distribution of 173,413 indexed articles for the years 2014-2018 related to WOS agriculture. In the five-year period, the minimum article belongs to 2014 with 30,118 imprint. There is a steady increase in the number of articles by years. With an increase of 26.9% compared to 2014, 38,230 articles were indexed in 2018.



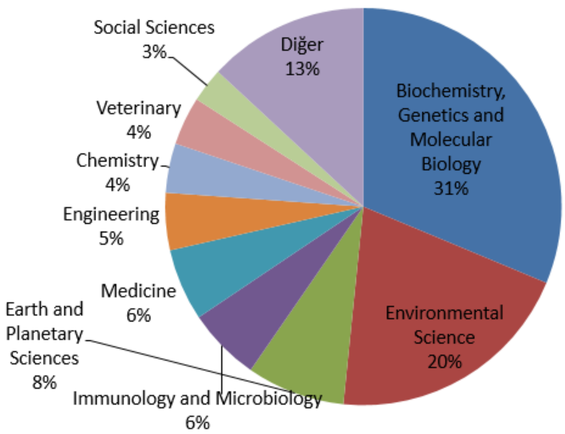
Graph 2: Number of Publication by Years in Scopus

Distribution by Subject

Graph 3 shows the distribution of agriculture related indexed articles in WOS according to sub-topics of agriculture. The subject with the most indexed subject is Food Science with a ratio of 16%.



Graph 3: Distribution by Topic in WOS

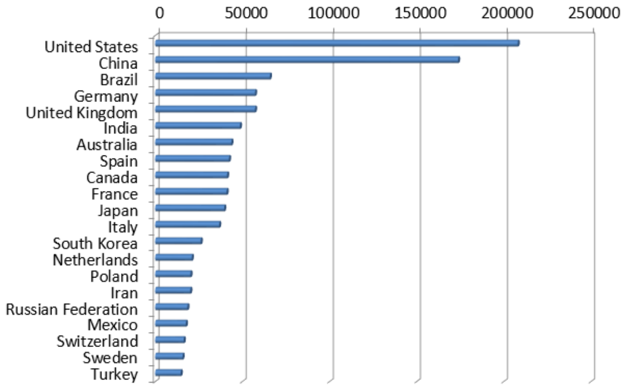


Graph 4: Distribution by Topic in Scopus

Graph 4 shows the distribution of articles related to agriculture indexed in Scopus. Scopus database shows that 962,364 articles on agriculture are at the rate of 31% with the highest rate of biochemistry, genetic and molecular biology. Environmental science ranks second with 20%.

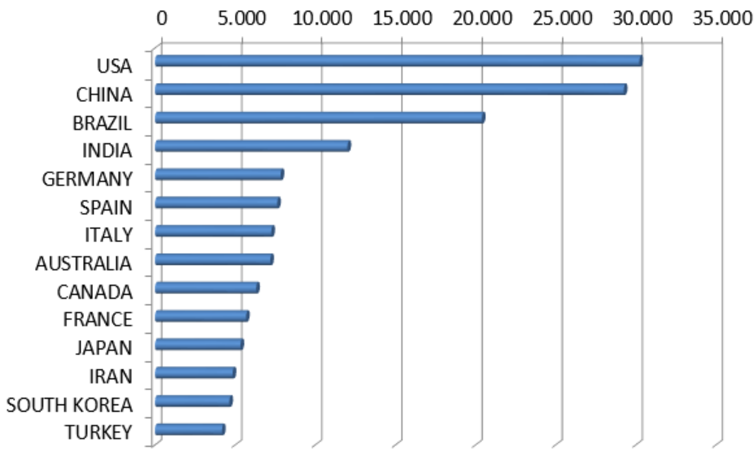
Distribution by country

When the distribution by countries in Graph 5 is examined, it is seen that the country which contributed the most with 208,035 articles to the literature is the United States. China follows the USA with 173,830 articles. From the data obtained, it is estimated that the world average is 6015 articles. Turkey 11th among European countries with 14 640 articles, 7th among Asian countries, ranks 21 in the world rankings.



Graph 5: Distribution by Country in Scopus

From the data obtained in WOS, the distribution of 173,413 articles is given by countries (Graph 6). With 30,229 articles, it is seen that the country that gave the most articles to the literature was the United States. China follows the US with 29,253 articles. The average number of articles was calculated as 854. Turkey among the European countries with the article 5. 4181, ranking the 6th in the world and ranks 14th among Asian countries.



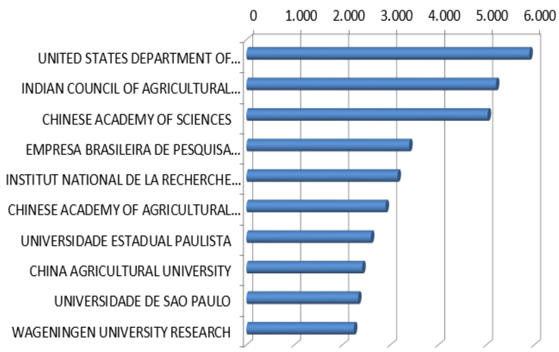
Graph 6: Distribution by Country in WOS

Distribution by Institutions

When Graph 7 is examined, it is seen that the most important countries that have the highest contribution to the literature is the People's Republic of China. As a matter of fact, when the first 20 institutions are examined, it is seen that there are 7 institutions with Chinese address. Among the most broadcasting institutions, there are higher education institutions at the Academy level. The second is the Chinese Ministry of Education. The University of São Paulo, located in Brazil, ranks first in university level. According to the data obtained it can not be seen any institution among the top 100 institutions from Turkey.

Graph 7: Distribution by Institutions in Scopus

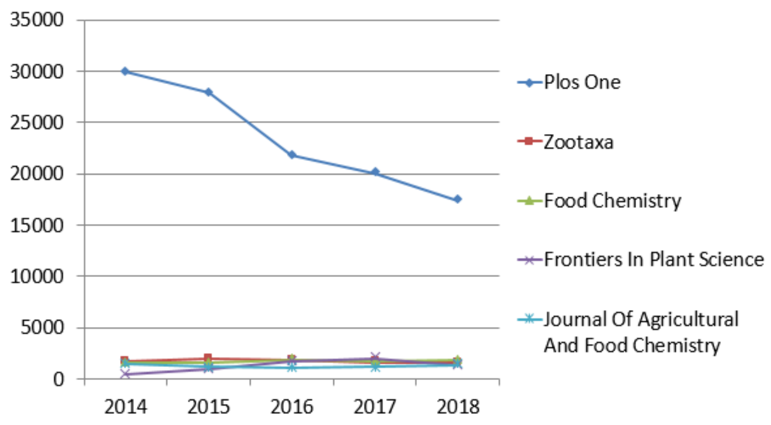
When the results of WOS searching are examined, it is seen that the organization contributing the most to the literature is the US Department of Agriculture with 5.896 articles. China's Ministry of Education ranks 2nd with 5,199 articles. At the Academy level the Chinese Academy of Sciences ranks first. At University level, Estadual Paulista University ranks first in Brazil. According to the data it is not included among the top 100 companies of Turkey.



Graph 8*:* Distribution by Institutions in WOS

Distribution by Publication Organizations

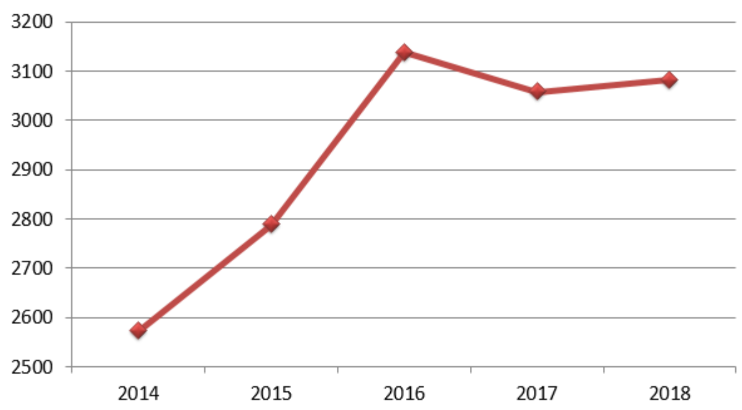
In the Scopus database, 357,715 of the 962,901 articles related to the science of agriculture and biology are open access articles**.** The most indexed publisher in the database is the open access Plos One with 116.992 article. Plos One publisher's article number is 12.14% of the number of articles in the last five year.



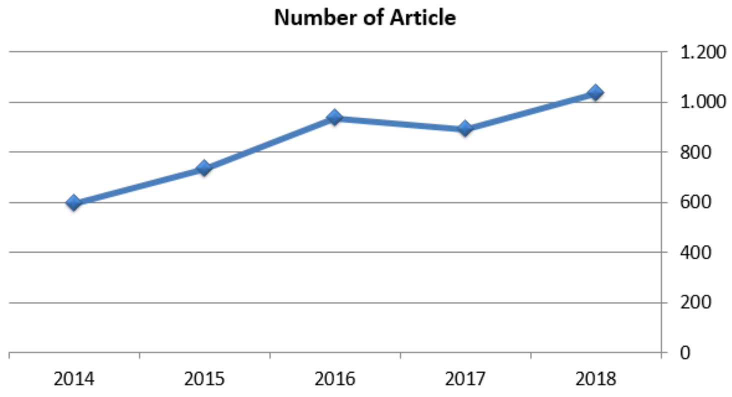
Graph 9: Distribution by Publication Organizations in Scopus

Distribution by Turkey of the Year

Scopus database in the last five years shows that Turkey produces 14 644 articles. In 2014-2018, the best increase was in 2016 with a rate of 12.5% compared to the previous year. The number of articles in 2018 increased by 19.9% compared to 2014 (Graph 10). WOS database in Turkey in the last five years shows that 4181 article produced. There is a 74.5% increase in the number of articles in 2018 compared to 2014 (Graph 11).



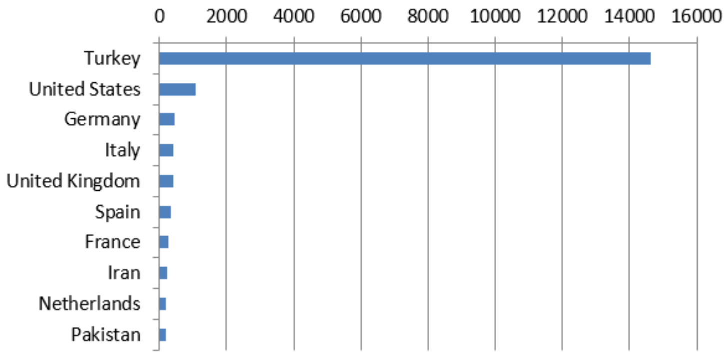
Graph 10: Distribution by Years of The Turkey in Scopus



Graph 11: Distribution by Years of The Turkey in WOS

Turkey's International Cooperation

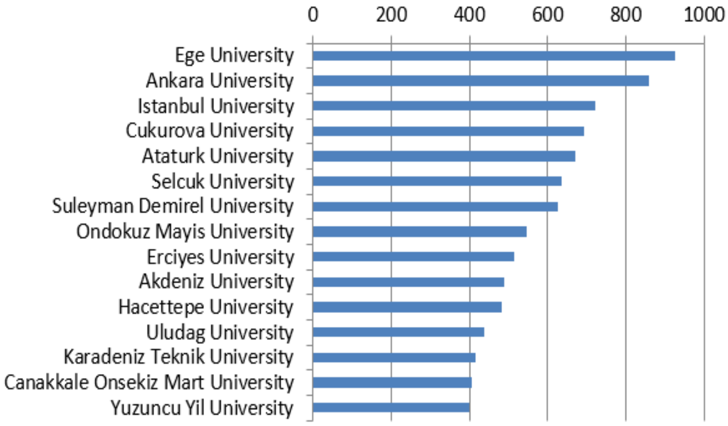
Looking at the last five years, Turkey's cooperation with other countries, it is seen that the most common articles United States. China is the second most publicized country at the level of countries. On the contrary, China is not among the top 10 countries in cooperation with our country.



Graph 12: International Cooperation of Turkey in Scopus

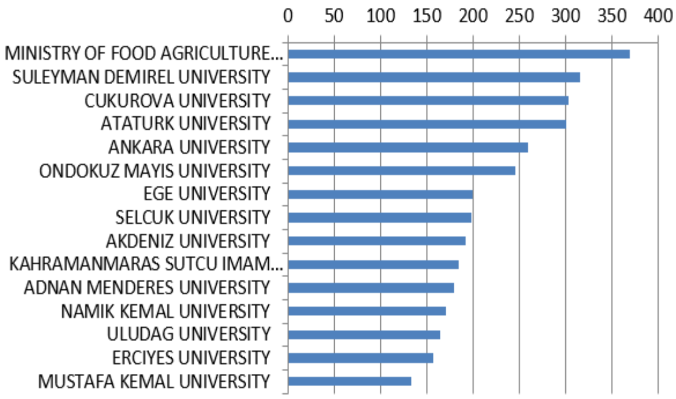
Distribution by Universities in Turkey

It is seen that the most indexed articles in the literature related to the science of agriculture and biology in Scopus database belong to Ege University. Academies and public institutions are among the institutions that produce the most publications worldwide. On the contrary, only universities are in the top 15 in our country.



Graph 13: In Scopus, Distribution by Universities in Turkey

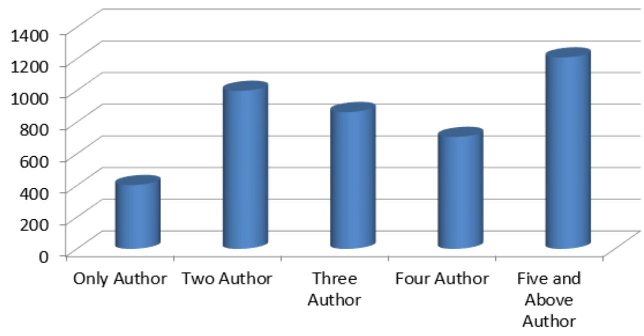
When the WOS database indexed in Turkey in agriculture issues related article analyzed 4181 shows that take place in the first Ministry of Food, Agriculture and Livestock. At the university level, Süleyman Demirel University is the first place.



Graph 14: In WOS, Distribution by Universities in Turkey

Distribution by Author Number

The literature review results showed that there was a large number of articles in both WOS and Scopus database. When Turkey's co-authored the article are examined, wos' in the article indexed in the last five years, one author of 9,6%, 23,9 % the two authors, shows that 66.5% three or more authors, consisting article.



Graph 15: In WOS, Distribution by Number of Authors in Turkey

Conclusion and Evaluation

By using bibliometric applications which allow statistical analysis of the publications, the country, institution, document type, authorship cooperation etc. also evaluations are made. In today's global world, the rapid dissemination of information, its availability, international scientific activities and cooperation among researchers are thought to accelerate scientific publication. When the Scopus WOS databases are examined, the following results are achieved.

- In the last five years, there has been a steady increase in the scientific publications produced and / or published in the field of agriculture.
- The increase in the number of publications has a large share of the international joint publication of researchers.
- It is found out that the country that contributed the most to the literature in the world about agriculture is the USA. The fact that the country with the most cooperation in the emergence of this situation has a great effect.
- Republic of China ranks second in the world ranking. İn addition to the People's Republic of China takes the first place in the world.
- Turkey is seen as the corporate database is not between the two countries in the top 100. in addition to, it is among the top 15 countries in WOS and 25 in Scopus.
- In international co-authored the article in Turkey is seen that the maximum cooperation of the countries the United States. Although the People's Republic of China is ranked 2nd in the world and 1st in the country, the number of co-authored works with China is very low.

- It is seen that academic institutions and ministries are among the institutions that publish the most articles in the world. The most broadcasting institutions in Turkey is seen that the universities.

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Investigation of Factors Affecting Catalase Enzyme Activity In Different Agricultural Soils

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Abstract

Catalase enzyme is an enzyme that catalyzes peroxide (H_2O_2), water (H_2O) and free oxygen (O_2) which are released as a result of metabolic activities in the soil and are toxic to vitality. In this respect, it is important to determine the total activity of microorganisms in the soil.

20 soil samples in Araban district of Gaziantep (southeastern Turkey) were taken from wheat field, pistachio gardens and the pastures. In these samples, soil pH, electrical conductivity (EC), salt (%), lime (%), organic matter (%), nitrogen (%), soil structure and catalase enzyme were analyzed.

Catalase enzyme activity was highest in clay soils (1.6 ± 0.84 mgO2/100gr). This is followed by clay with loamy soils (1.32 ± 0.48 mgO_2 / 100gr), loamy soils (1.05 ± 0.47 mgO_2/100gr) and sandy soils (0.63 ± 0.17 mgO_2/100gr). Catalase enzyme activity which has a positive significant relationship with soil structure ($p < 0.05$) was found to have no significant relationship in different agricultural soils ($p > 0.05$).

As a result of the statistical analysis, no significant correlation was found with catalase enzyme activity and soil parameters in pastures ($p>0,05$). On the other hand, it has been found that it has a significant positive relationship beetween catalase enzyme activity with soil salinity and texture in pistachio soil and also, that it has a significant negative relationship between the catalase enzyme activity and soil texture only in wheat soils ($p < 0,05$).

This study aiming at understanding the quality of soil and productivity in this region in terms of sustainable agriculture will also guide future studies.

Keywords: *Soil Enzyme Activities, Catalase, Pistacio, Wheat, Grassland*

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Özet

Katalaz enzimi toprakta metabolik faaliyetler sonucunda açığa çıkan ve canlılık için toksik olan peroksiti (H_2O_2)'yi, su (H_2O) ve serbest oksijene (O_2) katalizleyen bir enzimdir. Bu bakımdan topraktaki mikroorganizmaların toplam aktivitesinin belirlenmesinde önemlidir.

Gaziantep Araban ilçesinde (Güneydoğu Türkiye) buğday tarlası, antep fıstığı bahçesi ve meralardan 20'şer adet toprak örneği alındı. Bu örneklerde, toprak pH'sı, elektriksel kondüktivite (EC), tuz (%), kireç (%), organik madde (%), azot (%), toprak yapısı ve katalaz enzimi analiz edildi.

Katalaz enzim aktivitesi en yüksek değeri killi topraklarda (1,6 ± 0,84 mgO_2/100gr) tespit edilmiştir. Bunu killi tınlı topraklar (1,32 ± 0,48 mgO_2/100gr), tınlı topraklar (1,05 ± 0,47 mgO_2/100gr) ve kumlu topraklar (0,63 ± 0,17 mgO_2/100gr) izlemektedir. Toprak yapısı ile pozitif anlamlı bir ilişkiye ($p<0,05$) sahip olan katalaz enzim aktivitesi farklı tarım topraklarında anlamlı bir ilişkiye sahip olmadığı tespit edilmiştir ($p>0,05$).

Yine yapılan istatiksel analiz sonucunda, meralarda katalaz enzim aktivitesi ile toprak parametreleri ile anlamlı bir ilişki tespit edilememiş iken antep fıstığı topraklarında toprak tuzluluğu ve tekstürü ile pozitif, buğday topraklarında ise sadece toprak teskstürü ile anlamlı negatif ilişkiye ($p<0,05$) sahip olduğu tespit edilmiştir.

Sürdürülebilir tarım açısından toprakların kalitesinin ve verimliliğin bu bölgede anlaşılmasına yönelik bu çalışma gelecekte yapılacak çalışmalara da yön verecektir.

Anahtar Kelimeler: *Toprak Enzim Aktivitesi, Katalaz, Antep Fıstığı, Buğday, Mera*

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Introduction

Since enzymes are involved in biological and biochemical functions in soils (1-8), they are abundant in ecosystems (9, 10) and are complex molecules (3,11) that are important in terms of the continuity and health of ecosystems (8,12,13).

Catalase (hydrogen peroxidase oxidoreductase, EC 1.11.1.6), a soil enzyme, is an enzyme involved in the catalysis of peroxide (H_2O_2) in water (H_2O) and free oxygen (O_2), which is a result of various activities in the soil and which has a toxic effect on many organisms (5,9,11,14-18).

$$H_2O_2 \xrightarrow{\text{Catalase}} H_2O + ½ O_2 \quad (1)$$

It has been reported that the catalase enzyme is in the range of 2.55 to 3.08 uM $O_2.gr^{-1}.h^{-1}$ in soil (11). However, catalase enzyme is an intracellular enzyme that is closely related to all aerobic bacteria and facultative anaerobic bacteria (3,8,9,14). In addition, it is reported that the catalase is found as extracellular in soils (19). Catalase enzyme is considered as an indicator of microbial activity in soil (5,9, 14-16,18) and also soil fertility (1,3,4,6,7,15).

Although catalase enzyme activity is quite stable in soils as other soil enzymes (9), the catalase enzyme activity microorganism activity changes under microbial and biochemical factors such as heat, oxygen, moisture and nutrients (18). In previous studies, it has been reported that catalase enzyme activity is not related to the amount of microorganism in the soil is related to the amount of organic matter (7,14,15,20). It has also been shown that there is an inverse relationship between soil activity and catalase enzyme activity of soils and this is due to the fact that the density of aerobic microorganisms is higher at depths close to the soil surfaces (9,15). In addition, Durmuş et al. (15) found that soil nitrogen (N), available phosphorus (P) and changeable potassium (K) have effects on the catalase activity of soils and suggested that fertilizers containing these elements would increase catalase enzyme activities in agricultural areas. However, Franco-Otero et al., (16) also reported that the application of excess phosphorus (P) to the soil had a negative effect on the catalase enzyme activity.

In their study, they investigated the effect of salinity on root development and microbial community in rhizosphere soil of artichoke, Yang et al. (5) reported that the catalase enzyme activity would decrease due to the negative effects of salt on aerobic bacteria.

Catalase enzyme activity has a wide pH range. However, the pH does not show activity below pH 3.5. Also, it was found that the catalase enzyme has optimal activity at pH 6.8 in laboratory conditions (9,19,21,22). In these studies, during the measurement of the activity of the catalase enzyme, so the pH of 6,8 is used in the buffer, in his studies, Trasar-Cepeda et al. (14) used distilled water instead of buffer solution.

In the their study of biological remedation of soils by biological activities, Margesin et al. (23) reported that the catalase activity in the fertilized soils was higher than the untreated soils and that nutrients had no effect on the catalase enzyme activity. Again in this study, it was revealed that catalase enzyme activity increased in the first week due to the increase in microbial activity in the soil after the oil contamination. It has also been reported that catalase enzyme activity negatively affects heavy metals. Therefore, it is considered as an indicator of soil fertility and microbial activity in the studies on the effects of various pollutants on soil (15,20).

This study was carried out in order to reveal the effects of different agricultural activities and soil properties on catalase enzyme activities in alkaline soils in Southeastern Anatolia, as intensive agricultural activities were carried out in the study area. The results of the study will be used for agricultural production and also for future studies.

Material And Methods

Soil samples were taken from pistachio (Pistacia vera L.), wheat and pasture areas in the Araban District, Gaziantep (Southeast Anatolia, Turkey). A total of 60 soil samples were collected from the soil surface at a depth of 15 cm where three different area (Pistachio, wheat and pasture). These examples were brought to the laboratory of Gaziantep University, Araban Vocational High School and analyzes were made here.

Electrical conductivity in soil samples was determined by using electrical conductivity measurement device in soil water extract (24). The amount of organic matter was determined according to the dichromate oxidation method as suggested by Sarkar and Haldar, (25) and Kaçar, (26). The soil pH was determined by a pH meter using a 1: 1 soil water mixture (27,28). The amount of lime (%) of the soil was determined from the carbonate content formed by the reaction of the soil samples with hydrochloric acid (HCl) using a device (29). Also, the salt content (%) of the soils was determined by this resistance that measuring the resistance of water-saturated soil by an electrical conductivity (27). Total nitrogen (N, %) was also analyzed by Kjeldahl method according to Bremner (30).

Catalase enzyme activity was determined by using a gasovolumetric method based on the measurement of O_2 (free oxygen) released by reacting the soil sample of H_2O_2 (hydrogen peroxide) with the soil sample that method described by Beck (21).

SPSS version 22 was used for statistical analysis.

Results

Table 1 shows the mean values of the soil characteristics of the samples taken in the study. Organic matter amount (%), lime (%) and total nitrogen (%) ratio were found in the highest pasture soils. In the soils belonging to pistachio areas, it was found that the pH had the highest value. In the soil samples taken from wheat areas, EC (µS / cm) and salt (%) ratio have the highest values. However, the lowest values in pasture soils were determined at EC (µS / cm) and pH. In the pistachio soil, organic matter (%), salt (%) and lime (%) ratio has the lowest values. The lowest value of the total nitrogen (%) ratio was found to be the same in soil samples taken from pistachio and wheat fields.

According to the catalase enzyme activity (mg $O_2.100g^{-1}.1h^{-1}$) analysis of soils, the highest value (1.37 mg $O_2.100g^{-1}$.1h-1) in the pasture soils, the lowest value (0.98 mg $O_2.100g^{-1}.1 h^{-1}$) was detected in pistachio (Pistacia vera L.) soils (Table 2). In addition, the catalase enzyme activity of the soil taken from wheat fields was found to be 1.19 mg $O_2.100g^{-1}.1h^{-1}$.

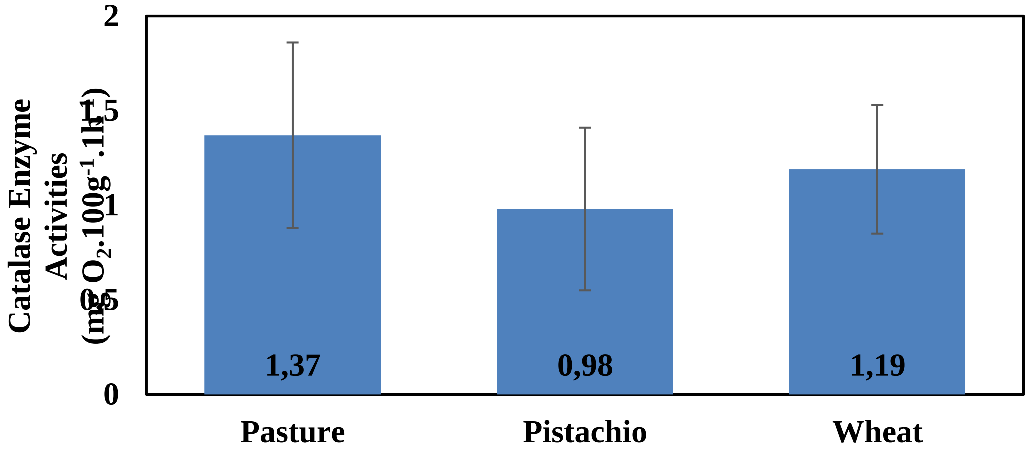
The highest catalase enzyme activity was found in soils with <1.0% of organic matter in all three areas (Table 3). However, the highest catalase enzyme activity (1.67 mg $O_2.100g^{-1}.1h^{-1}$) was found in rangeland soils of 0.1%, while the lowest catalase enzyme activity (0,84 mg $O_2.100g^{-1}.1h^{-1}$) was found in pistachio soils with organic matter content between 1.0% and 2.0%.

Table 4 shows the catalase enzyme activity according to the pH of the soils and it is seen that the values are close to each other in all three areas. However, catalase enzyme activity was found to be higher than alkaline earth in light alkaline soils. The highest catalase enzyme activity (1,48 mg $O_2.100g^{-1}.1h^{-1}$) was found in light alkaline pasture soils and the lowest catalase enzyme activity (0,9 mg $O_2.100g^{-1}.1h^{-1}$) in strong alkaline pistachio soils.

While sandy soil was not detected in pasture and wheat fields, clayey soils were not detected in peanut areas (Table 5). The highest value of soil catalase enzyme activity (1.98 mg $O_2.100g^{-1}.1h^{-1}$) was determined in clayey merala soil. The lowest catalase enzyme activity (0,54 mg $O_2.100g^{-1}.1h^{-1}$) was found in sandy peanut soil. However, catalase enzyme activity in on pasture and wheat soils with clay were higher than those of clay loam and loamy soil, whereas clay samples in pistachio soils were higher than loamy soil and sandy soils in this areas.

	Pasture	**Pistachio**	**Wheat**
Organic Matter (OM) (%)	1,42 ± 0,76	0,87 ± 0,53	0,91 ± 0,84
EC (µS/cm)	592,50 ± 183,52	640,85 ± 158,37	733,80 ± 107,40
pH	8,45 ± 0,21	8,62 ± 0,14	8,51 ± 0,16
Salinity (%)	0,22 ± 0,10	0,17 ± 0,06	0,26 ± 0,11
Lime (%)	31,17 ± 19,37	15,25 ± 18,40	18,31 ± 13,50
Total Nitrogen (%)	0,17 ± 0,09	0,14 ± 0,11	0,14 ± 0,12
Catalase (mg O_2.100g^{-1}.1h^{-1})	1,20 ± 0,53	1,14 ± 0,50	1,13 ± 0,54

Table 1. Mean of parameters of soil properties



Tablo 2. Catalase enzyme activity in different agricultural areas

Table 6 shows the catalase activity according to the salinity of the soils and the highest value (2.38 mg O_2.100g^{-1}.1h^{-1}) was found in pasture soils with salinity ratios between 0.35% and 0.65%. However, the lowest value (0.72 mg O_2.100g^{-1}.1h^{-1}) was found in soils containing <0.15% salt from the pistachio areas. While catalase enzyme activities are close to each other in the pasture areas that have <0.15% and 0.15% to 0.35% salinity, it has been found that it has almost the same catalase enzyme activity in the soil having salinity ratios between 0.15% to 35% and between 0.35% and 0.65%. However, it is possible to say that as the salt ratio increases, the activity of soil catalase enzyme is also increased.

It has been found that has the highest catalase enzyme activity (1,87 mg O_2.100g^{-1}.1h^{-1}) in wheat soils with 1% to 5% lime ratio, while it has been found that has the lowest catalase enzyme activity (0.73 mg O_2.100g^{-1}.1h^{-1}) on pistachio soil samples with lime ratios> 25% (Table 7). Catalase enzyme activity in pasture soils is determined from the highest to the lowest by the order of 5% -15% > 15% -25% > 25% and above lime ratio. While regular activity was observed in catalase enzyme activities towards 15% to 25% lime levels in pistachio areas, a sudden decrease in catalase enzyme activity was observed in soils with lime > 25%.

Catalase enzyme activity according to total nitrogen (N) content showed fluctuations in all three areas (Table 8). The highest catalase enzyme activity (1.80 mg) was found in soils with very little nitrogen (N) content in the pastures. The highest catalase enzyme activity (1.80 mg O_2.100g^{-1}.1h^{-1}) was found in soils with a total nitrogen (N) content of <0.045% in the pasture areas. The lowest catalase enzyme activity was found in the pistachio soils with total nitrogen ratios between 0.09% and 0.17% (0.79 mg O_2.100g^{-1}.1h^{-1}).

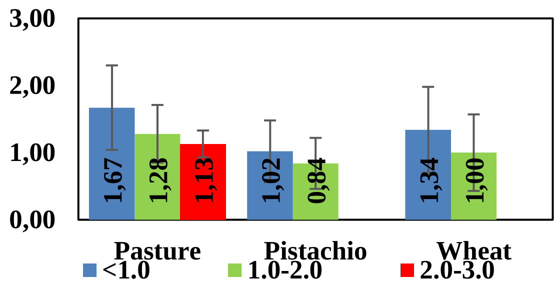


Table 3. Catalase enzyme activity according to soil organic matter content (%)

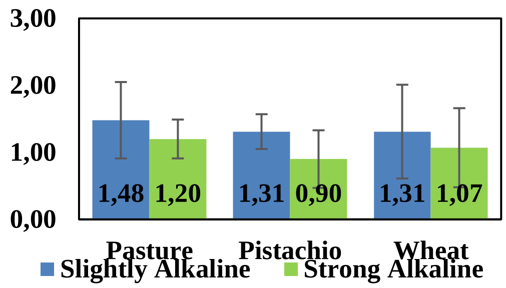


Table 4. Catalase enzyme activity according to pH of soils

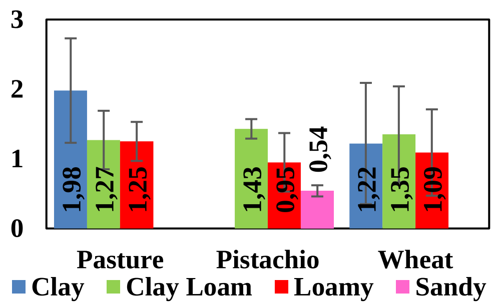
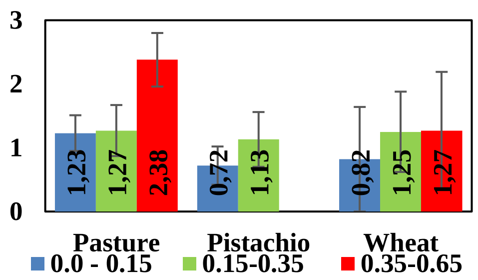
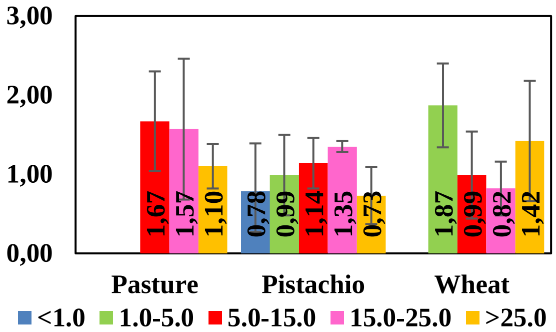


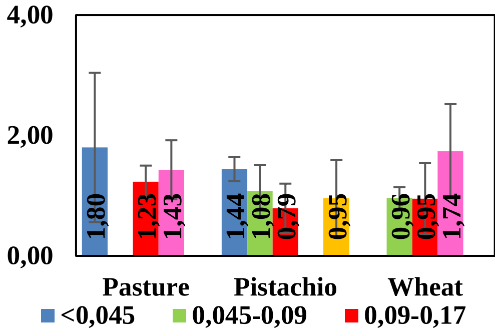
Table 5. Catalase enzyme activity according to *soil texture*



Tablo 6. Catalase enzyme activity according to soil salinity (%).



Tablo 7. Urease enzyme activity according to lime content (%) of soil.



Tablo 8. Urease enzyme activity according to total nitrogen (%) content of soil.

One-way ANNOVA test and Pearson correlation test results are given in Table 9 and Table 10 respectively. According to one-way ANOVA test results, no significant correlation was found between the measured parameters with the catalase enzyme activities detected in pasture soil samples. However, there were significant differences between the soil salinity and the catalase enzyme activity (p <0,05) in pistacio soils and between the soil texture and catalase enzyme activity (p <0,05) in wheat soils.

According to Pearson correlation test results, no significant correlations were found between the parameters of general characteristics of soil samples taken from pasture and wheat areas and catalase enzyme activity in these soil samples. However, it was determined that there was a positive correlation between the soil salinity and soil texture with the catalase enzyme activity in the soil samples at the level of p <0.05.

	Pasture	**Pistachio**	**Wheat**
Organic Matter (OM) (%)	,181	,551	,573
pH	,361	,089	,526
Salinity (%)	,204	**,039 ***	,160
Lime (%)	,510	,342	,167
Total Nitrogen (%)	,666	,400	,940
Soil Texture	,441	**,049 ***	**,000 ***

Tablo 9. One-way ANNOVA test results between urease enzyme activities and soil parameters in the samples

	Pasture	Pistachio	Wheat
Organic Matter (OM) (%)	-,417	-,149	,044
pH	,155	-,367	,257
Salinity (%)	,259	**,487 ***	-,215
Lime (%)	-,357	-,246	,223
Total Nitrogen (%)	-,417	-,147	,185
Soil Texture	,230	**,531 ***	-,385

Tablo 10. Pearson correlation test results of urease enzyme activities of soils according to different areas (* p <0.05, ** p <0.01)

Discussion

In all three areas, although there is no statistical significance, catalase enzyme activity decreases with increasing amount of organic matter. This finding is consistent with the findings of Kızılkaya et al. (12) in his study investigating the relationships between enzyme activities and soil properties in paddy farming. In a study conducted in the corn fields of Şanlıurfa, there was no correlation between catalase enzyme activity and soil organic matter content (7). However, some studies have reported a positive correlation between the amount of organic matter and catalase enzyme activity of the soils (9,15,20).

The results obtained at the end of this study show that the catalase activity decreases as the degree of soil alkalinity increases. However, statistically significant differences were not found between catalase enzyme activity and soil pH (> 0,05). Also, there were positive correlations between catalase enzyme activity and soil pH in pasture and wheat soils and negatively correlated with pistachio soils. These findings are in line with the results of another study in corn fields (7). In addition, there is present in some stuies with different findings fort he relationship between activity and soil pH. (31) in semi-arid soils in Spain and Guangming et al. (32) conducted studies in salty coastline in China, reported a negative correlation between catalase enzyme activity and soil pH. On the other hand, Guwy et al. (22) reported that they were active at wide soil pH ranges and had no activity below pH 3.5. Like the biochemical molecule in each protein structure, the catalase enzyme has also been reported to have optimal activity at about pH 6,8 (9,19,21,22). Increase in catalase activity as alkalinity decreases is the cause of the studied soil pH is higher than the optimal pH of the catalase enzyme. This shows that pH is very important in catalase enzyme activity in soils.

In the pistachio orchard gardens, the lack of catalase activity of sandy soils and the fact that this situation was not observed in other areas suggests that catalase enzyme activity is closely related to soil texture in pistachio areas. In the pistachio areas, Pearson correlation analysis revealed a positive correlation between the catalase enzyme activity and soil texture supports this proposition. Ji vd. (33) in their study revealed findings that clay soils have a catalase enzyme activity of about 10% more than that of loamy soil, supported our finding in pistachio areas. Finding in another study supporting our proposition is the negatif effect of soil sand content and positive effect of soil clay content on the catalase enzyme activities in the paddy soils (12). Adsorption of extracellular enzymes by soil clay colloids is sufficient to explain the relationships between soil texture and soil enzyme activity. However, it can be explained by the fact that the microflora, which is rich in catalase enzyme activity, may be higher than others because of its intracellular enzyme. Also, the our result that no relation was found between catalase enzyme activities and soil texture in pasture and wheat soils is in agreement with the results of another study recently conducted in corn fields (7). The fact that there is no significant relationship between soil texture and catalase enzyme activity in wheat fields is due to the different effects of different agricultural applications on enzyme activities. Furthermore, it is high in clayey soils in pastures, but it has very close enzyme activities in clayey loam and loam soils supports the suggestion of Alef and Nannipieri (9) that catalase enzyme activity in soil is stable.

The effect of salinity in soil on catalase enzyme activity is controversial. Kızılkaya et al. (12) showed that soil salt content has a positive effect on catalase enzyme activity in paddy fields. In contrast, Guangming et al., (32), in their study of loam and salty soils collected from the riverside in China, concluded that the soil salinity was negatively correlated with catalase enzyme activity. Also, Yang vd. (5) reported that the high soil salinity affected the catalase enzyme activity negatively because of its negative effect on aerob bacteria. As a result of this study, the results obtained from the pistachio fields indicate that the catalase activity of soils is positively related to salinity, which is consistent with the findings of Kızılkaya et al. (12). Likewise, the results of the statistical analysis showing that there is a significant difference between the catalase enzyme activity and soil salinity in the pistachio soils also reinforces this proposition.

Conclusions

There was no relationship between general soil parameters and catalase enzyme activity in pastures. However, catalase enzyme activity has been found to be related to soil salinity in pistachio orchards. The decrease in pH due to the increase in soil salinity indicates that the catalase enzyme activity is approaching to its optimal pH. On the other hand, soil texture has a positive effect on the pistachio orchards, and negative effects on the catalase enzyme activity of soils in wheat fields.

The results of this study are important for pistachio agriculture which constitutes an important agricultural economic resource in this region and it is also important in terms of forming basic knowledge in this and similar studies in the future.

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Determination of Urease Enzyme Activity In Different Agricultural Soils In Araban District of Gaziantep (Southeast Turkey)

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ABSTRACT

Soil enzymes are one of the most important indicators of soil productivity and agricultural sustainability. Among these, urease enzyme plays an important role in the transformation of nitrogen in soil to compounds that can be used by plants, not only in natural areas but also in agricultural areas. Therefore, the urease enzyme plays an important role in the realization of the nitrogen cycle in the soil.

20 soil samples in Araban district of Gaziantep (southeastern Turkey) were taken from wheat field, pistachio gardens and the pastures. These samples were analyzed for soil pH, electrical conductivity (EC), salt (%), lime (%), organic matter (%), nitrogen (%), soil structure and urease enzyme.

Urease enzyme activity from low to high in the order of the pasture (7.62 ± 1.97 mgN / 100gr), pistachio garden (5.99 ± 1.73 mgN / 100gr) and wheat field (4.67 ± 2.11 mgN / 100 g) ($p <0.05$). As a result of the study, it was observed that urease enzyme activity had significant relationships with soil textures, organic matter, total nitrogen status, lime and pH ($p <0.05$). This study is aimed at the importance of soil urease enzyme in terms of sustainable agricultural activities and it is aimed to direct future studies.

Keywords: *Soil Enzyme Activities, Urease, Pistacio, Wheat, Pasture*

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ÖZET

Toprakların verimliliği ve tarımsal sürdürülebilirlik açısından önemli göstergelerden birisi toprak enzimleridir. Bunlardan üreaz enzimi, sadece doğal alanlarda değil tarımsal alanlarda da topraktaki azotun, bitkilerin kullanabileceği formda bileşiklere dönüştürülmesinde önemli görevler üstlenmektedir. Bundan dolayı üreaz enzimi, toprakta azot döngüsünün gerçekleşmesinde önemli bir pay sahibidir.

Gaziantep Araban ilçesinde (Güneydoğu Türkiye) buğday tarlası, antep fıstığı bahçesi ve meralardan 20'şer adet toprak örneği alındı. Bu örnekler, toprak pH'sı, elektriksel kondüktivite (EC), tuz (%), kireç (%), organik madde (%), azot (%), toprak yapısı ve üreaz enzimi bakımından analiz edildi.

Üreaz enzim aktivitesi yüksekten düşüğe doğru sırası ile en fazla mera (7,62 ± 1,97 mgN/100gr), antep fıstığı bahçesi (5,99 ± 1,73 mgN/100gr) ve buğday tarlası (4,67 ± 2,11 mgN/100gr) olarak bulunmuştur ($p<0,05$). Yine yapılan çalışma sonucunda, üreaz enzim aktivitesinin toprakların tekstürü, organik madde, toplam azot durumu, kireç ve yine pH ile anlamlı ilişkileri olduğu gözlenmiştir ($p<0,05$). Bu çalışma sürdürülebilir tarımsal faaliyetler açısından toprak üreaz enziminin önemine yöneliktir ve gelecekteki çalışmalara da yön vermesi amaçlanmıştır.

Anahtar Kelimeler: *Toprak Enzim Aktivitesi, Üreaz, Antep Fıstığı, Buğday, Mera*

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INTRODUCTION

Soil is very important for nature (1) and especially for agricultural activities (2,3) because it hosts many living organisms (4). It is a dynamic structure where many biological, chemical and physical activities occur in the soil (5-9). Within this dynamic structure, enzymes have a special importance for biochemical activities such as matter cycle, organic matter decomposition (3,10-15). Soil enzymes are often considered by many scientists as an indicator of the fertility and quality of the soil (1,3,8,9, 16-24) due to their rapid response to physical, biological, chemical and atmospheric changes in soil (12,17,18,24-26).

Urease (urea amidohydrolase, EC 3.5.1.5) is one of the most important enzymes in the cycle of nitrogen (N) that is one of the most important macro nutrients in nature (14,15,27,28). Also, Sumner, who also crystallized this enzyme for the first time in 1926, has a special place in literature in terms of receiving the Nobel Prize in Chemistry in 1946 (13,27,29). This enzyme breaks the C-N bonds outside the peptide bonds in the amides (7,27). The urease, which contains nickel ions (Ni^{2+}) as a co-factor on its active surface (9,29-31), is a protein structure having a weight ranging from 1510 to 4800 kDa (9,30). Although urease is involved in the catalysis reactions of hydroxyurea, dihydroxyurea and semicarbazides (18,30,31), urease is an enzyme that mainly uses urea as substrates and converts it into ammonia and water (2,3,7,9,11,14,23,26,27,30-,33). The equation of this reaction is given below;

$$(NH_2)_2CO + H_2O \xrightarrow{\text{Urease}} CO_2 + NH_3$$

The source of the enzyme urease in nature is plants, animals and microorganisms (2,3,10,13,14,27,31,34). However, urease in soil, are found intracellular in microorganisms. They are also mostly found as extracellular in the form of complex structures with humic substances and other soil colloids (2,3,8,9,11,13,17,18,28,29,33). While the extracellular urease enzyme, which forms a complex structure with soil colloids, maintains its catalytic activity for a long time (13), the free extracellular urease enzyme is rapidly degraded by proteolytic enzymes in the soil (9).

The activity of urease has been reported to vary between 0.14 and 14.3 μmol N-NH^3 $g^{-1}h^{-1}$ in nature (10,13). However, Kızılkaya et al. (16) reported the soil urease enzyme activity as 24,12 to 39,03 mg N 100 g^{-1}. Also, the urease enzyme activity of soils varies with atmospheric effects such as temprature, rain or drought due to global warming anthropogenic effects (5,18,18,22,26,35) general soil properties such as pH, lime, salt, organic matter content, total amount of nitrogen (1,22,24,35), biological properties of the soil, such as microbial commutation and other soil enzyme activities (especially acid or alkaline phosphatase) (15,28), agricultural land activities such as cropping, irrigation, management, fertilization (especially organic fertilizer) (1,8,12,14,16,19,25,28,34,36), natural biological properties such as vegetation and anthropogenic effects such as xenobiotics, heavy metals, permanent organic pollutants (POPs) (12,15,16,23).

In this study, soil samples that taken pistachio (Pistacia vera), wheat fields and pasture from the Araban district of Gaziantep (Turkey) where located in Southeast Anatolia and Iran-Turan Phytogeographic Region were analyzed with the aim of determining the effects of the parameters determining the basic properties of soils on the soil urease activity.

MATERIAL AND METHODS

Soil samples were taken from pistachio (Pistacia vera L.) orchards, wheat fields and pasture in the Araban District, Gaziantep (Southeast Anatolia, Turkey). A total of 60 soil samples were collected from the soil surface at a depth of 15 cm where three different area (Pistachio, wheat and pasture). These examples were brought to the laboratory of Gaziantep University, Araban Vocational High School and analyzes were made here.

Electrical conductivity in soil samples was determined by using electrical conductivity measurement device in soil water extract (37). The amount of organic matter was determined according to the dichromate oxidation method as suggested by Sarkar and Haldar, (38) and Kaçar, (39). In this method, by determining the amount of organic carbon formed by titration of the remaining bichromate anion ($Cr_2O_7^{2-}$) as a result of reacting with potassium bichromate ($K_2Cr_2O_7$), sulfuric acid (H_2SO_4), with ferrous sulfate ($FeSO^4.7H^2O$), the amount of organic matter is determined. The soil pH was determined by a pH meter using a 1: 1 soil water mixture (40,41). The amount of lime (%) of the soil was determined from the carbonate content formed by the reaction of the soil samples with hydrochloric acid (HCl) using a device (42). Also, the salt content (%) of the soils was determined by this resistance that measuring the resistance of water-saturated soil by an electrical conductivity (40). Total nitrogen (N, %) was also analyzed by Kjeldahl method according to Bremner (43). Urease enzyme activity was determined by applying the method proposed by Hoffmann and Teicher (44).

SPSS version 22 was used for statistical analysis.

RESULTS

Table 1 shows the mean values of the soil characteristics of the samples taken in the study. Organic matter amount (%), lime (%) and nitrogen ratio (%) were found in the highest pasture soils. In the soils belonging to pistachio orchards, it was found that the pH had the highest value. In the soil samples taken from wheat fields, EC (µS/cm) and salt (%) ratio have the highest values. However, the lowest values in pasture soils were determined at EC (µS/cm) and pH. In the pistachio soil, organic matter (%), salt (%) and lime (%) ratio has the lowest values. The lowest value of nitrogen (%) was found to be the same in soil samples taken from pistachio and wheat fields.

Although urease enzyme activity has similar values in all three areas, the highest activity in the pasture (1,20 ± 0,53 mg N $100g^{-1}$ $1h^{-1}$) and the lowest activity in wheat fields (1,13 ± 0, 54 mg N $100g^{-1}$ $1h^{-1}$) (Table 2).

In Table 3, urease enzyme activity (mg N $100g^{-1}$ $1h^{-1}$) was given according to the organic matter, and urease activity in the pasture was found to be higher than the urease activity in the other two areas. However, samples categorized as <1.0% in terms of the amount of organic matter were found to have higher urease enzyme activity in all three areas than samples with 1.0-2.0% and 2.0-3.0% amounts of organic matter.

	Pasture	**Pistachio**	**Wheat**
Organic Matter (OM) (%)	1,42 ± 0,76	0,87 ± 0,53	0,91 ± 0,84
pH	8,45 ± 0,21	8,62 ± 0,14	8,51 ± 0,16
Salinity (%)	0,22 ± 0,10	0,17 ± 0,06	0,26 ± 0,11
Lime (%)	31,17 ± 19,37	15,25 ± 18,40	18,31 ± 13,50
Total Nitrogen (%)	0,17 ± 0,09	0,14 ± 0,11	0,14 ± 0,12
Urease $(mg\ N.100g^{-1}.1h^{-1})$	7,62 ± 1,97	4,67 ± 2,11	5,99 ± 1,73

Table 3. Mean of parameters of soil properties

Also in Table 4, urease enzyme activities are given according to the pH conditions of soils. According to this table, the urease enzyme activity in the soil samples classified as slightly alkaline in both pasture and wheat field is higher than the ones with strong alkaline in comparison to the pistachio soils. However, the urease enzyme activity in the slightly alkaline and strong alkaline soil samples in pistachio areas was similar, but it was found to be slightly higher in the strong alkaline soil samples.

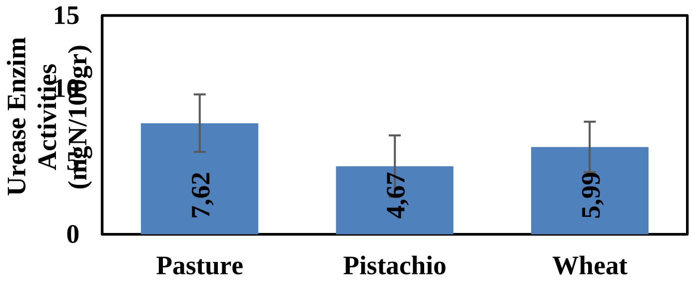


Table 4. Urease enzyme activity in different areas

In Table 5, urease enzyme activity was given according to soil texture. Urease enzyme activity in pasture has the highest value in clay soils and clay loam and loamy soils respectively. In terms of urease enzyme activity, soil with clay could not be detected in the lowest pistachio areas. However, urease is found as clay loam, sandy and loamy soils at the highest point in terms of enzyme activity. However, sandy and loamy soils have very close values. In soil samples taken from wheat areas, it was found that clay loam soils had higher urease enzyme activity than both clay and loamy soils.

The change in urease enzyme activity according to soil salinity is given in Table 6. The average urease enzyme activity of the 0-0,15% soil samples was found to be the lowest, while the urease enzyme activities determined from the soil samples classified as 0.35-0.65% salt were found to be the highest value. Soil samples taken from pistachio areas are only 0-0,15% and 0.15-0.35% soils. The urease enzyme activity of the 0.15-0.35% saline soils is higher than the 0-0,15% soils.

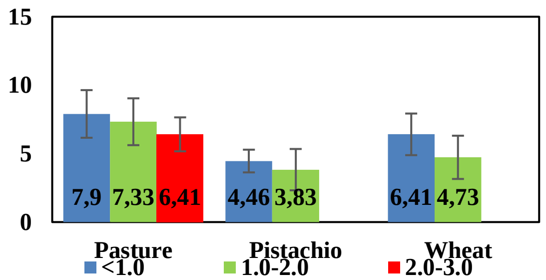


Table 3. Urease enzyme activity according to soil organic matter content (%)

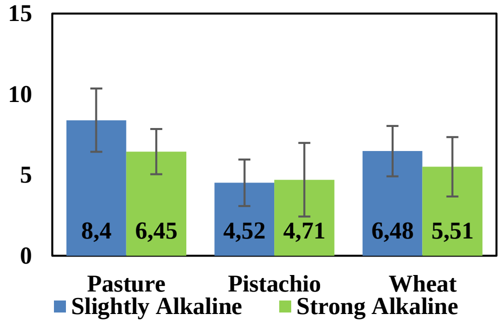


Table 4. Urease enzyme activity according to pH of soils

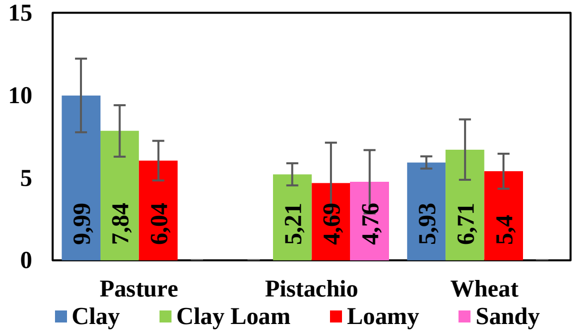
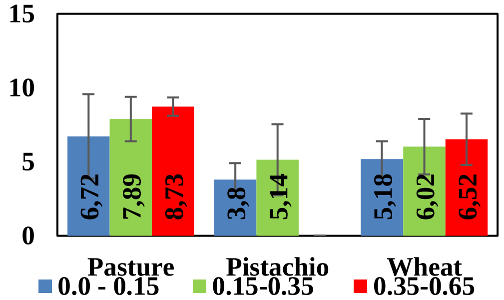


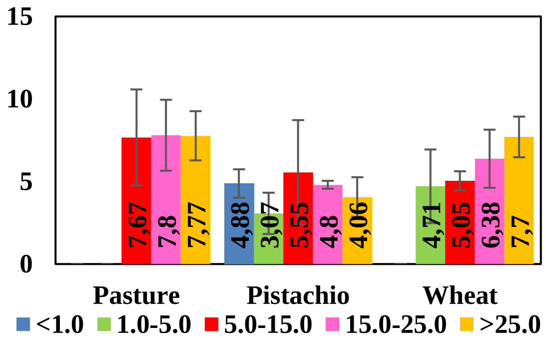
Table 5. Urease enzyme activity according to *soil texture*



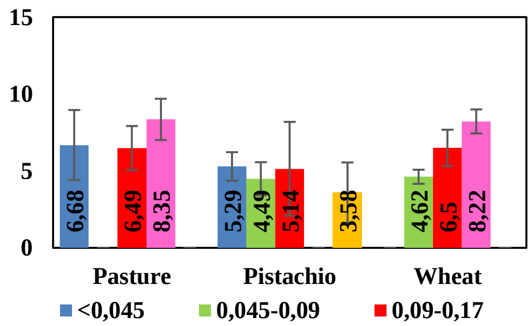
Tablo 6. Urease enzyme activity according to soil salinity (%).

The urease enzyme activities of the soil samples taken according to the lime state are given in Table 7. Soil samples taken from pastures are classified as 5-15% calcareous, 15-25% calcareous and >25% calcareous and all three classes of soil have no visible difference in terms of urease enzyme activity. On the other hand, soil samples from the soil samples taken from the wheat field were determined other than these three class soil samples. In addition, as the lime content increases, the urease enzyme activity increases in the soil samples taken from the wheat field. In the soil samples taken from the pistachio areas, there is no ranking similar to that of the pasture and wheat areas in terms of urease enzyme activity. On the contrary, all urease enzyme activities are completely different. However, the highest urease enzyme activity was detected in the 1-5 % calcareous soils. Again, the lowest urease enzyme activity is in the pistachio soils classified as 5-15%.

Urease enzyme activities in terms of percentage of total nitrogen of soils are higher in pasture soil samples than others (Table 8). It has been found that the urease enzyme activities of the soils classified as 0,09%-0,17% for percentage of total nitrogen (N) are higher than the pistachio soils in pastures and wheat soils and it has been found that the urease enzyme activity soils in pastures and wheat soils is very close to each other for soils. Soils with a high percentage of total nitrogen (N) found in pistachio areas have the lowest urease enzyme activity. However, as the percentage of total nitrogen increased in wheat fields, it was found that the urease enzyme activity of the soils increased. This situation is not available in other agricultural areas.



Tablo 7. Urease enzyme activity according to lime content (%) of soil.



Tablo 8. Urease enzyme activity according to total nitrogen (%) content of soil.

As a result of the statistical analysis, one-way ANNOVA test results are given in Table 9. Significant differences were found between urease enzyme activity and organic matter ($p<0,05$), total nitrogen (N) percentage ($p<0,05$) and soil texture ($p<0,05$) in pasture soils. Also, significant differences were found between urease enzyme activity with organic matter content of the pistachio soils (p <0.05) and significant differences were found between urease enzyme activity with lime content of soil (p <0.005) and total nitrogen (N) percentage in wheat soils. In the pasture soils, soil urease enzyme activities were found to be negatively correlated with the soil pH and found to be positively correlated with the percentage of total nitrogen (N) and the texture of the soil samples (Table 10). However, a positive correlation was found between the urease enzyme activities of the soil samples taken from the wheat fields with lime percentage of the this soils. However, no significant correlation was found between any of the parameters of pistachio soils and soil properties.

DISCUSSION

Soil fertility and quality are important in agricultural applications. One of the most important indicators of soil fertility and quality is the presence and activity of soil enzymes (1,3, 8-11,15-24).

In different agricultural areas, soil urease enzyme activity varies according to the crop and agricultural activities such as irrigation, fertilization, and tillage (Table 2). Differences in urease enzyme activity determined in three different agricultural areas support this proposition. In a study conducted in Spain (45), they found that different enzymes have different activity in different vegetations in soil samples from different areas with different vegetation, similar to the findings of this study. In the studies of Kizilkaya and Dengiz (19), also, the finding that urease enzyme activity in the pastures is higher than in the agricultural areas corresponds with the findings. Kızılkaya and Dengiz (19) explained this situation with the higher content of organic matter in pastures and the loss of the amount of organic matter by agricultural activities. This parallelism between the organic matter contents of soils (Table 1) and the urease enzyme activity supports the description of Kızılkaya and Dengiz (19).

	Pasture	**Pistachio**	**Wheat**
Organic Matter (OM) (%)	**,038 ***	**,000 ***	,078
pH	**,026 ***	,880	,221
Salinity (%)	,370	,184	,622
Lime (%)	,777	,547	**,016***
Total Nitrogen (%)	**,009 ***	,826	**,000***
Texture	**,007 ***	,892	,535

Tablo 9. One-way ANNOVA test results between urease enzyme activities and soil

In this study, urease enzyme activity is decreased in all three areas despite the increase in the amount of organic matter (Table 3). However, in this study, there were significant differences between the organic matter content of soils and the urease enzyme activities of the soils in both pasture and pistachio gardens (p <0.05). It is possible to explain this by the reduction of the pH of the environment as a result of the mineralization of urea in the organic matter rich soil (46). Increasing the soil pH of the organic material addition to the environment (22,28,34) causes an increase in the urea enzyme activity of the soils (7-9,12,14,15,19,23,24,33,35).

	Pasture	**Pistachio**	**Wheat**
Organic Matter (OM) (%)	0,169	0,377	0,085
pH	**-0,586 ****	-0,137	-0,312
Salinity (%)	0,229	0,351	0,308
Lime (%)	0,072	-0,059	**0,677 ****
Total Nitrogen (%)	**0,515 ***	-0,154	0,159
Texture	**0,660 ****	0,071	0,152

Tablo 10. Pearson correlation test results of urease enzyme activities of soils according to different areas (* p <0.05, ** p <0.01)

When the relationships between soil pH and soil urease enzyme activities were evaluated, significant differences were found between soil pH and urease enzyme activity only in pastures (p <0,05). Also, there is a negative correlation between soil pH and urease enzyme activity in pastures. However, as shown in Table 4, urease enzyme activity decreases as alkalinity increases. In line with the findings obtained from this study, Wang et al. (35) reported that urease enzyme activities were affected by varying pH levels and increased urease enzyme activity with increasing soil pH. This result, which will be explained by the fact that enzymes have maximum activity under optimal pH conditions, supports the finding that the maximal pH of the urease enzyme is between 6 and 8 (47).

Similar to the findings of Kizilkaya et al. (11) and Shi et al. (12), a statistically significant difference between the amount of clay and the soil texture with the increase in soil urease enzyme activity (Table 5) only in pasture soils can be explained with more organic matter content in clay soils than in other textures. Also, extracellular enzymes such as urease are adsorbed in the soil by clay and are thus protected against proteolytic enzymes (2,3,8,9,11,13,17,18,28,29,33). The increase in the amount of clay as a result of this situation means the increase of the adsorbed extracellular urease. At the same time, microbial community, which has significant effects on urease enzyme activity, has strong relationships with soil clay (11). A positive correlation between soil texture and urease enzyme activity at $p < 0.01$ is an evidance of increased urease enzyme activity as soil clay content increases. However, this has not been observed in pistachio soils and wheat soils, probably due to the carrying out of agricultural activities such as intensive irrigation, fertilization and tillage ($p > 0.05$). In contrast to the findings of this study, Zornoza et al. (18) found a negative correlation between clay and urease enzyme activity in soil samples taken from areas with natural Mediterranean vegetation in Spain. Also, Küçük and Cevheri (1) found in their study in the corn fields of Şanlıurfa that the urease enzyme activity has a positive relationship with the amount of sand in the soil.

Guangming et al. (24) found a negative relationship between soil salinity and urease enzyme activity. However, this study shows that increased soil salinity increases the urea enzyme activity of soils in all three areas (Table 6). This can be explained by the fact that in the three studied areas it decreases the soil pH due to salinity on the light and strong alkaline soils and therefore brings the urease enzyme activities closer to the optimal pH. Therefore, increased salinity rates in all three areas lead to an increase in urease enzyme activity of soils. In spite of the fact that, Pearson correlation test showed positive non-significant correlations of urease enzyme activities with soil salinity in all three areas, there was no statistically significant difference in the one-way ANNOVA test results in these three areas ($p > 0.05$).

Kızılkaya et al. (11), in his study on alluvial soils in Bafra and Çarşamba plains, also Kucuk and Cevheri (1), in his study on alluvial soil in corn cultivated areas, they reported that soil lime contents have not been effective on the activity of urase enzymes. Kravkaz Kuşçu (15), in his study, found a significant positive correlation between the lime content of soils and urease enzyme activity. In this study, it was found that urease enzyme activities increased significantly as soil lime content increased in only wheat soils. Contrary to these studies, statistically, lime content in wheat soils showed significant differences with urease enzyme activity ($p < 0,05$) and significant correlation between lime content and urease enzyme activity in wheat soils at $p < 0,01$ level according to Pearson correlation test result in this study, the increase in lime content in wheat soils is an evidence that increases the urease enzyme activity. This may possibly be due to the fertilization activities applied in the wheat soils.

Since urease enzyme activity is an important extracellular enzyme involved in the nitrogen cycle in nature, there are many studies suggesting a positive relationship between the total nitrogen (N) content of soils (12,18,22,24,28). In this study, the findings obtained from pasture and wheat soils are consistent with the findings obtained from these studies. Statistically significant differences were found between urease enzyme activity and total nitrogen (N) content of soils in both pastures and wheat soil ($p<0,05$). However, Pearson correlation analysis showed that there was a positive correlation between urease enzyme activity and total nitrogen content only in pastures soils. Since the total nitrogen (N) content of the soil is closely related to the amount of organic matter in the soil, it is expected that the total nitrogen (N) content will be high in soils with high urease activity. This situation is caused by the urease enzyme in the nitrogen (N) cycle. The fact that urease enzyme activities do not show significant differences in the other two areas is likely to mean agricultural activities such as irrigation, soil tillage and losses due to the content of organic matter and nitrogen (N).

CONCLUSIONS

As a result of this study, urease enzyme activities of different agricultural areas were found to be different from each other. It has been found that it has more organic matter and total nitrogen (N) content in pastures soil with the highest urease enzyme activity than pistachio and wheat soil since there are no agricultural activities such as irrigation, soil spreading and fertilization. This causes urease enzyme activities in pastures to be higher than other areas. In addition, urease enzyme activity in pastures changed negatively with the pH of the soils and changed positively with the total nitrogen (N) content and soil texture of soils. However, urease enzyme activity did not have significant correlations with soil parameters studied in pistachio soils. In wheat fields, the urease enzyme activity was found to be positively correlated only with the lime content of the soils.

Although the results of this study contain information that may be useful for producers engaged in agriculture in these areas, detailed studies are needed in this area as urease enzyme activities in agricultural areas vary depending on the product.

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Functions of Dunaliella Salina

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ABSTRACT

Dunaliella salina is able to accumulate a high concentration of β-carotene when it is cultured under certain stress condition such as high salinity, light illumination, and nitrogen starvation. *Dunaliella salina* is a unicellular, photosynthetic, and motile biflagellate green microalga morphologically distinguished by the lack of a rigid cell wall. Biotechnological importance of *D. salina* is reviewed in the present study. *Dunaliella salina* can accumulate significant amounts of valuable fine biochemicals such as carotenoids, glycerol, lipids, vitamins, minerals, and proteins. They also have a large potential for biotechnological processes such as expressing foreign proteins and treatment of wastewaters. *Dunaliella salina,* the halotolerant alga, is well known for its natural β-carotene isomers it can serve as an essential nutrient, antioxidant and anticancer compounds and has high demand in the market. *Dunaliella* powder has been widely used in nutraceutical and pharmaceutical applications. The applications include human health dietary supplements as tablets, capsules, fortified nutritional blends, animal feed, natural pigments and dyes and in cosmetics. As a result, considering these characteristics of *D. salina*, which can be used in various biotechnological fields such as wastewater management programs, design of biosensors, production of new antibiotic substances and biofuel production, market share is expected to grow day by day.

Keywords**:** *Dunaliella salina,* β-carotene, Dietary Supplement, Antioxidant.

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INTRODUCTION

Microscopic algae contain important biological and ecological roles in aquatic ecosystems as well as important nutrients for human health and aquaculture. Under controlled conditions, intense production of algae is made, including pigments, proteins, vitamins and minerals, which are used in the feeding of terrestrial and aquatic organisms (Duru and Yılmaz, 2013; Koray, 2002), in powder feed and in live feed production, in water purification, in the food industry and in the fertilizer source (Borowitzka and Borowitzka, 1992). Many microalgae types are used in industrial biotechnological studies due to the high protein, food, unsaturated fatty acid, beta-carotene, and vitamin. The purpose of this review is to summarize the information on the activities of the *Dunaliella salina*, a class of β-carotene-rich green alga, used in the food industry, pharmacy, cosmetics, medicine, and biomedical research (Ben-Amotz and Avron, 1990) It is also to provide important areas for future research by providing an accessible assessment of the current state of knowledge about the areas of use of this important algal genus.

General Information

Microalgae are photosynthetic prokaryotic (Cyanobacteria) or eukaryotic microorganisms (Hamed, 2017). The nutritional composition of algae contains mainly trace elements including proteins, carbohydrates, lipids and vitamins, antioxidants and trace elements (Gökpınar et al., 2006; Borowitzka and Borowitzka, 1992). All of these algal components are a natural complement to human and animal feed to replace synthetic components or to meet the increasing demands of such components. Increased consumption of animal protein creates a high demand for high-quality fish and animal feed to produce healthy proteins for humans (Borowitzka and Borowitzka, 1992). Microalgae are the source of valuable molecules such as protein, polyunsaturated fatty acids, photosynthetic pigments, and polysaccharides. These molecules are used in many industrial fields (antioxidants, anticancer, hypertension, immunomodulatory, and cardiovascular diseases) such as food, medicine and cosmetics due to their biological activities (Miki, 1991).

Microscopic algae contain important biological and ecological roles in aquatic ecosystems as well as important nutrients for human health and aquaculture. Intensive moss production in controlled conditions; Because of the pigments, proteins, vitamins and minerals they contain, they can be used in the feeding of terrestrial and aquatic organisms, in powder feed and live feed production, in water treatment, in the food industry and as a fertilizer source (Borowitzka and Borowitzka, 1992).

Dunaliella is a single-cell green alga that can accumulate large amounts of β-carotene under stress conditions. Additionally, different species of Dunaliella can accumulate significant amounts of valuable fine chemicals such as carotenoids, glycerol, lipids, vitamins, minerals, and proteins (Borowitzka and Borowitzka, 1992). β-carotene is the most common carotenoid in nature. Carotenoid is a potent antioxidant. Antioxidants have protective effects against cancer, aging, ulcers, heart attack, coronary artery disease. β-carotene has a high economic value and has an industrial application area. The natural food coloring is used in the food industry, as an antioxidant additive in the cosmetic and nutraceutical industry and as an anticancer agent in the pharmaceutical industry. β-carotene is used in the aquaculture industry as a natural colorant for pro-vitamin A and fish tissues for animal feed (Hamed, 2017). β-carotene is used in the food industry, pharmaceuticals, cosmetics, medicine and biomedical researches (Bosma and Wijffels, 2003). The estimated β-carotene market is 10-100 tons/year and its price is 750 Euro/kg (Pulz, 2001).

Taxonomy and Biology of Dunaliella salina

The taxonomic structure of the *Dunaliella* genus is as follows (Algaebase, 2019).

Domain	: Eukaryota
Kingdom	: Plantae
Episode:	: Chlorophyta
Class	: Chlorophyceae
Team	: Chlamydomonadales
Family	: Dunaliellaceae
Species	: *Dunaliella* Teodoresco, 1905
Genus	: *Dunaliella salina* (Dunal) Teodoresco 1905

Dunaliella species belong to phylum Chlorophyta, which belong to the family of Volvocales and Polyblepharidaceae family and are single-celled, photosynthetic and mobile biflagellate microalgae which are morphologically distinguished due to lack of solid cell wall (Ben-Amotz and Avron, 1987). Dunaliella Teodoresco, species of the genus 1905; *Dunaliella salina, D. Minuta, Dunaliella tertiolecta, Dunaliella primolecta, Dunaliella viridis, Dunaliella bioculata, Dunaliella acidophyla, Dunaliella parva and Dunaliella medium* (Borowitzka and Siva, 2007).

Dunaliella spp., Volvocales orders in unicellular, photosynthetic, green microalgae. Cells are between 5-25 3m in length and 3-13 5m in width. Cells typically contain a cup-shaped chloroplast having a central pyrenoid surrounded by starch granules (Ben-Amotz, 1995). All green algae are common in the nucleus, mitochondria, vacuoles, there are organs such as

Golgi apparatus (Ben-Amotz and Avron, 1989).

The cells of dunaliella salina are surrounded by an elastic plasma membrane, swelling or contracting rapidly when exposed to the hypertonic or hypotonic environment (Ben-Amotz and Avron, 1989). This provides an advantage in changing the cell shape and complying with osmotic changes. In this way, it provides osmoregulation by increasing the concentration of glycerol in the cell against extracellular osmotic pressure (Ben-Amotz and Avron, 1990; Ben-Amotz 1993).

Dunaliella species have a wide range of spans because they can adapt to various environmental factors. They are the first producers of salt lakes and evaporation lakes in the salt works around the world (Avron 1992; Shariati and Lilley, 1994).

Dunaliella salina (Chlorophyceae) cells are 9-16 x 5-9 μm in size, circular and ellipsoidal in shape and appear to be printed from the lateral and the bottom (Figure 1). It has two whips, the whip is either the length of the cell or shorter (Çelekli and Dönmez, 2001; Koray, 2002). Unlike other members of Chlorophyta, *Dunaliella* does not have a thick cell wall. The cell is surrounded by a thin elastic membrane. This thin membrane permits rapid changes in cell shape and volume in response to osmotic changes in the environment and prevents cells from exploding due to osmotic pressure (Ben-Amotz and Avron, 1987).

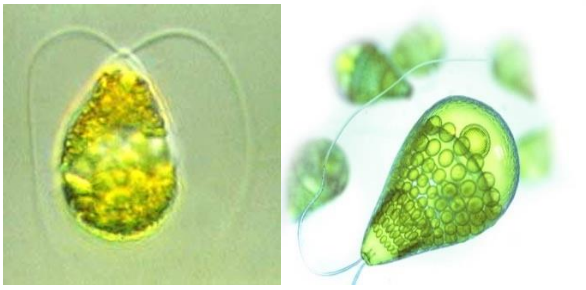

Figure 1: Microscopic view of *Dunaliella salina* (Oren, Aharon 2005).

Cells are only surrounded by an elastic plasma membrane, swelling or contracting rapidly when exposed to the hypertonic or hypotonic environment. This provides an advantage in changing the cell shape and complying with osmotic changes. Thus, this type of life in the salt, the extracellular osmotic pressure in the cell increases the concentration of glycerol osmoregulation (Avron, 1992; Shariati and Lilley, 1994).

They multiply by lengthwise division. The volume of the organism increases before the cells are divided, the number of whips doubles and the cells are divided. They may be present in the form of aplonospores (cysts) in conditions such as changes in ambient conditions, salinity degradation or drying of the environment (Borowitzka and Siva, 2007). In *Dunaliella* species, sexual reproduction is carried out by conjugation with isogamy. The zygote is surrounded by a thick and soft cell wall in green or red. After the resting phase, the cell wall of the zygote explodes and 2, 4, 8 or 16 sibling cells are released (Borowitzka and Siva, 2007).

Dunaliella is a genus of green algae with a single cell, two flagella, no cell wall. The genus Dunaliella was first described by Teodoresco (1905) on the basis of D. salina obtained from the Salt Lake of Romania (Ben-Amotz, 1980). This description is given by M.F. In honor of Dunal. For the first time in 1837, Dunal was the scientist who said that the red color in the Montpellier Salt Pitch came from algae. (Ben-Amotz et al., 1983).The Dunaliella genus contains fewer species that can accumulate large amounts of β-carotene and glycerol in high light intensities, high salt concentrations, and exposure to oxygen and nitrogen-restricted conditions (Ben-Amotz and Shaish, 1992). D. Salina is an algal species that can accumulate β-carotene for up to 14% of dry weight. (Aasen et al., 1969). The countries engaged in β-carotene trade by establishing a Dunaliella salina production facility are Australia, the US and China (Borowitzka, 1990; Ye et al., 2008). In some countries, such as Chile, Iran, Kuwait and Spain etc, pilot-scale projects are being tried. (Del Campo et al., 2007; Hosseini Tafreshi and Shariati, 2006).

Dunaliella is a genus that can accumulate large amounts of β-carotene and glycerol when exposed to high light intensities, high salt concentrations, oxygen and nitrogen limited conditions. (Ben-Amotz et al., 1983). The most commonly used species for the production of β-carotene are *Dunaliella salina and Dunaliella Bardavil.* Various studies have shown that both species can produce more than 10% of dry weight. Lutein, chlorophyll, other pigment and carotenoids are produced by *Dunaliella* species, under the same stress and environmental conditions (Ben-Amotz and Avron, 1987).

Dunaliella salina is an important organism in terms of extracellular glycerol secretion, beta-carotene accumulation in the cell and high protein content. The level of glycerol released is related to the concentration of salt in the medium. High salt concentration, such as 3 M NaCl, contains 40% glycerol (Ben-Amotz et al., 1987).

Adverse environmental conditions, especially high irradiance, high salt concentration, stressful temperatures, and/or nutrient deficiency can stimulate the production and accumulation of β-carotene in oil globules within the algal chloroplast (Çelekli and Dönmez, 2006). The accumulation of β-carotene by this halotolerant green alga can be enhanced up to about 10–14% of algal dry weight (Lamers et al., 2012; Prieto et al., 2011). Consequently, the color of *Dunaliella* cells changes from green to orange under adverse cultivation conditions. This massive accumulation of βcarotene seems to be related to the protection mechanism against photoinhibition (Prieto et al., 2011).

Dunaliella salina is the best known natural β-carotene source (Ben-Amotz, 1980). β carotene; It has been determined that it works in the collection of free radicals, protection of the cell against harmful rays, regulation of immunity and especially the prevention of cancer as a potential antioxidant (Çelekli and Dönmez, 2001). *Dunaliella salina* also contain valuable carotenoids such as alpha carotene, violaxanthin, neoxanthine, zeaxanthin and lutein (Aasen et al., 1969).

In addition, *Dunaliella* is a single-cell green alga that can accumulate large amounts of β-carotene under stress conditions (Figure 2). β-carotene is the most common carotenoid in nature. Carotenoid is a potent antioxidant. Antioxidants have protective effects against cancer, aging, ulcers, heart attack, and coronary artery diseases. β-carotene has a high economic value and has an industrial usage area. The natural food coloring is used in the food industry, as an antioxidant additive in the cosmetic and nutraceutical industries and as an anticancer agent in the pharmaceutical industry. β-carotene is used in the aquaculture industry as a natural colorant for pro-vitamin A and fish tissues for animal feed. *Dunaliella* species can be shown as the main source of β-carotene (Ben-Amotz and Avron, 1987).

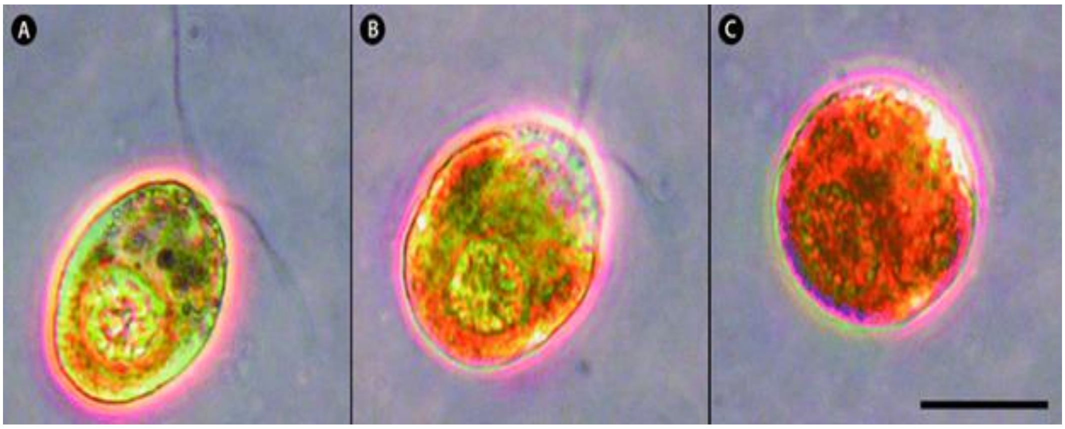

Figure 2: *Dunaliella salina* cells under different culture conditions. Scale bar;10 µm (Photos Dr. M. Aksoy). (A) Non-stressed green cell; (B) Stress under stress; the cell turns orange; and (C) β-carotene deposition due to stress.

Dunaliella salina distribution and ecology

Dunaliella salina is one of significant commercial microalga; it can yield three major valuable products, β-carotene, glycerol, and proteins (Çelekli and Dönmez, 2006; Ben-Amotz, 2009). Commercial production of *D. salina,* as a source of β-carotene, has become a major microalgal industry in Australia, Israel, and Mexico since the 1980s (Borowitzka, 1999). β-carotene demand has been increased as a food coloring agent, a provitamin-A in food supplement, animal food, antioxidant, an additive to cosmetics, and a multivitamin preparation (Ben-Amotz, 2009).

Today, commercial production of β -carotene from *Dunaliella* species is carried out in Israel, USA, Australia, Spain, and China. Numerous studies have been carried out on the biology of this organism producing industrially important β-carotene and glycerol (Ben-Amotz and Avron, 1980, Ben-Amotz et.al, 1983). In Turkey especially is almost no studies on microbial roads β-carotene production for industrial purposes. The production of lake waters for industrial purposes will increase the use of the lake in Lake Tuz, which has important contributions to the economy of Turkey. However, it is necessary to isolate and purify the *Dunaliella* species found in the lake and to determine the production capacity of β-carotene (Çelekli and Dönmez, 2001).

Dunaliella salina is known as the most halophilic species (Borowitzka and Borowitzka, 1992). The mean cell numbers (nx10^4 cells/ml) of *D. salina* microalgae in different salinity concentrations are shown in Figure 3.

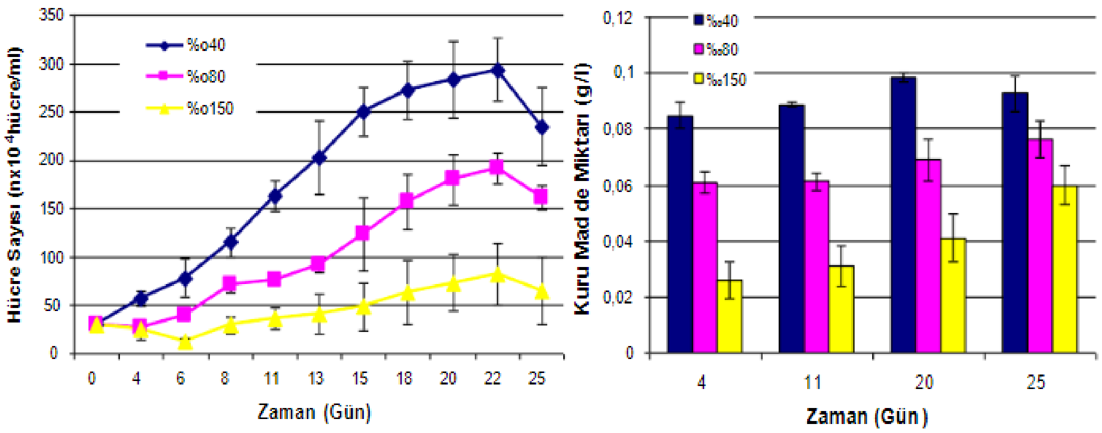

Figure 3. The variation in average cell number and dry weight of *Dunaliella salina* at different salinity (Doç. Dr. Yaşar DURMAZ)

It is known that *Dunaliella* species can survive in environments between -35 °C and 40 °C

(Ben-Amotz, 2004). It has been reported that *D.salina* continues its photosynthetic activity up to -8 °C (Borowitzka and Borowitzka, 1992).

Many living cells cannot tolerate salt concentrations exceeding 15%. Only organisms that have developed an osmotic regulation mechanism can adapt to such environments. Photosynthetic Dunaliella salina is one of such organisms and can survive at very large (5%-35%) NaCl concentrations (Borowitzka and Borowitzka, 1992).

The overgrowth of *D. salina* is called algal bloom. Algal bloom is a phenomenon of a certain type of algal blooms in a certain region. Salinity is increasing due to the decrease of water in shallow areas. The density of the salinity of *D. salina* is also increasing. *Dunaliella salina* increases its cell number in the summer season, causing reddish environment (Figure 4). This phenomena dissapates in fall, winter, and spring seasons (Çelekli and Dönmez, 2001)

Figure 4: The reddish color from Lake Tuz in June 2017 (Photograph: Prof. Dr. Abuzer Çelekli, 2002).

Biochemical composition of *Dunaliella salina*

Dunaliella contains a series of carotene xanthophylls such as chlorophyll a, b, and β-carotene, α-carotene, cis-in carotene, lutein, violaxanthin, zeaxanthin and neoxanthine (Borowitzka and Borowitzka 1992). *Dunaliella Salina* contains a high proportion of protein. The chemical composition of *Dunaliella salina* is shown in table 1.

Table 1: Biochemical composition of *Dunaliella salina*

Organic matter	**%**
Protein	10-57
Carbohydrate	10-32
Lipids	7-30
Ash Content	5-7
Nucleic Acid	6-7
Chlorophyll	0,01-6
Carotenoids	0,03-10

The major carotenoid group contains β-carotene, including α-carotene, lutein and lycopene. 86.5% of the total carotene content consists of β-carotene. Fat-soluble pigments such as β-carotene sweep free radicals and reduce the oxidative stress on the intracellular membrane structures of ROS (Reactive oxygen species), in particular, because of their lipophilic nature. In addition, catalase, peroxidase and superoxide dismutase liver enzymes such as re-repair (Borowitzka and Borowitzka, 1988a).

Carotenoid induction

β-carotene is a yellow-orange colored pigment that is oil-soluble but emulsified in aqueous solutions. The species of *Dunaliella*, known as the best source of carotenoid, is *D. salina* and *D. bardawil*. *Dunaliella salina* produces β-carotene more than 14% of its dry weight (Borowitzka and Borowitzka, 1992). β-carotene is the first commercially produced product by *Dunaliella salina* (Gomez et al., 2003).

Nowadays, β-carotene has been found to have many positive effects on human health and β -carotene has been defined as the most commonly used pigment in the world as a food colorant (margarine, cheese, fruit juices, dairy products (Ben-Amotz and Avron, 1990).

It was determined that β-carotene works to collect free radicals, to protect the cell against harmful rays, to regulate immunity and especially to prevent cancer as a potential antioxidant (Çelekli and Dönmez, 2001).

The most common carotenoid is β-carotene and its main source is the genus *Dunaliella (D. salina* and *D. bardawil*). β-carotene is a lipophilic high-value compound, accumulated as lipid globules in the interthylakoid spaces of the chloroplasts in *Dunaliella* (Raja et al., 2007). β-carotene synthesis increases after inducing stress to protect the cell from free radicals. In fact, due to its antioxidant property, it quenches excessive free radicals, restoring thereby the physiological balance (Ben-Amotz and Avron, 1990). It has a wide variety of market applications in the food industry as a natural food coloring agent, in cosmetics and nutraceutical industries as an antioxidant additive, and in pharmaceutical industries as an anti-cancer compound. Additionally, β-carotene has been used in aquaculture feed industries as a natural colorant for fish tissues and as pro-vitamin A for animal feed (Ben-Amotz and Avron, 1990).

In order to maximize β-carotene production per unit time, different methods can be applied by using different standards (Borowitzka and Borowitzka, 1990; Garcia-Gonzalez et al., 2003). These strategies are based on the observation of severe conditions such as high salinity, low nutrient levels and high radiation, retardant growth, as well as high temperatures that trigger the production of β-carotene in the cell. In fact, the higher the stress density and the slower the growth rate of the result, the greater the total amount of light absorbed by the cell during a division cycle. This can lead to higher - ro carotene accumulation per cell. However, these conditions also reduce the number of cells per unit culture volume by affecting cell viability (Ben-Amotz et al. 1983).

Usage Areas of *Dunaliella salina*

Dunaliela salina, as well as being the source of red pigmentation β-carotene, is demanded natural food coloring, nutritional supplements, high cosmetic products. In addition, anti-oxidant effects and vitamin A as a source of feed for humans and animals or nutrients are produced for the purpose (Borowitzka and Borowitzka, 1988a). Nutrient composition values of some human foods and dry weight of different algae are shown in Table 2.

Table 2. Nutrient composition of some human foods and dry weight of different algae (Razzak, 2013)

Food Type	**Protein**	**Carbohydrates,**	**Lipids**
Bread yeast	39	38	1
Milk	43	1	34
Rice	26	38	28
Soybean	8	77	2
Meat	37	30	20
Chlamydomonas rheinhardii	48	17	21
Chlorella vulgaris	51-28	12-17	14-22
Dunalielle salina	57	32	6
Spirulina maxima	60-71	13-16	6-7
Scenedesmus obliguus	50-56	10-17	12-14
Synechococcus sp.	63	15	11

Today, Australia and Israel produce 1000 tons of dry *Dunaliella* biomass per year. β-carotene produced is used for medical purposes (Ben-Amotz et al. 1983).

Studies have shown that carotenoids have antioxidants, anticarcinogens, and immunosuppressive properties. β-carotone protects against radical cell damage responsible for premature aging, cataracts, cardiovascular diseases and other chronic diseases. Carotenoids with provitamin A activity are α, β, γ carotene and cryptoxanthin (Borowitzka and Borowitzka, 1989). Zeaxanthin and lutein pigments from *D. salina* (Chlorophyceae). Presently, *D. salina*, one of the most important commercial species in β-carotene production, can survive in saturated NaCl solution and accumulate more than 40% glycerol and dry beta-carotene over 40% by dry weight. Today, there are commercial *Dunaliella* culture industries established in Israel and Australia (Figure 4) to produce glycerol and beta-carotene (Borowitzka and Borowitzka, 1988b).

Figure 4: *Dunaliella salina* culture industries established in Israel and Australia (Prof. Kirsten Heimann)

In Australia, the production facilities of β-carotene source *D. salina* üretim have become the third largest microalgae industry in commercial production after the establishment (Çelekli and Dönmez, 2001). USA, Japan, Israel, South Korea, Australia and China it can be produced commercially by mixing in open, shallow and wide circular pools without any artificial mixture (Ben-Amotz et al. 1983).

In the study by Tojo and Lee (1989), some carotenoids were found to inhibit tumors caused by UV light and chemicals. In addition, it has been found that they increase the immune response, have high antioxidant activity and protect the skin against damage caused by UV light (Borowitzka and Borowitzka, 1992).

Dunaliella salina is used in aquariums and coral farms to enhance and enhance the natural colors of soft and hard corals (Ginzburg et al. 1985).

The flamingos are fed by the articular salina we call *Artemia salina*. The food source of *Artemia salines* is *Dunaliella salina*. As the salinity increases, the number of *D. salina* is naturally increased, and is naturally found in the food chain of some organisms such as flamingos (Lers et al. 1990; Borowitzka and Borowitzka,1992).

In aquaculture, as a source of nutrients for many fish and crustaceans, carotenoids, minerals, vitamins and fatty acids are of great importance. *Mahi mahi* (dolphin), *Seriola* sp., *Latridides* sp., *Lates* (Asian perch), Clownfish, including; Crustaceans, Rock lobster, *Panulirus* sp., bay insect, Thenus and Ibacus sp. It is a source of food for many living things (Borowitzka and Borowitzka, 1988a).

Recent studies have shown that β-carotene reduces the risk of heart disease and controls the amount of cholesterol in the blood. It is used to thicken the color of b-carotene, chicken meat and egg yolk added to animal feed. β-caroten is used in pharmacology and cosmetics. It is also recommended to use it as human food and animal feed by drying the direct biomas (Borowitzka and Borowitzka 1992).

In the food sector, β carotene is used in the coloring of nutrients and preserving the color of fruit juices. In 1989, more than 100 tons of β -carotene was used for this purpose in the world. β carotene, fish (salmon, trout), shellfish and poultry meat and egg yolks are also mixed in feeds for coloring (Lance 1991).

For commercial production of glycerol other than β-carotene, *Dunaliella* species are used. Glycerol esters are used in the food industry to produce various fatty acids. Glycerol works in microalgal osmoregulation by adapting it to high saline environments. It forms the main skeleton of the phospholipids in the cell membrane, especially in the cell membrane. For the commercial production of glycerol, *Dunaliella* culture studies continue (Borowitzka and Borowitzka, 1992).

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The Effects of Increasing Vermicompost Applications on Some Biological Properties of Radish (*Raphanus Sativus* L.) cv. 'Cherry Belle' Plant

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ABSTRACT

Radish, *Raphanus sativus* L. are cool season, fast maturing, easy to grow annual or biennial herbaceous plants grown for their roots. Different radish variety are cultivated almost all year round throughout Turkey and often produce roots, and radish production in Turkey is approximately 200.000 tons annually according to 2018 statistics data. The study was done to determine the effect of increasing vermicompost applications on some biological growing parameters of radish (*Raphanus sativus* L.) cv. 'Cherry Belle' (8TR-17 variety) plant. In addition, the efficacy of NPK fertilizer application with vermicompost was also investigated. According to the pot experiment results, important increases in some biological properties of radish plant were determined with increasing vermicompost applications. The average root diameter were determined between 2.08 - 2.56 cm; fresh root weight changed between 29.83-59.83 g/pot; fresh leaf weight changed between 18.48-77.43 g/pot; leaf length changed between 14.13-23.45 cm; leaf number changed between 6.70-8.44 cm; root length changed between 2.89-4.14 cm and chlorophyll SPAD value changed between 37.70-47.54. Application of vermicompost had a positive and statistically significant effect on growing of radish ($P<0.05$ and $P<0.01$). There was no statistically significant difference between fertilizer applications.

Key words*: *Radish, vermicompost, biological growing parameters.

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ÖZET

Turp, *Raphanus sativus* L. kökleri için yetiştirilen tek yıllık veya iki yıllık olan, kolayca yetişebilen, hızlı olgunlaşan bir serin iklim otsu bitkisidir. Türkiye genelinde hemen hemen tüm yıl boyunca farklı turp çeşitleri ekilir ve çoğu zaman kök üretir ve Türkiye'de turp üretimi 2018 yılı verilerine göre yıllık yaklaşık 200.000 tondur. Çalışma artan oranlarda vermikompost uygulamalarının 8TR-17 çeşiti fındık turpun (*Raphanus sativus* L.) bazı biyolojik gelişme parametrelerine etkisinin belirlemek için yapılmıştır. Çalışmada aynı zamanda vermikompost ile NPK'lı gübre uygulamasının etkisi de incelenmiştir. Saksı denemesinden elde edilen sonuçlara gore; turp bitkisinin bazı biyolojik özelliklerinde,artan vermikompost uygulamaları ile önemli artışlar belirlenmiştir. Ortalama kök çapı 2.08 - 2.56 cm; taze kök ağırlığı 29.83 - 59.83 g / saksı; taze yaprak ağırlığı 18.48 - 77.43 g / saksı; yaprak uzunluğu 14.13 - 23.45 cm; yaprak sayısı 6.70 - 8.44 cm; kök uzunluğu 2.89 - 4.14 cm ve klorofil SPAD değeri ise 37.70 - 47.54 arasında değişmiştir. Vermikompost uygulaması turpun gelişimi üzerinde olumlu ve istatistiksel olarak anlamlı bir etki göstermiştir (P <0.05 ve P <0.01). Gübre uygulamaları arasında ise kontrole kıyasla istatistiksel olarak anlamlı bir fark bulunmamıştır.

Anahtar Sözcükler: *Turp, vermikompost, biyolojik gelişim özellikleri.*

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INTRODUCTION

Radish (*Raphanus sativus* L.) belongs to the family of Brassicaceae (Cruciferae) and it is usually consumed as fresh in various countries. Different parts such as root, seeds, leaves of due to the medical effects is used for human health. Radish is rich in terms of vitamin C, folic acid and potassium, is also a good source of B6, riboflavin, magnesium and calcium (Zohary and Hopf, 2000: 18). The consumption as fresh is common in our country. It is one of the plants that can be considered as functional food. It is eaten raw without being cooked, has nutritious properties. The components in the radish consumed as an appetizing vegetable in meals also have a high medical quality (Akan et al., 2013: 1). The root portions consumed in radishes are different in shape, color and size and have names like hazelnuts, chestnuts, red and horseradish according to their appearance (Vural et al., 2000: 15).

When examined annual production amount since 2002 in Turkey; total radish production, which was 21.282.000 tons in 2002, has increased over the years and reached to 25.430.915 tons according to 2017 data. The most cultivated variety in our country is red radish (TÜİK, 2017: 11), and the total cultivation area is 65.248 da (TÜİK, 2018: 12). The radish production of our country is concentrated especially in provinces such as Osmaniye, Ankara, Kahramanmaras, Hatay, Icel and Konya (TÜIK, 2011: 13).

Although radish is cultivated almost everywhere, clayey or clay loamy soils affect the plant root development negatively. Compared to only the use of chemical fertilizers; the application of organic fertilizer, vermicompost, compost, bio-fertilizers and also the uses of low-doses chemical fertilizer with organic fertilizer have increased the production parameters and dry matter production of radishes (Subramani et al., 2010: 14, Imthiyas and Seran, 2015: 6, Kiran et al., 2016: 7). Intensive use of inorganic fertilizers meets the need for plant nutrients, but this can lead to pollution problems in the soil and water over time due to the washing effect. It is known that the addition of organic fertilizer to the soil has a positive effect in order to reduce the negative effect of inorganic fertilizers and improve soil physical properties.

In this study, the effect of the use of vermicompost in different ratios as a source of organic matter and also the effect of traditional fertilizer application (NPK and trace element) with vermicompost were investigated on the growing parameters of radish.

MATERIALS AND METHODS

The experiment was arranged according to the coincidence plot trial pattern in the greenhouse environment. The soil used in the pot experiment was taken from 0-20 cm depth from the land of Sarıcalar Application and Research Farm of Agricultural Faculty of Selçuk University. The soil, which was air dried, was sieved by a 4 mm sieve, weighed and filled in pots (2.7 kg dry soil / pot). The soils were analyzed. Particle size analysis was done by the hydrometer method (Gee and Bauder, 1986: 5), soil pH was measured in H_2O (1:2.5 soil: water), $CaCO_3$ content (using Scheibler calcimeter). EC was determined directly on the saturation paste. Organic matter was determined using a modified Walkley-Black procedure (Walkley and Black, 1934: 16). Soil available P was determined by the Olsen sodium bicarbonate procedure (Olsen and Sommers, 1982: 9). The DTPA soil test of Lindsay and Norvell (1978: 8) was used to determine Fe, Zn, Mn, and Cu contents of the soil. The pH of the test soil is 8.14, EC is 455 mS / cm, the lime content is 13%, the organic matter is 3.78% and the texture is silty clay. Ca, Mg, K, P content of the soil are 3525, 333, 790 and 16.25 mg / kg respectively. The contents of Zn, Fe, Cu and Mn are 0.51, 4.84, 1.70 and 27.36 mg / kg, respectively. The vermicompost obtained from a special company was applied to the pots as 4 doses (0% - 2.5% - 5% - 10%)(V_0-$V_{2,5}$-V_5-V_{10}). Some features of the vermicompost used in the experiment are presented in Table 1. In addition to the different doses of vermicompost also NPK fertilizer (9 kg N / da, 4 kg P_2O_5 / da and 9 kg K_2O / da) and NPK + trace element fertilizer (specified 9.4.9 ratios + 0.5 kg Zn + 0.5 kg Fe + 0.5 kg Mn + 0.5 kg Cu / da) were applied (Figure 1).

Radish variety	Vermicompost (%)	Vermicompost+ NPK	Vermicompost+ trace elements(te)	NPK+
8TR-17	V_0	V_0+NPK	V_0+NPK+te	
	$V_{2,5}$	$V_{2,5}$+NPK	$V_{2,5}$+NPK+te	
	V_5	V_5+NPK	V_5+NPK+te	
	V_{10}	V_{10}+NPK	V_{10}+NPK+te	

Figure 1. Experiment plain

The trial was experimented in a total of 36 pots as 3 replications. In the experiment was used as test plant 8TR-17 varieties of radish. Radish seeds were uptake from Eskişehir Transitional Zone Agricultural Research Institute. The seeds were sown in pots on December 13, 2017 and the water needs of the plants were met by taking into account the soil moisture condition and the need of the plant. When the root development was completed at the end of 70 days, the plants were harvested in February 2018. Chlorophyll SPAD measurement was determined with Minolta 502 before harvest. Fresh root weight, fresh leaf weight, leaf length, root diameter, and root length were determined after harvest. The results obtained from the greenhouse experiment were compared by using the variance analysis and Tukey tests by using MINITAB package programs.

Vermicompost	Content
Total Organic Matter(%)	46
Total Humic Fulvic Acid(%)	32
Total CaO (%)	3
Water Soluble K_2O (%)	1
Total P_2O_5 (%)	1
Total N(%)	2
Organic Carbon(%)	23
Moisture (%)	20
pH	6-8
EC (ds/m)	5.0

Table 1. Some features of vermicompost used in the experiment

RESULT AND DISCUSSION

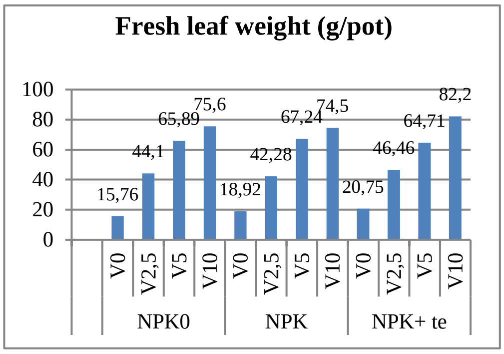
The effect of vermicompost applications, which are mixed with soil in different ratios, on plant growth parameters is presented in Table 2. As can be seen from the table, there was a significant increase in all growth parameters compared to the control with vermicompost applied in increasing rates (P <0.01).The average fresh root weight was 29.83 g / pot at control treatment, while at V_5 application was the 59.83 g/pot. Fresh leaf weight increased with increasing vermicompost application and reached the highest value with 77.43 g/pot at V_{10} dose. Leaf length, root diameter, root length and chlorophyll content were also increased with increasing applications of vermicompost. In the study, vermicompost had a significant and positive effect on plant growth parameters (P <0.01).

The vermicompost application to the sand environment increased linearly the harvest weight of the radish plant. It has been reported that 100% vermicompost treated soils were received 10 times more product than those treated with 10% vermicompost (Buckerfield and Webster, 1998:3). In another experiment on red radish, it was determined that vermicompost inhibited germination at the beginning, then increased plant growth with diluted extract applications and increased red radish harvest by 20%. The addition of high amounts of vermicompost inhibits growth due to its high salt content and excessive nutrient content (Buckerfield et al., 1999: 4). The radish leaves grown in the mixture of vermicompost and peat have better water retention capasity compared to the control plants (Alsina et al., 2013: 2), and the highest yield is obtained with 10 ton / ha vermicompost + 120 kg / ha N (Prabhakar et al., 2011: 10); it has been reported that the administration of vermicompost significantly supports the growth of the radish root and the transfer of the assimilation products from the shoots to the roots, and the increasing application rates of vermicompost significantly increase the various antioxidant substances including nutrients, soluble sugars, soluble proteins, amino acids and flavonoids, total phenolics and vitamin C. (Zohary and Hopf, 2000: 18) .

Vermicompost	Fresh root weight (g/pot)	Fresh leaf weight (g/pot)	Leaf length (cm)	Root diameter (cm)	Root length (cm)	Chlorophyll content SPAD
V0	29,83 c	18,48 d	14,13 c	2,08 b	2,89 b	37,70 c
$V_{2,5}$	44,99 b	44,28 c	19,30 b	2,24 ab	3,77 ab	43,16 b
V_5	59,83 a	65,95 b	23,45 a	2,56 a	4,14 a	46,00 ab
V_{10}	55,71 ab	77,43 a	23,42 a	2,43 ab	3,90 a	47,54 a

Table 2. The effect of the application of increasing rates vermicompost on some biological parameters of radish plant 8TR-17 (*n = 3; **p<0.01)

When compared with vermicompost applications and NPK and NPK + trace element applications, it was observed that there was no significant difference in the development parameters of fertilizer application (Figure 2,3,4 and Photo 1,2,3). This situation is related to the sufficient P, K, Ca, Mg, Fe, Cu and Mn contents of the soil used in the study. Additional inorganic fertilizer application did not create a significant difference in plant growth. As the application of vermicompost on study soil, which has silty clay texture, has a positive effect on soil physical properties, plant and root development have been good.



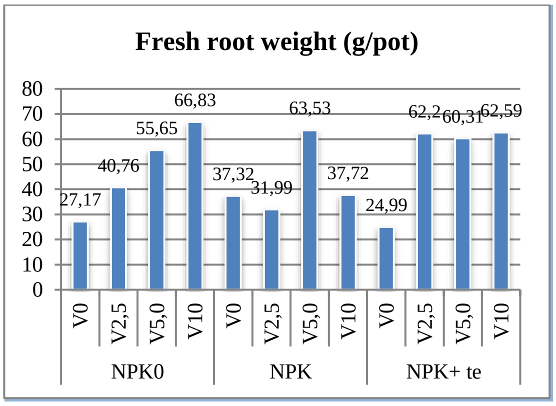


Figure 2. The effect of chemical fertilizers and increasing amounts of vermicompost on fresh root and leaf weight of radish plant 8TR-17 (n = 3)

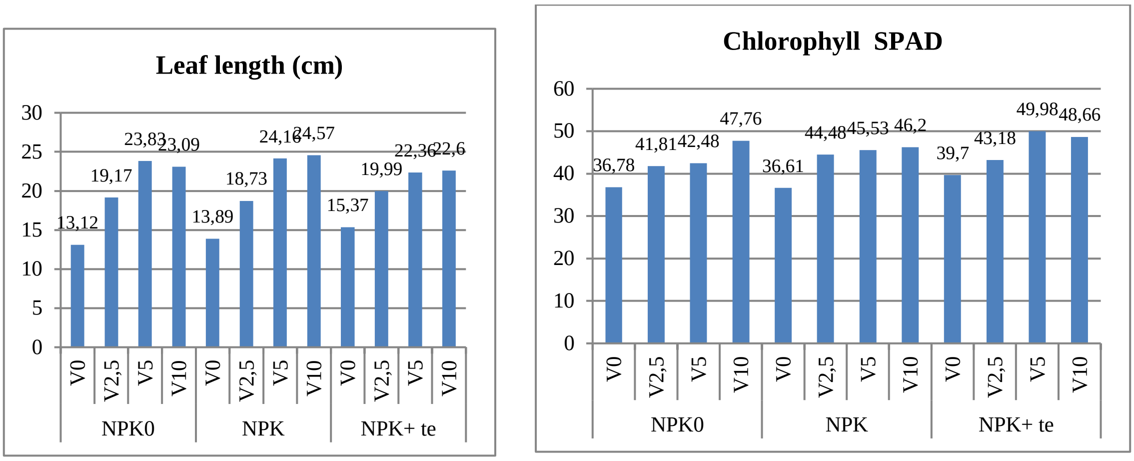


Figure 3. The effect of chemical fertilizers and increasing amounts of vermicompost on leaf length and clorophyll SPAD value of radish plant 8TR-17 (n = 3)

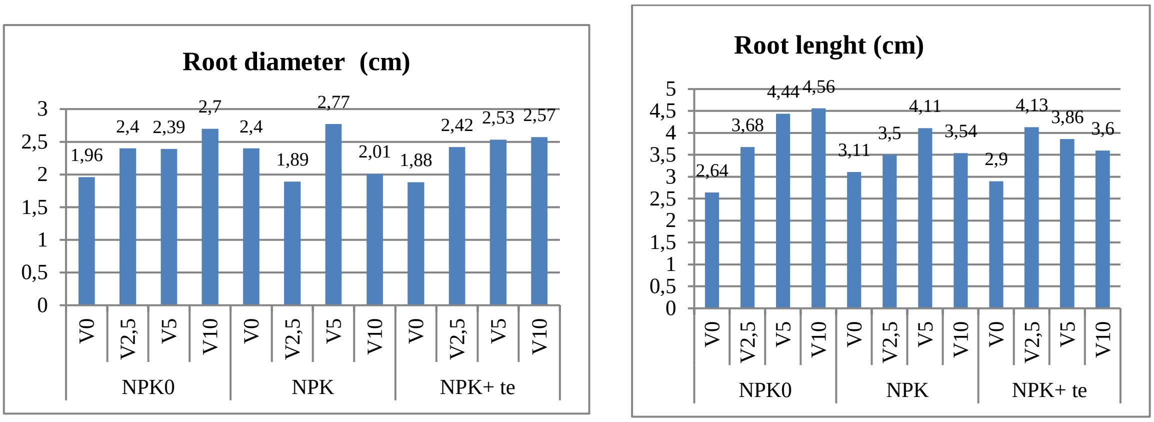


Figure 4. The effect of chemical fertilizers and increasing amounts of vermicompost on root diameter and root length of radish plant 8TR-17 (n = 3)

Photo 1,2. The effect of vermicompost and chemical fertilizer on growing of radish plant 8TR-17

Photo 3. The effect of vermicompost and chemical fertilizer on growing of radish plant 8TR-17

As a result, total fresh root weight was highest in 10% vermicompost application and 5% in vermicompost application. In this case, if the nutrient content in the soil is sufficient, it may be advisable to mix vermicompost into the growing medium at a dose of 5%, because it is more economical than 10% in radish cultivation.

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Use of Diatoms As Biological Indicator

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ABSTRACT

Deterioration of ecological water quality in natural water resources has increased throughout the world due to the loads of wastes resulting from excessive demographic change and industrial effluent into receiving waters. Millions of people around the world cannot supply clean water. Studies that reveal the ecological status of freshwater ecosystems are of great importance for improving water quality. Ecological quality of surface waters is assessed by the use of five aquatic bio-indicator organisms (diatoms, phytoplankton, macrophytes, benthic invertebrates, and fish) with the requirements of the European water framework directive (WFD). Turkey is one of the candidate countries for membership of the WFD directive implementing the EU harmonization process. Diatoms, a tremendously diverse group of phytobenthos with 100000 taxa linkage in biogeochemical cycles, can be sampled from almost all aquatic habitats throughout the year. Rapid, sensitive, and robust responses of diatom assemblages to changes in the aquatic ecosystems makes them an ideal ecological indicators of water bodies for the assessment ecological status of surface waters. The use of diatoms as a bioassessment tool for the ecological quality of running waters is getting more interest in order to achieve environmental sustainability, which supports ecosystems balance and biodiversity. Several diatom indices such as Trophic Index, Eutrophication and/or Pollution Index-Diatom, Specific Pollution Index, and Trophic Diatom Index have been developed for the evaluation of running waters ecological status. Research on the limnoecolog of diatoms in Turkey can be important due to the still poor knowledge, despite intensive research conducted in the last decade. Recently, a new trophic diatom index called Trophic Index Turkey was developed in Turkey, dedicated to the Anatolia catchment and Mediterranean region to evaluate water quality using diatoms.

Key words**:** Biological indicator, Diatom, European Water Framework Directive

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Özet

Dünya genelinde yüzey sularındaki su kalitesinde bozulma, aşırı demografik değişim ve alıcı sulara endüstriyel atıkların deşarjı nedeniyle atık sular dünya genelinde artmıştır. Dünyadaki milyonlarca insan temiz su sağlayamıyor. Tatlı su ekosistemlerinin ekolojik durumunu ortaya koyan çalışmalar su kalitesini geliştirilmesinde büyük önem taşıyor. Yüzey sularının ekolojik kalitesi, Avrupa su çerçeve direktifinin (SÇD) gereklilikleri olan suda yaşayan beş biyolojik indikatör organizmanın (diyatomeler, fitoplankton, bentik omurgasızlar, makrofit ve balık) kullanılmasıyla değerlendirilmektedir. Türkiye, AB uyum sürecini uygulayan SÇD direktifinin üyeliği için aday ülkelerden biridir. Biyojeokimyasal döngülerde 100000 takson olan muazzam çeşitlilikteki bir fitobenthos grubu olan diyatomeler, yıl boyunca neredeyse tüm su habitatlarından örneklenebilir. Diyatome gruplarının su ekosistemlerindeki değişikliklere hızlı, hassas ve sağlam tepkileri, yüzey sularının ekolojik durumunu değerlendirmek için su kütlelerinin ideal ekolojik göstergeleri olmasını sağlamaktadır. Diyatomelerin akan suların ekolojik kalitesi için bir biyolojik değerlendirme aracı olarak kullanılması, ekosistemlerin dengesini ve biyolojik çeşitliliği destekleyen çevresel sürdürülebilirliği sağladığı için daha fazla ilgi çekmektedir. Trophic Index, Eutrophication and/or Pollution Index-Diatom, Specific Pollution Index, and Trophic Diatom Indexgibi çeşitli diyatomeindeksleri, akarsuların ekolojik durumunun değerlendirilmesinde geliştirilmiştir. Son on yılda yapılan yoğun araştırmalara rağmen, Türkiye'nin diyatom florası ile ilgili araştırmalar halen yetersiz nedeniyle önemli olabilir. Son zamanlarda, Türkiye'de Trofik İndeks Türkiye adında yeni bir trofik diyatome indeksi Anadolu ve Akdeniz bölgeleri için geliştirildi ve diyatomeler kullanarak su kaynaklarını kaliteleri değerlendirilmiştir.

Anahtar Kelimeler: Avrupa Su Çerçeve Direktifi, Biyolojik indikatör, Diyatome

INTRODUCTION

Freshwater on the Earth is about just 3% with low concentrations of salts and the remaining 97% resides in the ocean (Figure 1). Of freshwater, 69% resides in the vast glaciers and ice sheets of Greenland, 30% underground, and less than 1% are located in rivers, lakes, and swamps (Inglezakis and Poulopoulos, 2006). Only about one percent of the water on the Earth'surface is usable by humans, and 99% of the usable quantity is situated underground.

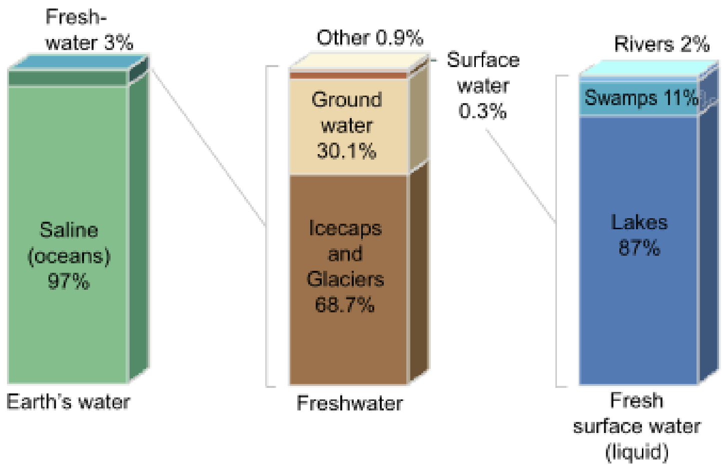

Figure 1. Distribution of Water on the Earth (Anonymous, 2017)

Approximately 80% of the world's diseases are caused by water and water related reasons. Industrialization, parallel to the rapidly growing world population, continuously increasing domestic wastes, improperly implemented or too late policies are the most important factors that play a role in the development of environmental problems related to water (Inglezakis and Poulopoulos, 2006).

Up to one-fifth of the world's population, about 1.2 billion people, have a problem finding clean water and this number is expected to increase day by day (UN Water, 2013). Wetlands are ecosystems that have rich biodiversity, regulate the climate of the environment, filter waste materials and have numerous ecological, economic importance. Wetlands with such a functional ecology are also under threat and are ecosystems that must be protected (Güney, 1995).

The European water framework directive (WFD) requires 5 different ecological quality components such as phytobenthos, phytoplankton, macrophytes, fishes and benthic invertebrates (Figure 2) to evaluate the ecological quality of surface waters (European Communities, 2009). Diatoms constitute a large part of the phytobenthos and have become an important indicator of water quality monitoring aquatic ecosystems around the world (Rott et al., 1999; Potapova et al., 2004; Della Bella et al., 2007; Toudjani et al., 2017).

Figure 2. Biological quality components used by the European Water Framework Directive (REF).

Diatoms in the first step of the food network living in the benthic regions of ecosystems are clinging to a variety of subscripts (Smol and Stoermer, 2010). Diatoms known as silica algae have long been used as a reliable environmental indicator species (Lowe and McCullough, 1974; Rott et al., 1999, 2003; Kelly et al., 2008; Smol and Stoermer, 2010; Çelekli et al., 2019). It has a very important function among the phytobentos groups for the primary production. Due to their dominant role in hydrological systems, it is thought that they contribute 20-25% to net primer production of the aquatic ecosystem (Hendey,1964). Diatoms also play an important role in the biogeochemical cycles such as carbon, phosphate, and silicon cycles in nature (Wetzel, 1975; Round, 1991; Stevenson et al., 1996; Lopez et al., 2005).

Diatoms are found in almost all habitats on earth (Werner,1977). Their sizes generally vary between 2-200 μm (Krammer and Lange-Bertalot, 1986). Large filtration surface is used in the filtration process because of its capacity to absorb some microorganisms in oil and water (Round, 1991). There are also two types of reproductive options. The diatoms are made up of two interlocking shell cell walls, and these cell walls are made of silyl. The structure and shape of the cell walls of diatoms are very important in the classification of these groups. Diatoms (Figure 3) are a diverse group of algae with 100000 species (Round, 1991; Çelekli et al., 2019).

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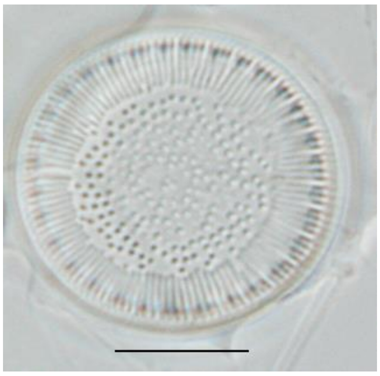

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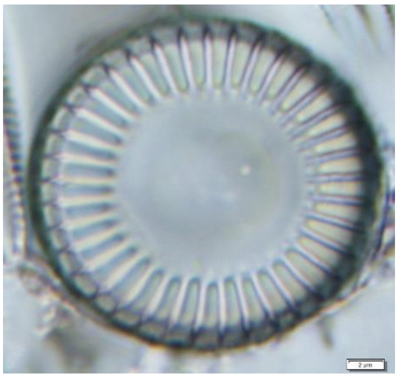

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Figure 3. *Diatom species a) Anomoeoneis sphaerophora, b)Navicula tripunctatac) Cyclotella bodanica, d)Cyclotella meneghiniana, and e) Cymbella cistula. Photgraphes: Prof. Dr. Abuzer Çelekli*

The most important environmental reason for the transformation of the diatomaceous composition in an aquatic ecosystem is the water movement because it is the species that continues to live on the water surfaces while remaining among the diatoms. Water movement affects the susceptibility of hanging on the water surface depending on the bonding capacity they have (Wetzel, 1975).

Diatoms as primary producers are sensitive to the physicochemical changes of their environment and respond quickly. For this reason, diatoms are important for both aquatic ecosystems and ecosystems (Smol and Stoermer, 2010; Toudjani et al., 2017). Because of their photosynthetic abilities, they increase the level of oxygen in their environment and contribute significantly to the aquatic ecosystem organisms. Besides, they absorb harmful substances in ecosystems, they act as a filter for the cleaning of polluted water (Smol and Stoermer, 2010).

Diatoms that are extensively present in most aquatic ecosystems reflect the ecological changes in their ecosystems very well. Because of these capabilities, they are frequently used in water quality monitoring, especially in eutrophication studies (Round, 1991; Kelly et al., 2008; Çelekli et al., 2019).

Why Use Diatoms As A Biological Indicator

Biological monitoring is done by evaluating the reactions of living beings to the changes that occur in the environment where living beings live to ensure ecological integrity (Karr, 1991; Angermeier and Karr, 1994; European Communities, 2009). Diatoms, one of the biological quality components determined by WFD, are known as important ecological indicators of aquatic ecosystems due to their rapid changes and sensitivities in the face of environmental changes (Kelly et al., 1998; Potapova et al., 2004; Bona et al., 2007; Delgado and Pardo, 2014; Çelekli et al., 2018).

To assess the water quality of streams in Europe Specific Pollution Index-IPS (Cemagref, 1982) Trophic Index-TI (Rott et al., 1999), Eutrophication and/or Pollution Index-Diatom-EPI-D (Dell'Uomo, 2004), and Trophic Diatom Index-TDI (Kellyet et al., 2008) have been developed. Direct apply of scores of foreign diatom indices (e.g., Rott et al., 1999; Dell'Uomo, 2004; Kellyet et al., 2008) can lead to erroneous interpretation of ecological status because there are limited overlaps in diatom flora among different ecoregions. Diatomic species have different optimum and tolerance levels for environmental variables from one eco-region to the other, an index needs to be developed according to the ecological region in which the country is located (Lobo et al., 2004; Toudjani et al., 2017). Many researchers (e.g. Kelly et al., 1998; Rott et al., 1999; Pipp, 2002; Rott et al., 2003; Dell'Uomo, 2004) have indicated that these diatom indices developed in certain parts of Europe are not equally effective when used in other areas of the same continent. Therefore, each country needs to determine trophic indexes to determine the ecological water quality of each region. In this way, the water quality problem in the region is clearly explained and the solution ways can be applied more effectively and permanently. From that points, a newly developed trophic diatom index, which is specific to Turkey Trophic Index Turkey (TIT) (Çelekli et al., 2019) for evaluating water quality using diatoms.

Diatoms are an important component of phytobenthos algal populations, which are abundant in surface waters. A large part of the total algae biomass forms diatoms on a wide range of trophic states. Diatoms are important biological indicators due to various reasons:

a) They occur in all different types of surface waters (Smol and Stoermer, 2010).

b) They had a broad range of tolerance along a gradient of trophic status, each species has specific trophic weight for water chemistry (Werner, 1977; Round, 1991; Rott et al., 1999).

c) They have short generation times in the biological indicators (Rott, 1991). They respond rapidly to environmental changes and provide early warnings of both pollution increases and habitat restoration success (Round, 1991; Kelly et al., 1998).

d) They are sensitive to changes in nutrient content of surface watres (Pan et al., 1996; Rott et al., 1999; Çelekli et al., 2019). Each taxon has a specific optimum and tolerance for nutrients such as phosphate (Hall and Smol, 1992; Fritz and Engstrom, 1993; Bennion, 1994, Reavie and Smol, 1995; Bennion and Anderson, 1996) and nitrogen (Christie and Smol, 1993), which can usually be quantified to a high degree of certainty.

e) Diatoms are usually diverse assemlages and therefore contain considerable ecological information about the ecological status of ecosystems. For this reason, and because it is easy to obtain large numbers of individuals, robust statistical and multivariate procedures can be used to analyze assemblage data (Dixit et al., 1992).

f) They respond rapidly to eutrophication and recovery (e.g. Rott et al., 1999; Çelekli et al., 2019). Because diatoms as primarily phototrophic organisms are directly affected by changes in nutrient and light availability (Tilman and Kilham, 1982).

g) The taxonomy of diatoms is generally well-documented (Krammer and Lange-Bertalot,1991a,b, 1999a,b; Lange-Bertalot, 2001; Krammer, 2000; 2002; Bey and Ector, 2013). Frustule morphology is commonly used to identify diatom species.

h) Diatoms can be found on substrata in streambeds even when dry so they can be sampled at most times of the year (Stevenson and Pan, 1999).

Assessment of the ecological status of ecosystems in water bodies based on physical and chemical variables is one of the approaches used to determine water quality. The use of physical and chemical properties of water to determine water quality gives strong ideas about the yield of water, the state and sustainability of the water body (Mustapha, 2008). However, these evaluations are insufficient in terms of evaluating the ecological status of aquatic ecosystems as they are based on instant measurements. Because, since the aquatic ecosystem of any sampling station will have physical and chemical changes over time, it only gives an insight into the measurement (Rocha, 1992).

The advantage of determining the ecological quality of benthic diatoms is that they can be present at any time in any surface water (Stevenson and Pan, 1999). These organisms are used to assess the ecological quality of streams worldwide (Rott et al., 1999; Rott et al., 2003; Kelly et al., 1998; Potapova et al., 2004; Taylor et al., 2007; Della Bella et al., 2007).

Trophic Index

Trofic index (TI) (Rott et al., 1999) and Turkey Trofien index Turkey (TIT) (Çelekli et al., 2019) have been used to determine the ecological status of streams in Anatolia region.

$$TIT = \frac{\sum_{i=1}^{n} b_i * e_i * c_i}{\sum_{i=1}^{n} e_i * c_i}$$

b_i;species sensitivity to nutrients (TP) (0.3-5)

e_i; indicator level of the species (0-5)

c_i; proportion of diatomic species in sampling or percent dominance

TIT scores were used to derivate ecological quality ratios (EQR) according to the WFD requires. $EQO = \frac{(4 - TIT_{hes})}{(4 - TIT_{ref})}$

TIT_{hes}: Calculated TIT değeri

TIT_{ref}:: Referans TIT değeri

The EQR values range from 0 (the bad ecological condition) to 1 (the high ecological condition). If the EQO value is greater than one, the normalization analysis should be performed.

Trophic Index (Rott et al.,1999).

$$TI = \frac{\sum_{i=1}^{n} TW_i x G_i x H_i}{\sum_{i=1}^{n} G_i x H_i}$$

TWi; trophic weight of taxa

Gi; indicator value of taxon

Hi; is the multiplicity of the sample

Water quality is determined with the developed trophic indexes and prepares the necessary measures.

Conclusion and Suggestions

According to the European water framework, diatoms, phytoplankton, macrophytes, benthic invertebrates, and fishes are suggested as ecological quality bioindicator tools for the bioassessment of surface waters. The aim of this assesment is to ensure that aquatic ecosystems and living organisms in these ecosystems are protected in the highest degree in terms of ecological, hydromorphological, physico-chemical and quantity.

The existing European indices can not be adapted efficiently to the particular hydrological and climatic conditions of this Mediterranean region. This could be due to the effects of ecoregion environmental factors on the trophic weight of diatom taxa. Regional variation in each ecoregion, especially in geology, anthropogenic activities, climate, and land-use, can significantly change predictor factors, constraints, and regulation of diatom assemblages. Therefore, each country needs to determine trophic indexes to determine the ecological water quality of each region. In this way, the water quality problem in the region is clearly explained and the solution ways can be applied more effectively and permanently.

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Fermented Coffee Production

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ABSTRACT

Coffee is one of the most popular drinks across the world and its enormous commercial and social importance is obvious. According to the International Coffee Organization, global coffee consumption is 148 million cups per year and despite the background of global inflation, continued price fluctuations and restrictions on trade, there is a continued increase in demand for high quality coffee and speciality coffees. This has led to strong interest in improve beverage quality and optimization of coffee aroma modulation in recent years. According to this interest most studies focus on two major categories: outlining of the roles in which aroma precursors in green coffee contribute towards coffee aroma formation and the characterization of the impact of technical factors such as roasting temperature and time on the corresponding aroma profile.

In addition to these researches the use of microbial starter cultures can improve beverage quality and has shown positive results for coffee aroma modulation. The relationship between coffee fermentation and coffee aroma is intricate and delicate at which the coffee aroma profile is easily impacted by the fermentation process during coffee processing. Studies have noted that proper control over the fermentation process imparts desirable attributes and prevents undesirable fermentation which generates off flavors. Production of fermented coffee with selection of appropriate microorganisms would be illustrate the intricate and delicate relationship between fermentation and coffee aroma.

Key Words: coffee, fermentation, aroma

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1. INTRODUCTION

Coffee is one of the most appreciated non-alcoholic drinks and popularity of coffee products is related to their unique sensory and pleasant flavor. Worldwide coffee sales continue to increase each year, in part due to increased consumption in emerging markets like Turkey and Russia. In traditional coffee markets, such as the European Union, the USA, and Japan, growth is primarily driven by an increased demand for high quality, specialty-grade coffee (ICO 2015). Brazil is the leading producer and exporter of coffee followed by Colombia, Paraguay, Venezuela, Indonesia, Ethiopia, India, Mexico and 40 other countries (Ribeiro et al., 2018).

The coffee aroma is complex and determined by the chemical compounds present, as well as the method used to roast the coffee. Over 1000 volatile compounds have so far been identified in roasted coffee. These can be divided into different classes, including (in order of abundance, with the approximate number of compounds) furans (150), pyrazines (100), phenols and ketones (90 in each class), pyrroles (80), hydrocarbons (76), carboxylic acids (60), esters (55), alcohols (50), and aldehydes (45). In addition, the classes (in order of abundance) of thiophenes, thiazoles, pyridines, oxazoles, amines, lactones, anhydrides, and miscellaneous compounds with sulfur and nitrogen in their structures together add approximately 215 compounds. Clearly, not all of the ∼1000 volatile compounds are relevant in terms of the aroma. The literature suggests that only around 5% of these compounds may be responsible for the aroma of coffee, which would give about 50 odorant compounds. These compounds include pyrazines, furans, aldehydes, ketones, phenols, and sulfur compounds, among others. (Toci & Boldrin, 2018).

The coffee fruit can be processed by two different methods, referred to as dry and wet. Wet processing is used mainly for Arabica coffee: the ripe fruits are depulped and then submitted to 24–48 h of underwater tank fermentation and dried until a final water content of 10–12% is achieved. In dry processing, in contrast, entire coffee fruits are dried (in the sun) on platforms and/or on the floor without prior removal of the pulp. During wet processing, the ripe coffee fruits undergo a spontaneous fermentation, carried out by a complex microbiological process that involves the actions of microorganisms like yeasts, bacteria and filamentous fungi. The fermentation is carried out to eliminate any mucilage still stuck to the beans and helps improve beverage flavor by producing microbial metabolites, which are precursors of volatile compounds formed during roasting (de Melo Pereira et al., 2014)

The relationship between fermentation and the corresponding coffee aroma profile can be described as being intricate and delicate. With optimized parameters and appropriate starter cultures for fermentation during mucilage removal in wet-processing, fermentation can impart desirable attributes to the corresponding coffee aroma while uncontrolled fermentation inevitably leads to off-flavors (Huch & Franz, 2014).

Based on the literature reviewed, it is possible to offer a higher quality product to the consumer by choosing the appropriate microorganism according to the developments in the sensory qualities of the coffee aroma provided by the fermentation during the coffee processing.

2. History of Coffee

Genetic analysis of the origins of coffee trees shows that they were indigenous to the Great Rift Valley of Ethiopia. In fact, there are over 40 species of *Coffea* found in Africa, over 50 in Madagascar, and only a handful found in the Mascarenes; other than that, there are no naturally occurring Coffea species found outside of these three areas. That is to say, the species found all around the world have all come from plantings taken from these three regions. So while Ethiopia remains the birth- place, coffee was first cultivated commercially in the Yemen (Gibson, 2018).

Figure 1. Historical Origin of Coffee

3. World Coffee Production

Nowadays, all commercially grown coffee is from what is known as the “coffee belt.” This is an imaginary line (loosely formed around the Tropics of Cancer and Capricorn) that wraps around the globe covering all of Africa’s, Central and South America’s, and Asia’s best coffee-growing regions (Gibson, 2018).

Figure 2. The Coffee Belt

4. The Anatomy Of The Coffee Cherry

The coffee beverage we all know and love is actually made from the roasted seeds from the fruit of a *Coffea* tree called a coffee cherry (Fig. 3). And while it may be called a bean, it is in fact a seed. As can see from the figure, the cherry's outer skin is called the exocarp, which covers a thin layer of pulp called the mesocarp. Underneath this, there is a layer of sticky/slimy mucilage-type texture of pectin. Covering the beans themselves are paper-like tissues called endocarp, or more frequently parchment. Inside this is yet another membrane (the epidermis) or silver skin within which the bean (or the endo- sperm) is finally uncovered. Two seeds are found inside each coffee cherry, yet in about 5% of the world's coffee, there is only one bean inside—these are known as pea berries and are sometimes isolated for separate sale (Gibson, 2018).

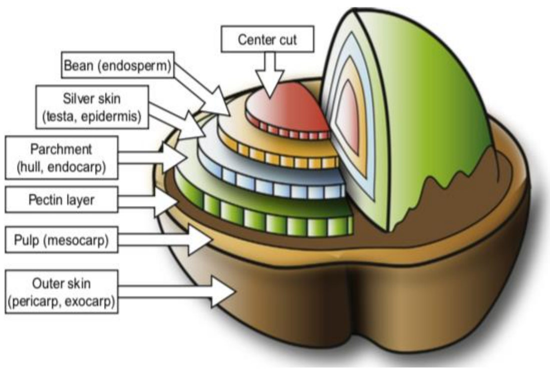

Figure 3. The Anatomy of The Coffee Cherry

5. Coffee Species

The coffee tree belongs to the tribe *Coffeeae* in the family *Rubiaceae*. One hundred species are associated with the genus *Coffea*, but only two species are agroeconomically important, *Coffea arabica* and *C. canephora. C. dewevrei, C. congensis, C. eugenioides, C. kapakata,* *C. salvatrix, C. stenophylla, C. liberica, C. racemosa,* and others are primarily used in genetic crosses. Presently, *arabica* coffee accounts for about 63% of coffee produced, and *robusta* coffee 37% (Batista, Chalfoun de Souza, Silva e Batista, & Schwan, 2015).

5.1.*Coffea arabica* (Arabica Coffee)

Coffea arabica was first described by Linnaeus in 1753. The best known varieties are '*Typica*' and '*Bourbon*,' but from these, many different cultivars have been developed, such as '*Caturra*' (Brazil and Colombia), *'Mundo Novo'* (Brazil), 'Tico' (Central America), the dwarf '*San Ramon'*, and the *'Jamaican Blue Mountain'* (Batista et al., 2015).

5.2.*Coffea canephora* (Robusta Coffee)

Robusta coffee is harvested in West and Central Africa, throughout Southeast Asia, and to some extent in Brazil, where it is known as *conilon*. *Robusta* coffee constitutes a relatively new commercial crop, so there is a great potential for genetic improvement. *'Robusta'* is the most widely cultivated variety of *C. canephora* in the world, so that the name of this variety is used to designate the common name of the species. Nevertheless, in Brazil, *'Conilon'* (also known as *'Kouillou'*) is practically the sole cultivated variety of *C. Canephora* (Batista et al., 2015).

5.3.*Coffea liberica* (Liberian Coffee)

Coffea liberica (*Liberian coffee*) is another commercial coffee species that is grown on the world market, albeit in small quantities. Originating from the low-altitude growing areas of West Africa and Malaysia, it grows as a large tree (up to 18 m high), with large leathery leaves, and is comparable with *C. robusta* in flavor.

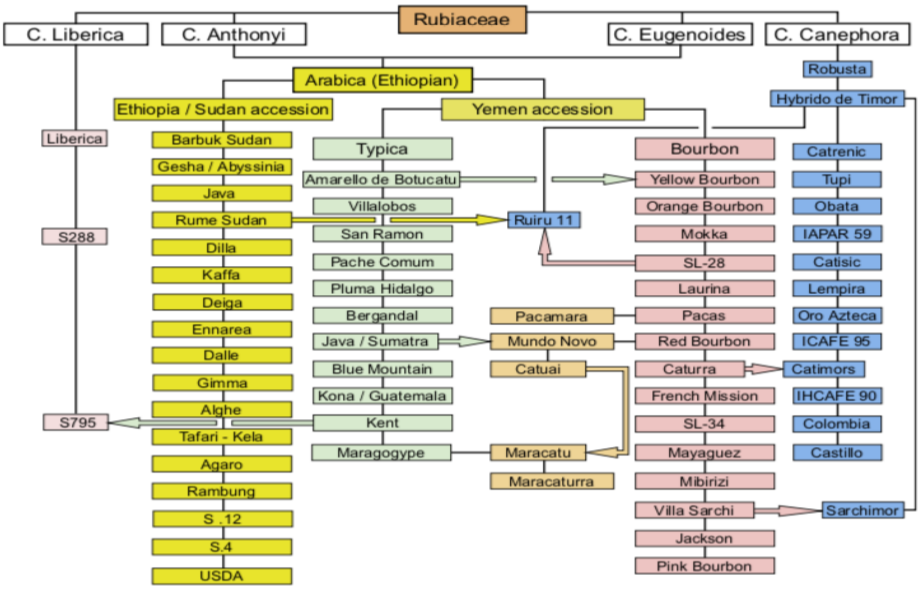

Table 1. Coffee Species

6. Factors Affecting Coffee Quality

There are many factors affecting the quality of coffee; such as plant type, soil chemistry, weather condition, rainfall and sunlight amount, harvesting method, temperature applied in roasting process, drying method, packing properties and storage conditions. These factors can be classified under 3 main topics: Genetic factors, agricultural conditions and harvesting and post-harvest operations.

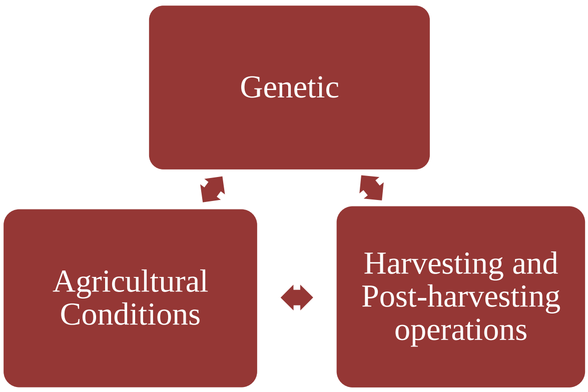

Figure 4. Factors Affecting Coffee Quality

7. Coffee Process

The processing can be done using two different methods (dry and wet) to obtain the seeds. The difference between the two distinct processing methods is not only the performance, but also the resulting products (parchment beans with and without leftovers of mucilage or beans still covered by the complete pericarp). The easiest and oldest way is dry processing, which results in the so-called unwashed or natural coffee. This method is often used in countries with less rainfall and long periods of sunshine, e.g. in Brazil, Ethiopia, Haiti, Indonesia and Paraguay. Dry processing is without microbial fermentation and is generally used for Robusta coffee (Huch & Franz, 2014).

For dry processing, the berries are often left on the coffee plants until overripe before harvesting. The berries are then dried in the sun to a moisture level of about 10–11%. Alternatively, the berries are dried directly after harvest by spreading in a ∼10 cm thick layer on the ground during the day and heaping together for the night. This process is a combination of fermentation and drying, which lasts about 10–25 days, depending on weather conditions. After the dry processing, the berries are dry, leathery fruits still covered by the pericarp and are mechanically peeled. The dry method is used to produce cheaper coffee brands. In the wet method, which leads to a coffee of higher quality, the berries are fermented. Using the wet method, the coffee cherries are sorted by dumping into water, in which the unripe fruits float and are removed, whereas the ripe cherries sink to the bottom. After this, the cherries are mechanically depulped to remove the exocarp, while the mesocarp is removed by submerged fermentation for 12–36 h, followed by washing and drying for 5–10 days, depending on weather conditions. The remaining moisture content of the dried beans is 12%. Wet-processed coffee cherries are also called washed-coffee cherries in contrast to dry-processed ones, which are not washed. The resulting beans after wet processing are covered by a crumbling parchment skin (Huch & Franz, 2014).

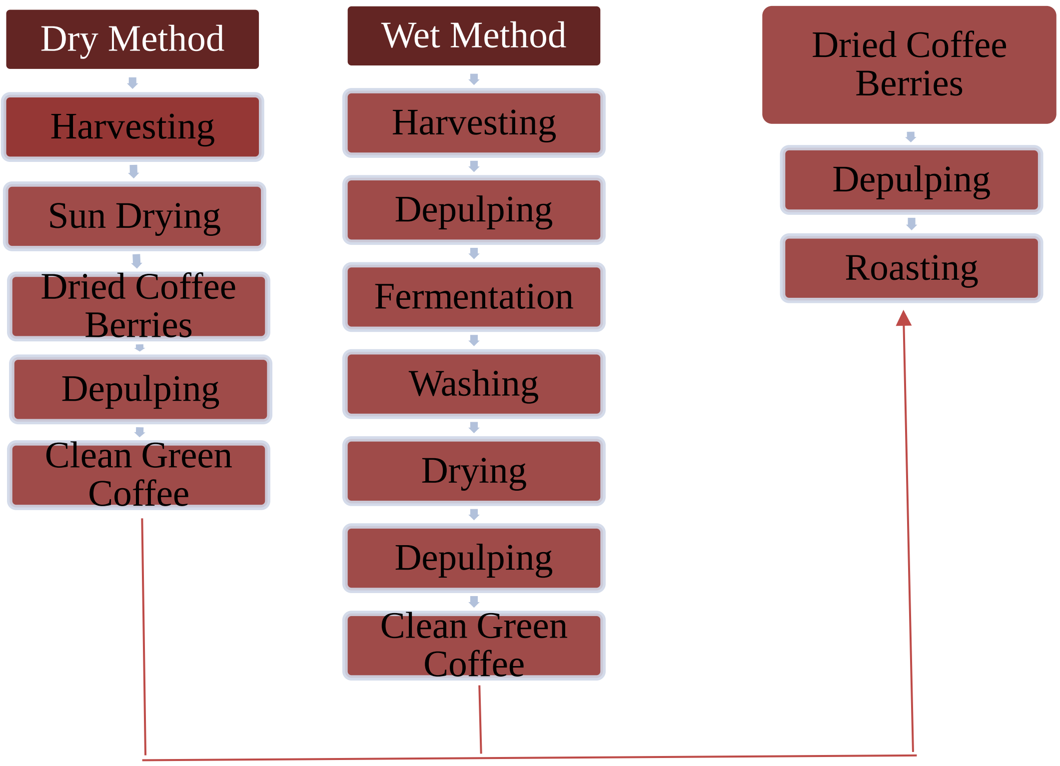

Table 2. Coffee Process

8. Fermented Coffee

The formation of coffee aroma occurs predominately during roasting via a complex series of Maillard reactions, caramelization and other thermal reactions involving aroma precursors that are present in green coffee beans. Therefore, roasting is an avenue that has a significant impact on coffee aroma and unsurprisingly has been the main target for research into coffee aroma modulation over the past century. The focus of most studies within this area fall into two major categories:

- the exchange of aroma compounds in green coffee and its effect on the final product
- effect of production parameters such as roasting temperature and time on coffee characterization (Wei, Wai, Curran, Yu, & Quan, 2015)

Analysis of the sensory profiles of dry and wet-processed coffees found that the latter were more aromatic with fruity and acidic attributes and possessed lesser bitter, burnt and woody notes. These differences in the sensory attributes could most likely be attributed to the fermentation process involved in mucilage removal in wet processing. However, the effects of fermentation during wet-processing on the aroma profile of coffee have not been fully elucidated and are often neglected since its main role is commonly accepted as mucilage removal (Wei et al., 2015).

Fermentation promotes the growth of microorganisms that produce enzymes such as polygalacturonases and pectin-lyases, which are necessary to depolymerize and hydrolyze the pectin present in the mucilage. Removal of mucilage by microorganisms facilitates the drying of the berries and produces metabolites that diffuse into the coffee beans and react with substances that affect the taste of the last product. The metabolites formed as a result of microorganism activity diffuse into the berries and affect the final product quality by forming different aroma compounds depending on the microorganism used.

The choice of microorganisms in coffee fermentation should be based on the formation of pectinase, acid and other metabolic compounds that make coffee special and which affect the quality of the final drink positively.

Conclusion

In conclusion, the influence of numerous variables and processes during coffee fermentation on aroma formation during roasting highlights the intricate and delicate relationship between coffee fermentation and flavor. Based on the literature reviewed, improvements to the sensory qualities of coffee aroma brought about by fermentation during coffee processing is most likely attributed to the modification of the composition of aroma precursors in green coffee beans observed following fermentation. However, as fermentation in coffee processing relies on natural microflora that are present in coffee cherries, there are issues of inconsistency and uncontrollability. In this direction, it is possible to further improve the aroma of coffee with the appropriate selection of microorganisms and controlled fermentation.

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Applications of Ultrasound In Fruit Juices

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ABSTRACT

Fruits are highly perishable and have to be processed into juices to ensure year-round continuous supply. The highest juice quality is required to meet consumer needs and juice safety aspects are important considerations for prolonging shelf life. The quality of juices is defined as by their physical, enzymatic, microbiological, and sensory stability. Today, the use of non-thermal food processing technologies is available to meet the demands of natural and healthy fruit juice drinks with minimal damage of its natural nutritional and organoleptic properties. The conventional fruit juices processing process is thermally inclined and results in some nutritional compounds loss such as flavonoids and carotenoids. The usage of ultrasound as an alternative technology to the conventional fruit juices processing technologies has attracted interest of many for its benefits in decreasing processing time, reducing energy consumption, increasing efficiency and improving shelf life and quality of fruit juices. Ultrasound is composed of mechanical sound waves that originate from molecular movements that oscillate in a propagation medium. The waves have a very high frequency, equal to approximately 20 kHz, are divided into two categories (i.e., low-intensity and high-intensity waves) and cannot be perceived by the human ear.

Key Words: *Fruit Juices, Ultrasound, Sonication*

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INTRODUCTION

Fruit juices are one of the food products which are thermally sensitive and susceptible to chemical, physical and microbiological changes. The processing methods may affect the quality and safety of the fruit juices. Today, the use of non-thermal food processing technologies is available to meet the demands of natural and healthy fruit juice drinks with minimal damage of its natural nutritional and organoleptic properties. The conventional fruit juices processing process is thermally inclined and results in some nutritional compounds loss such as flavonoids (1) and carotenoids (2). Its production efficiency is about 60 to 80% of fruit juice yield with rapid drop if old fruits are used. Risks of darker juice and containing excessive suspended solids and unwanted flavours also occur (3). It accounts for 90% of the total energy consumption (4) and requires prolonged processing time of 15 to 45 minutes(5). The usage of ultrasound as an alternative technology to the conventional fruit juices processing Technologies has attracted interest of many for its benefits in decreasing processing time, reducing energy consumption, increasing efficiency and improving shelf life and quality of fruit juices. These improvements are possible due to the properties of instantaneous transfer of acoustic energy into fruit juices. The ultrasonic treatment can penetrate fruit cell walls and release cell contents trapped in the fruit tissues.

Thermal preservation such as pasteurisation and sterilisation are commonly used to destroy microorganisms and inactivate enzymes in fruit juices. These extreme heat treatments at temperature of more than 80 °C may cause undesirable changes in various properties of fruit juices including physical, chemical, biological and organoleptic such as nutrients, colour and flavour (6). The thermosonication technology, which combines moderate heat of 37 to 75 °C with ultrasound treatment, is a potential alternative processing technique to enhance inactivation of enzymes and microbial (7). The US Food and Drug Administration requires fruit juices to meet a minimum of 5-log reduction in pertinent microorganisms to control the spread of food-borne illnesses (8). To achieve the USFDA requirement, food-borne pathogens inactivation with ultrasound undergoes long processing time leading to high production cost and small throughput. Therefore, the combination of low frequency ultrasound with mild heat will help in reducing processing temperature and time by 16 and 55%, respectively, minimising the negative effects on fruit juices quality and makes the processing more economically feasible (9). Thermosonication involves a lower processing temperature than the conventional thermal processing to attain the same lethality values as the conventional method. The enzymes and microbial inactivation by thermosonication treatment is attributed to heat and cavitation, which is the phenomenon of formation, growth and explosion of bubbles in a liquid. The cavitation causes disruption of cell membrane and production of free radicals by both temperature and pressure changes.

Basic Principles of Ultrasound

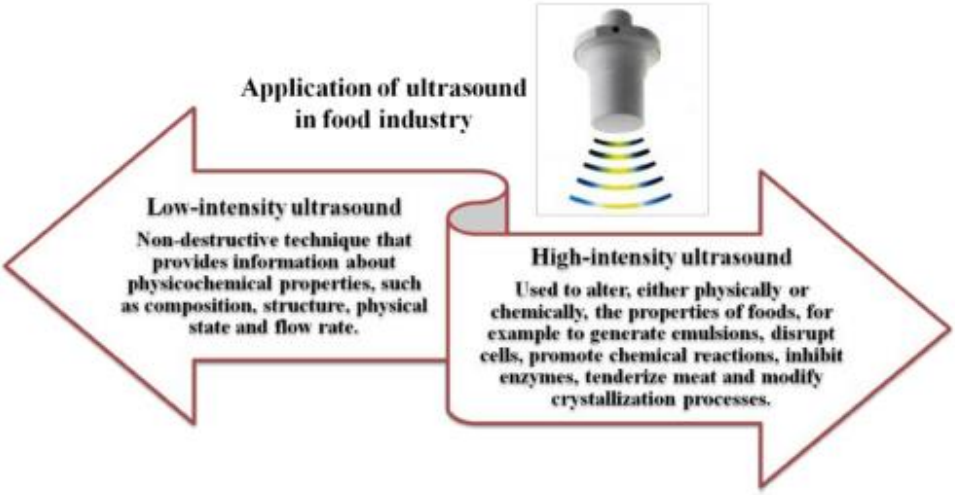
Ultrasound is sound wave transmitted with frequency higher than audible frequency of 20 kHz (10). The ultrasound equipment usually has frequencies from 20 kHz to 10 MHz (11). The application of ultrasound in food industry consists of low and high energy ultrasound.

The low energy ultrasound has intensities of less than 1 Wcm-2 and frequencies of more than 100 kHz. It can be used in nondestructive analytical measurements and monitoring of composition and physicochemical properties of food during processing and storage for quality control purposes such as those in detection of honey adulteration (12), particle sizing (13) and emulsion stability (14). High energy ultrasound, which is also known as power ultrasound has intensities higher than 1 Wcm-2 and frequency range of 20 to 100 kHz. The power ultrasound is useful in invasive applications, which gives impact to physical, chemical and biological properties of foods in processing, preservation and safety such as milk homogenisation (15), juice yield enhancement (16). There are two different ultrasonication techniques, which are submergence in an ultrasonic bath (17) or direct application to the fruit juices using a probe sonicator (18).

Applications of Ultrasound

Nature has created the first ultrasound applications. Bats use ultrasound to navigate in the dark. Ultrasound is employed in many science and technology applications. First, as we all know, ultrasound has an applications in medicine; In diagnostic sonography (ultrasonography), ultrasound is used to as diagnostic imaging technique. Second, ultrasound technology offers great potential in industrial applications, such as welding, cutting, punching, thermofixing, washing, embossing, sealing and so on. Also in today's engineering technology, special ultrasonic machines are being developed and built in order to automate processes and combine working steps. Third, ultrasound have been using in cleaning technology since 1950. Ultrasonic cleaners offer perfect cleaning of wide range of materials in short time. Also ultrasound is employed in processing technology, because of its capability to mix and improve chemical reactions. Sonochemistry describes the chemical effects resulted by subjecting a chemical reaction to the influence of sound waves. In particular, ultrasound has recently been used in the food industry to develop various effective and reliable food processing applications.

Applications of Ultrasound in Food Industry



Over the past few years, the properties of US have aroused increasing interest in the food industry, as the induction of physical and chemical reactions can lead to a strategic advantage in the various stages of processing. Currently, US is considered an emerging and promising technology in the food processing industry, since it produces permanent mechanical, chemical and biochemical changes in liquids (due to intense cavitation) and gases (for the generation of high intensity acoustic fields). Since the 1990s, the use of US has become a technological alternative that is applicable on a large scale in the processing industry (19). Ultrasound has been applied to food technologies due to its mechanical and/or chemical effects on the processes of homogenization, mixing, extraction, filtration, crystallization, dehydration, fermentation, and degassing through its antifoaming actions, reduction of particle sizes, temporary or permanent modifications of viscosity, modulation of the growth of living cells, cell destruction and dispersion of aggregates, inactivation of microorganisms and enzymes, and sterilization of equipment.

Applications of ultrasound in food processing.

Applications	Conventional methods	Ultrasound principle	Advantages	Products
Cooking	Stove Fryer Water bath, ...	Uniform heat transfer	Less time Improving heat transfer and organoleptic quality	Meat Vegetables
Freezing/ crystallization	Freezer Freezing by immersion, by contact, ...	Uniform heat transfer	Less time Small crystals Improving diffusion Rapid temperature decreasing	Meat Vegetables Fruits Milk products
Drying	Atomisation Hot gas stream Freezing Pulverisation	Uniform heat transfer	Less time Improving organoleptic quality Improving heat transfer	Dehydrated products (fruits, vegetables, ...)
Pickling/marinating	Brine	Increasing mass transfer	Less time Improving organoleptic quality Product stability	Vegetables Meat Fish Cheese
Degassing	Mechanical treatment	Compression-rarefaction phenomenon	Less time Improving hygiene	Chocolate Fermented products (Beer, ...)
Filtration	Filters (membranes semi-permeable, ...)	Vibrations	Less time Improving filtration	Liquids (juices, ...)
Demoulding	Greasing moulds Teflon moulds Silicon moulds	Vibrations	Less time Reducing products losses	Cooked products (cake, ...)
Defoaming	Thermal treatment Chemical treatment Electrical treatment Mechanical treatment	Cavitation phenomenon	Less time Improving hygiene	Carbonated drinks Fermented products (Beer, ...)
Emulsification	Mechanical treatment	Cavitation phenomenon	Less time Emulsion stability	Emulsions (ketchup, mayonnaise, ...)
Oxidation	Contact with air	Cavitation phenomenon	Less time	Alcohols (wine, whisky, ...)
Cutting	Knives	Cavitation phenomenon	Less time Reducing products losses Accurate and repetitive cutting	Fragile products (cake, cheese, ...)

Uses of Ultrasound in Fruit Juices

Fruit juice is easy to consume, delicious, and refreshing, and it is rich in vitamins, phytochemicals, and sometimes fiber, depending on the raw materials used. The quality of juices is defined as by their physical, enzymatic, microbiological, and sensory stability.

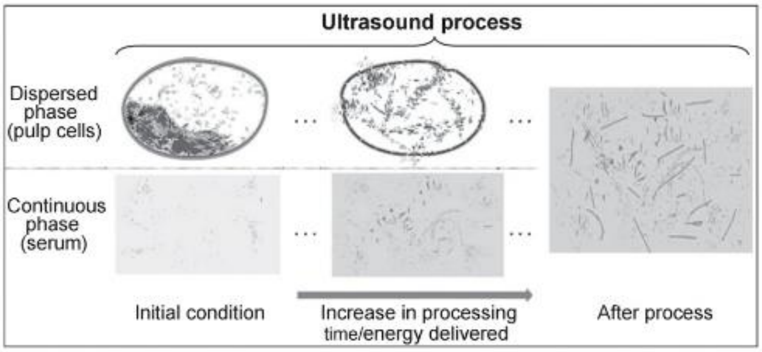
Some Quality Parameters of Fruit Juices with Applications of Ultrasound

Preservation

Microbial and enzymatic inactivation are essential for pasteurization of juices, and ultrasound, one of the nonthermal processes, has important potential in this respect. It does not have the common side effects of conventional thermal treatments on food nutritional and quality parameters, such as degradation of some vitamins, color, and proteins, and it has been approved by FDA since 2000, providing a potential 5 log reduction in juice microbial content.

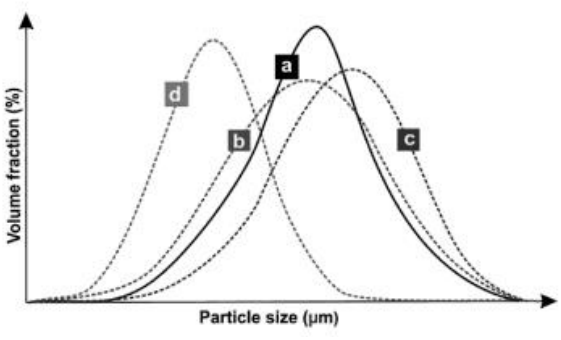
Structure

The main impact of ultrasound application on juice is at the structural level. Fruit juices can be considered as polydisperse systems (21), composed of an insoluble phase (pulp) dispersed in a viscous solution (serum). Changes in the structure of these components were demonstrated as a function of the ultrasound processing time or acoustic energy supplied to samples.



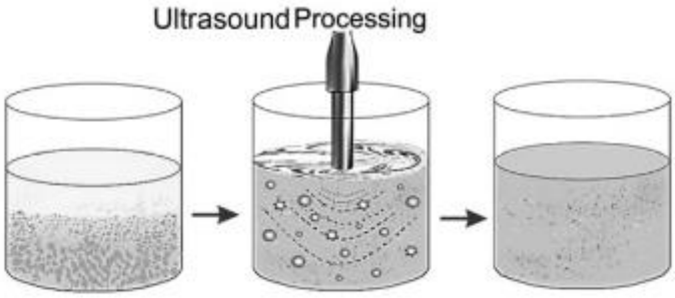
First, the movement of intracellular compounds is observed—when the cell internal structure passes from a highly organized to a disperse system. After that, the ultrasound causes cell wall distruption in localized areas, with probable influx of water and posterior output of intracellular compounds, conserving the cell wall structure. Finally, the mixing of all the broken structures and internal compounds takes place.

The complexity of the structure changes and interactions is evidenced by particle size distribution (PSD) analysis, reported for juices such as tomato juice (22) diluted avocado puree (23), and peach juice (24). A reduction in the size of particles and more homogeneous distribution are expected with ultrasound processing. However, this involves other phenomena that influence the particle size and distribution, and consequently it is not always directly proportional to the processing time.

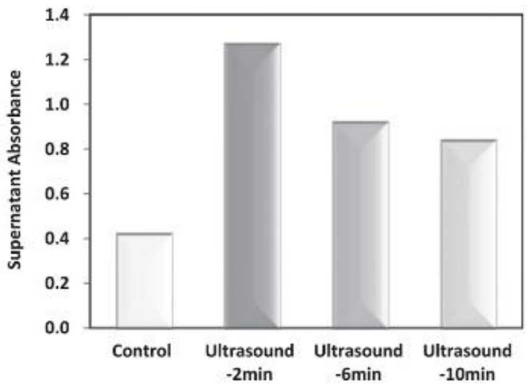


Sedimentation Stability: Cloud Retention

Ultrasound processing can be an important technology to prevent juice sedimentation. The stability of large particles suspended in a fluid is governed by hydrodynamic forces (25) and the sedimentation mechanism can be mainly explained by Stokes' law.



Ultrasound applicaiton improves cloud retention in juices by keeping particles suspended, such as in orange juice (26). The turbidity measured in juice supernatant after centrifugation in unprocessed samples is low and it increases in processed samples (27). This is because the larger particles (in unprocessed samples) tend to renain in susoernsion after centrifugation; however, they can also form aggregates, decreasing again turbidity of the supernant.

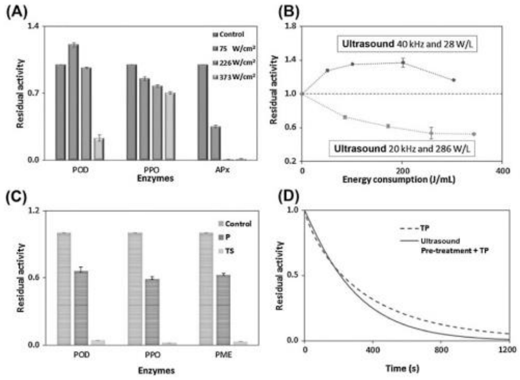


Color

Color is one of the most important sensory properties of foods. It also constitutes an important tool to determine quality and nutritional losses of liquid foods during processing and/or storage. Ultrasound can enhance the color stabilization of many juices, such as pineapple juice (28) and peach juice (29) during storage. The color parameter (lightness L*, redness a*, and yellowness b*) stability after ultrasound processing depends on the particle size, intracellular material release, and pigment stability. The L* value commonly increases after ultrasound applicaiton, as reported for grapefruit juice (30), apple juice (31), and watermelon juice (32), among other.

Enzymes

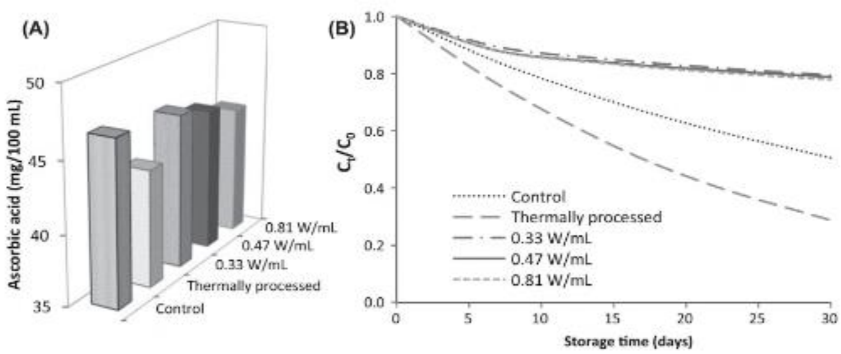
There are many studies of the application of ultrasound in juices to inactivate enzymes such as peroxidase (POD), polyphenol oxidase (PPO), and pectin methylesterase (PME), among others. The mechanism that influences enzyme activity during sonication can be a combination of several chemical and physical factors occuring simultaneously (33). These factors can affect enzymeactivity by changing the enzyme's structure (34).



In the partA; the activity reduction behavior with ultrasound application is different for each type of enzyme in the same juice under the same process conditions. Part B Shows that the residual activity of cocount water peroxidase. High-power ultrasound and long processing times are required to achieve high inactivation levels. For Part C; The inactivation is higher in the thermosonication process than in the conventional thermal process at the same temperature for the same time. Then Part D; Enzyme sensitization through the application of ultrasound as a pretreatment prior to the conventional thermal process, which can allow the use of lower temperatures and/or shorter times.

Bioactive Compounds

Fruit juices are products rich in bioactive compounds known for their antioxidant properties, such as carotenoids, ascorbic acid, and phenolics. The ultrasound effects on these compounds have been extensively studied.



Graph A; Shows the orange juice Ascorbic Acid content after ultrasound processing at different amplitudes, compared to thermal processing. It is observed that effectively at high ultrasound power, Ascorbic Acid content decreases, but this reducition is less than in the sample that was thermally processed. Graph B; Shows Ascorbic Acid stability during storage when the ultrasound process is applied. It is also observed that the stability of Ascorbic Acid is high with ultrasound than thermally processed.

RESULTS AND DISCUSSIONS

The application of ultrasound in fruit and vegetable juices has shown positive results, improving their properties and stability. All results are related to the physical and chemical effects of ultrasound produced at alimentary matrix. The reported results with ultrasound depend principally on the power, time, and temperature of the process; the composition and structure of the juice sonstituents; and the type, structure, shape, and condition of the microorganisms and enzymes. Consequently, because several variables coexist, in each case, the effects of ultrasound will be complex, each case with its own responses. Use of ultrasound as alternative technology has many benefits; decreasing processing time, reducing energy consumption, increasing efficiency, improving shelf life, and quality of fruit juices.

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Physical and Biochemical Changes of Kashar Cheese During Ripening Period

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ABSTRACT

The kashar cheese is the important a dairy product. The kashar cheese is a food have the smooth surface, the color mixture of the White-yellow, no porous, solid and the light flexible structure, light salty, the amount of dry matter 58-60%. The kashar cheese have a lot of important quality criteria in the ripening process and this can cause the significant to spoil problems. Because of this, this study is about to investigate physical and biological changes of the kashar cheese during the ripening process. In order to obtain quality kashar cheese, all of material should have wanted to quality properties, firstly in the raw milk should not be unwanted microorganisms and animal should be healty. Because in the pastorization of milk, some microorganisms can die but some can be resistant to heat and can cause to be cheese poisoned, in order to prevent to this acid control can make and can hold to wanted conditions. The starter culture can be other spoilage problem that can include the bacteriophage, the increase of this can cause the high moisture in the finished kashar cheese, and this can cause biological changes and off-flavor and rancidity and the lipolytic and proteolytic spoilages during ripening. The effects of proteolytic enzymes can cause the bitter taste in the kashar cheese. During the ripening process proteolytic enzymes of microorganisms can destroy to amino acid can form ammonia. This cause ammonia smell. During ripening of kashar cheese lipolytic bacteria type of achromobacter can cause form of basic metabolic produces and can spoil to taste of kashar cheese. For all of this conditions the parameters pH, temperature, water content should be analyzed. In conclusion the aim of this study to solve the spoilage problems and to obtain quality kashar cheese in the ripening. Therefore The results of this research will help Food Engineers and food quality control centers to improve the quality of kashar cheese.

Keywords: *Kashar cheese, physical and biochemical changes, ripening of kashar*

INTRODUCTION

Kashar, a semi-hard Turkish traditional cheese, is one of the most consumed cheeses in Turkey (Koca & Metin, 2004). According to Turkish Statistical Institute, total cheese production of Turkey was 665580 tonnes in 2015, and semi-hard cheese production was 191206 tones (Anonymous, 2005). The reasons of popularity are long shelf life and fla-vor. It has similar characteristics with Caciocavalle, Provo-lone, Regusono, Kashkaval cheeses and with the 'Pasta Filata' type cheese such as Mozarella partially (Halkman & Halkman, 1991). Some researchers mentioned similarity between Cheddar and Kashar Cheese (Çetinkaya et al., 2003).

According to Turkish Standards, Kashar cheese is classified as ''fresh'' and ''old or mature'' in terms of ripening (Turk-ish Standards Institute, (TSI), 1999). Both types can be eaten at breakfast; however the fresh cheese is also consumed in toasted sandwiches or baked foods in the same way as Moz-zarella cheese (Çetinkaya et al, 2003; Üçüncü 2004). Mature kasar cheese is traditionally produced in 27-30 cm diameter and 10-13 cm height and 6-10 kg weight. Traditionally, kashar cheese is made from raw sheep or cows' milk or their mixtures without the addition of starter cultures. The tradi-tional method involves renneting, curd forming, curd fer-mentation (about pH 5.1-5.4), scalding and texturing of the curd in hot water (65-80°C) containing 6-8% NaCl, shaping of the scalded curd, pre-ripening at 15-20 °C and ripening at 2-4°C for at least 3 months (Aran, 1998). Mature Kashar cheese is consumed after long term ripening, and it is be-lieved that the cheese gains its characteristic flavour after 6 to 12 months. During this period dry salting is applied over the surface of cheese. Production of mature kashar cheese requires more labour force and time, reduce yield due to wa-ter loss during ripening period (Sert et al., 2007).

During the ripening process of kashar cheese, there can be important spoilage factors, all of this can negativelly effect to kashar cheese in the ripening. Amino acids provide carbon, nitrogen and energy sources for bacterial cells and play an important role in the development of flavour in cheeses. Cheese is an ideal substrate for amine production. It contains the high free amino acids con-centration as a result of proteolysis, availability of amino acid decarboxylase producing microorganisms, adequate temperature, pH, cofactor and water activity (Benkerroum, 2016).

The others factors can affect to kashar cheese unwanted bitter taste, burnt flavor, rancidity taste and smell, very solid structure, very soft and sticky structure, different porous sizes and others unknown problems. Moreover several extrinsic factors may also play an important role, namely, pasteurization of milk, salt-in-mois-ture levels and ripening time (Linares et al., 2013).

There are important researches about kashar cheese but the aim of this study to determine and learn about biological and physical changes of kashar cheese in some quality pH, protein,protein oxidation total nitrogen (TN), water soluble nitrogen (WSN), salt and moisture content and lipid oxidation (thiobarbituric acid reactive substances) parameters of cheeses during ripening period and also to investigate fresh kashar cheeses.

What is the kashar cheese

Another popular cheese common in Turkey and Greece is called "'taze kasar"(tah-ZEH' kah-SHAR'), which means kashar cheese that hasn't been aged. Fresh kashar is a smooth, firm, light yellow cheese usually made from cow's milk. It's a very versatile cheese good for slicing, melting, grating or eating straight up. It most often accompanies white cheese at breakfast. It's also used on pizzas, in sandwiches and salads and as the main ingredient in Turkey's classic comfort food, "tost." In English, it's called a grilled cheese sandwich.

The history of kashar cheese

The history of kashar cheese is not very historical or very old. A few centuries ago, was made by a jewish girl. The flavor of the kashar cheese was a delicious taste obtained in this new era, the expert rabbi tasted to kashar cheese. The expert very liked to the taste edible of kashar cheese (kashar) word used after this date is referred as kashar.

There are various opinions about the origin of the word of kashar. According to some sources, of latin origin, and the whey is squeezed under the pressure of ‘coerceo’ latin for so the kashar word is coming than here. In the other sources permissible in hebrew language and the jewish religion, which means that there is a problem in overcoming ‘cacher ‘(kashar) it was suggested that it is related to and the kashar name is gived than the expert rabbi.

The properties of kashar cheese

The following characteristic of a good cheese are as follows.

- The external appearence is a smooth, amber yellow in color, very hard and must have thick skin.
- Internal appearence yellowish to White-yellow in color, porous, or pore, can be found in the very least.
- At intermediate level solid and a bit flexible.
- Slightly salty taste.
- Dry matter proportion is approximately close to 58-60 %.
- Fat in dry matter approximately 45-48 % amounts.
- The rate of salt (NaCl) approximately amounts to 3-5 %.

COUNTRY	NAME
Türkiye	Kaşar
Bulgaria	Kaşkaval
Yugoslavia	Kackavalj
Romania	Caşcaval
Greek	Kasseri
Hungary	Kaşkaval
Russia	Kavkazskij syr
Egypt	Rumi

Table 1. The name of kashar cheese according to countries.

The ripening of kashar cheese

The cheeses that have been salted and pre-matured are washed with hard brushes in pasteurized cheese water and washed. The leave them for 1-2 hours by laying in the crayfish.

They are then ripened for 30-60 days at 12-16 ^{0}C and 85 % relative humidity. Then the temperature is reduced to 5-6 ^{0}C and maturation is continued. During the ripening process, the kashar cheeses is converted once a week. If there is mold on the surface, it is washed with 5% brine and then olive oil is applied to the surfaces; thus excess moisture loss and in this context excessively thick crust formation, cracks are also prevented. The matured kashar cheeses are cleaned, washed with warm saline (10-12 % NaCI), dried, packaged and stored for 3-10 months at 2-4 ^{0}C storages.

The benefits of kashar cheese

The energy value is quite high calcium, protein and zinc resources in terms of the rich in vitamin B_2 is a good source of phosphorus linoleic acid presents in cheese, it reduces the risk of sphingolipids and conjugated cancer disease prevents bone resorption and is effective against microbial infection cures diarrhea resolves stomach discomfort and digestive system regulates brain energy, prevents dental caries and lowers blood pressure and help prevent cancer.

Physical and biochemical deterioration of kashar cheese

Odor and taste faults

Odor and taste ingredients are composed of various chemical properties that arise from the breakdown of cheese components, especially during ripening. The aroma of cheese occurs largely during the maturation process.

Precautions

Maturation should be in the desired direction and run clean.

Bitter taste

The bitterness is caused by the accumulation of bitter peptides. These peptides are rich in amino acids of hydrophobic character and occur as a result of proteolytic enzymes on casein. Research has shown that rancidizing cultures have high levels of protease-peptidase, thus hydrolyzing casein with large molecular weight and forming peptides of painful character.

Precautions

Measures The high peptidase activity can also be effective in inhibiting aggravation by carrying out hydrolysis of pain peptides. In particular, cultures with specific peptidases have been reported to inhibit aggravation by hydrolyzing the aggravating peptides.

Burned flavor

Burning and kneading of the telemen may result in burns if hot water is used or if it is subjected to heat treatment longer than necessary, or if the cheese is cooled very slowly after the process. Streptococcus lactis var. Because maltigenes may have demonstrated efficacy, such bacteria can produce compounds that are reminiscent of over-cooked or burnt milk flavor.

Precautions

Streptococcus lactis var. Care should be taken that Maltigenes are not contaminated with cheese. In the case of kashar cheese, during the boiling and kneading process, it should be ensured that the frying temperature is not higher than 65 ° C and the molded wire should be cooled as quickly as possible.

Ammonia smell

Milk actually contains 1,3 - 2,5 mg / liter of ammonia (NH3) but it is not considered normal to exceed 5 mg / l. Some microorganisms can produce ammonia by degrading the proteolytic enzymes, amino acids in the maturation process.

Precautions

Proteolytic effect should be used in non-strong cultures. The temperature of the maturation chamber should be reduced and the cheese should be packed just in time. Cheeses must be thoroughly cooled before packing. Sufficient water vapor permeability should be used because the wet surface flora is particularly active and may stimulate the formation of NH_3.

Ransit, soapless taste and odor

Short chain fatty acids which are released as a result of hydrolytic and especially enzymatic hydrolyzing of lipids in cheeses are capricylic acid, caprylic acid and caprinic acid, especially butyric acid. they cause a ransit taste. Achromobacter species from lipolytic bacteria form a variety of basic metabolic products, resulting in taste imperfections, especially soap-like taste and odor. Some of the Pseudomonas species have proteolytic and lipolytic activity, their heat-resistant lipase enzymes producing free fatty acids causing rancidity. For example, P.sapolactia leads to the emergence of soap-like flavor.

Precautions

Contamination with basic metabolism products and lipase-forming microorganisms should be avoided and all cleaning and hygiene rules should be applied correctly in milk production and cheese making. Milk should be homogenized before pasteurization process, partial homogenization should be avoided and homogenization effect should be controlled. Oil leakage from cheese should be prevented.

Sourdough, sour flavor

Acetobacter species such as acetic acid bacteria are infected by aerobic conditions under the oxidation of ethanol to convert to acetic acid and can cause sour taste. In addition to formic acid and lactic acid, some coliform bacterial species that are capable of producing acetic acid may also be infected. Emmental and similar cheeses, as well as propionic acid in acetic acid can occur and the amount of acid increases in the cheese increases in the sourness.

Precautions

The hygiene and sanitation rules required to prevent contamination of microorganisms that can produce acetic acid should be applied in full. Proper propionic acid bacterial cultures should be used and propionic acid fermentation should be performed correctly.

Conclusion

The results of this study show the ripening process for kashar cheese is very important. Because there are a lot of deterioration causes for kashar cheese in the ripening process such as odor and taste faults, bitter taste, burned flavor, ransit taste and odor, sour flavor and also maybe there can be unknown problems in the ripening process. The some studies demonstrate The effects of proteolytic enzymes can cause the bitter taste and the lipolytic bacteria type of achromobacter can cause be the sourdough problems. For this spoilage causes, the physical and biochemical changes during the ripening process of kashar cheese all of related analysis and controls should be made in this stage. In the ripening process some properties can increase and decrease positively and some properties can be negatively in the this state if all of controls make as physical and biochemical also microbiology anlaysis can solve to this problems. Due to the faults in the ripening process of kashar cheese a lot of producer and all of people are effecting negativelly. Because of this, in order to obtain quality kashar cheese, all of material should have wanted to quality properties. The researches show, when we use enough cleaned and if made all analysis for raw materials in the ripening we can obtain more quality and have long shelf life and also healty products. The resultly the objective of this study to determine all physical and biochemical problems and solve during the ripening of kashar cheese and also to develop new controlling system in order to increase shelf life and to protect to food product and to obtain more quality and healty product for kashar cheese.

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Enzymes and Heavy Metals in Soil

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ABSTRACT

Since the beginning of the industrial revolution, human beings have been polluting their environment with many kinds of pollutants. Accumulation of more pollutant in the environment than nature can tolerate causes pollution of the environment. One of the most important of these pollutants due to its impact on the environment is heavy metal pollution. In the environment where can live, heavy metals are difficult to tolerate for many living organisms. Therefore, one of the most important effects of heavy metals is its effect on the nutrient cycle. Also, soil enzymes play a very important role in the realization of nutrient cycles. At this stage, heavy metal pollution has negatif impacts on biological soil activities that to be indicator of the soil fertility and health.

In this study, it is aimed to discuss the effects of heavy metal pollution on soil enzymes in soil. For this purpose, definitions such as heavy metals, soil enzymes, pollutants, sources of pollutants and effects on soil enzymes are evaluated together. This study will be reviwed in general terms for those who will work on this topic in the future.

Keywords: *Soil Enzymes, Soils, Heavy Metals, Pollution, Enviroment*

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ÖZET

Sanayi devriminin başladığı günden bu güne kadar insanoğlu, çevresini pek çok çeşitte kirletici ile kirletmektedir. Doğanın tolere edebileceğinden daha fazla kirletici birikimi çevreninde kirlenmesine neden olmaktadır. Bu kirleticilerden, çevreye olan etkisi nedeni ile en önemlilerinden birisi de ağır metal kirliliğidir. Ağır metaller bulundukları çevrede bir çok canlının bünyesinde birikebilen tolere edilmesi güç elementlerdir. Bu nedenle toprakta ağır metallerin en önemli etkilerinden biri besin döngüsüne olan etkisidir. Besin döngülerinin gerçekleşmesi açısından ise toprak enzimleri çok önemli görevler üstlenirler. Bu aşamada ağır metal kirliliği toprağın verimliliği ve sağlığının göstergesi olan pek çok biyolojik toprak aktivitesine olumsuz etkilere sahiptir.

Bu çalışmada topraktaki ağır metal kirliliğinin toprak enzimleri üzerine etkilerinin tartışılması amaçlanmıştır. Bu amaçla ağır metaller, toprak enzimleri, kirleticiler, kirletici kaynakları ve toprak enzimleri üzerine etkileri gibi kavramlar bir araya getirilmiştir. Bu çalışma ile bu konu üzerine gelecekte çalışacak olanlar için bilgiler genel kapsamda derlenmiş olacaktır.

INTRODUCTION

Soil is a part of the earth that has a complex structure that has been developed for thousands or even millions of years in terrestrial ecosystems, which offers many living and feeding areas (1). Soils can be defined as the natural structure covering the Earth's surface in plant growth capacity with many characteristics consisting of main material as a result of climate and organism activities depending on topography conditions (2,3). Soil is a dynamic structure consisting of inorganic and organic substances (such as plant nutrients and humus), gases (such as O2 and CO2), liquids (like water) and living organisms (such as plants, fungi, worms, microorganisms) (3,4).

Soil is not only home to living organisms, but also an important biochemistry laboratory where substance cycles, which are one of the foundations of the ecosystem, take place. The transformation of nutrients such as nitrogen (N), carbon (C), phosphorus (P), sulphur (S) in nature is carried out by many enzymes produced by cells belonging to the organisms living in the soil or released and killed by them (5-7). Soil enzymes are important not only for nature but also for agricultural activities (5). Soil enzyme activities are also an indicator of the quality and health of the soil (6,8,9). However, enzyme activities are also adversely affected by soil pollution.

Pollution briefly means that an pollutant in an ecosystem is more than the amount it contains or is naturally present. Therefore, the pollution causes physical, chemical and biological damages to the natural environment it pollutes (4,10,11). At the present time, the sources of pollutants are mostly anthropogenic (12). Especially the industrial revolution that occurred two centuries ago and the rapid industrialization after it are the most important reasons of air soil and water pollution (13). The anthropogenic sources of pollutants originate not only from the industry but also from the phenomena covering all human activities such as agriculture, urbanization, fuel use, transportation and metallurgy (14,15).

One of the important sources of anthropogenic pollution is heavy metal pollution. Heavy metals are elements with a specific gravity greater than 5 g / cm^3 and with atomic numbers greater than 20 (12,15-18). These elements, which are considered to be heavy metals in the periodic table, are micro nutrients for living organisms such as iron (Fe), copper (Cu), zinc (Zn), manganese (Mn), molybdenum (Mo) and nickel (Ni). They have a toxic effect on living organisms (12,13,15,17,18). The sources of heavy metals are natural and anthropogenic in two different ways (1,16,19). Various processes, such as the fragmentation of the bedrock (15-17,20) or volcanic activities (19), constitute natural resources. However, anthropogenic sources are mining, industrial and agricultural activities, transportation, domestic or industrial wastes and atmospheric pollution resulting from human activities (15-17,19,20).

Heavy metal pollution is toxic to many living organisms (4,8,21). Therefore, their presence in the soil has negative effects on the biological and chemical activities of the soil. The most important of these is the effects on soil enzyme activities (8). Soil enzyme activities, pollution, ecosystem deterioration and are also used as an indicator of agricultural practices (6). Soil accumulation and prolonged stay have long-term negative effects in soil enzyme activities (6,22). Besides, they have negative effects on soil fauna and flora (6,8,13,20).

This study was conducted in order to bring together the previous studies, to gather the information and to inform the future studies.

SOIL ENZYMES

Enzymes are important biochemical molecules in the protein structure for life on earth. Their main task is to increase the speed of these reactions by decreasing the activation energy of metabolic reactions in organisms (23). Also, one of the most important features is that it can continue its activity outside the cell in appropriate conditions. Enzymes are important not only for living things, but also for the healthy and sustainability of ecosystems created by living things and their environment (24- 26).

Nearly 100 enzymes of microorganism, fungus, plant and animal origin are found in the soil, which provide growth, development, nutrition and living environment for living organisms and one of the basic elements of ecosystems (24,27-29). Although the soil enzymes are produced by living organisms, they are divided into extracelluler enzymes that secreted out of the cell or released by death of cells (i) and and intracellular enzymes that continue to function in the cell (24,25,27,28). Extracellular enzymes are adsorbed by soil colloids and retain their activity over long periods of time (30). However, these enzymes are involved in nutrient cycles in soil (Table 1) and they are responsible for the transformation of organic matter into the environment (7,25,26,31). Intracellular enzymes are mostly related to metabolic activities in the organism. Therefore, intracellular enzymes such as catalase are indicative of aerobic and facultative microbial community and activities in the soil (26).

The soil is home to many living organisms (31) as well as environment for many physical, chemical and biological activities (28,33,34). Therefore, it has the ability to respond quickly to many factors (35-38). It has attracted the attention of many scientists, especially because the soil enzymes' responses to these effects can be determined easily, accurately, precisely, quickly and cheaply (22,25, 38-41). Bu bakımdan toprak enzimleri hem doğa da (26) hem de tarımsal alanlarda (39,42) meydana gelen değişimlerin anlaşılmasında ve takibinde kullanılmaktadır. Soil enzymes, which is an indicator of soil quality and fertility (7,25), are considered as indicators of disturbances in ecosystems, agricultural practices and especially pollutants (8,43). As a result, whether the effects of the agent on nature, soil, especially agriculture, damage the environment, if it causes damage, understanding the extent of damage, whether damages can be eliminated and positive or negative effects on human life due to the obligatory relationship with soil can be determined and evaluated.

SOIL POLLUTION

Soils where are many living things on and within (33) and in this respect, nature and human beings have an invaluable importance (24,25,44,45), are a dynamic structure where many physiological, chemical and biological activities take place (25,28,31,34,47,48).

Along with the industrial revolution that began in 1800s, globally, our world began to be polluted gradually. Today, our land, atmosphere and seas are polluted in different sizes due to many anthropogenic pollutants due to industry, transportation, domestic wastes, urbanization (21,49).

Pollution can be defined as the accumulation of more pollutants than those that are absent or naturally present. Pollution is a condition that has negative effects on the physical, chemical and biological activities of ecosystems and mostly with anthropogenic effects (4). Soil pollution, especially as a result of human activities, is a component of the environment in the accumulation of pollutants and soil loss or non-natural changes in the function of the natural (8,11,50). Soil pollution may occur naturally due to main rocks, volcanoes or fires and is now mostly anthropogenic (3,4,16,20,48).

Pollutants in soils are organic (such as permanent organic polymers) and inorganic substances (such as heavy metals). These have negative effects on the physical, chemical and biological structure of soils that are the indicators of the general activities of ecosystems given in Table 2 (3,4,16,17,49).

Soil organisms that contribute to the formation and development of these structures and which have different biological characteristics in terms of morphological, anatomical, physiological and biochemical properties, give different responses to permanent organic pollutants (POPs) as pesticide, organik pollutants as hydrocarbons and inorganic pollutants as heavy metals, ranging from species to species (48). Because of their effects on these organisms (26,51,52), which have important contributions to soil health, soil pollutants are generally important in the efficiency and quality of soils.

Enzymes	**Indication of Soil Function**	**Nutrient Cycling**
Dehydrogenase	General microbial activity	H^+ transfer to various molecules
Catalase	Aerobic and facultative aerobic bacteria activity	It involves part in detoxification of Peoxide (H_2O_2), which is toxic to living things.
α-Amylase β-Amylase Maltase Endocellulase Exocellulase Pectinase Lignin peroxidase Manganese peroxidase Laccase	Decomposition of organic matter	They are involve in the cycle of carbon (C).
β-Glucosidase	General microbial activity	
Protease	Nitorgen (N) source for soil microorganisms	They are involve in the cycle of nitrogen (N).
Deaminase Nitrate reductase Amidase Urease	Nitrogen (N) source for soil microorganisms and plants	
Acid phosphatase Alkaline phosphatase Phosphodiesterase Phytase	They form the source of phosphate (P) for plants and microorganisms	They are involve in the cycle of phosphorus (P).
Sulfatase	Sulfur (S) source for plants and microorganisms	They are involve in the sulfur (S) cycle.

Table 1: Some Soil Enzymes in Nutrient Cycles (25)

HEAVY METALS AND SOIL POLLUTION

Heavy metals are inorganic elements with a specific gravity greater than 5 g/cm^3 and with atomic numbers greater than 20 (12,15-18,20). These elements, which make up a little more than 35% of the periodic table (20), are as much as 70, but 20 are valuable in terms of ecosystems (18). These elements are iron (Fe), manganese (Mn), zinc (Zn), copper (Cu), cobalt (Co), nickel (Ni), chromium (Cr), lead (Pb), beryllium (Be), cadmium (Cd antimony (Sb), selenium (Se), tin (Sn), silver (Ag), arsenic (As), mercury (Hg), aluminum (Al) vanadium (V) (Table 3) (3,4,8,15,20,21,48,53,54). Some of these are micronutrients for living organisms (such as Fe, Zn, Mn, Cu, B, Mo, Ni, Co, Cr, Se, Sn) which are toxic to organisms above the amounts needed by organisms (3,20,42,48).

Heavy metal sources may be natural, and heavy metals after industrialization revolution are mostly anthropogenic origin (4). Therefore, the first type of pollution in environmental pollution is heavy metal pollution (15). It has been reported to be high in lead (Pb), zinc (Zn) and cadmium (Cd) due to its high concentrations in the main rock in Mendip Region, England (Fuge et al., 1991). It has also been reported that volcanic activities, vegetation, forest fires, erosion (Table 4) are the source of heavy metals, as well as the main rock origin transmission (15-20,54). Nowadays, most of the heavy metal sources are anthropogenic. In general, industrial, mining, urbanization, domestic wastes and agricultural practices have a significant share in heavy metal pollution (15-17,19,20,54).

The effect of heavy metals pollution on ecosystems is caused by the accumulation of these elements in ecosystems (20,21,47). The heavy metal pollutants entering the ecosystem, especially by the primary producers taking these elements in an active or passive manner, cause the accumulation to reach to the top of the chain through the food chain (4,15,48). As it is a part of the system in the soil, especially when agricultural activities are considered, heavy metals entering the soil reach to people and threaten human health (20). Heavy metal pollution in the soil not only threatens human health, but also affects the physical, chemical and biological structure of soils in ecosystems (4,8,15-20,47,54).

Physical Indicators	**Chemical Indicators**	**Biological Indicators**
* Bulk density * Aggregate stability * Water holding capacity * Infiltration capacity * Topsoil depth * Slaking * Soil crusts * Soil structure * Macropores * Amount of humus	* pH * Electrical conductivity * Cation exchange capacity * Total organic carbon (TOC) * Total nitrojen * C:N ratio * Mikrobial biyomas C_{mik}, N_{mik}, P_{mik} and S_{mik} * Available nutrients (e.g., NH_4^+, NO_3^-, PO_4^{3-}, Na^+, K^+, Ca^{2+}, Mg^{2+}) * Pollutatants (inorganik pollutants as heavy metal sor organik pollutants as pesticide, hydrocarbons)	* Soil respiration * Mikrobial biomass * Soil anzymes (e.g., urease, catalase, β-glucosidase, arilsulphatase, phosphomonoesterase) * Potentially mineralizable nitrogen * Microbial diversity * Microfauna abundance and richness (e.g., nematodes) * Mesofauna abundance and richness (e.g., collembola, mites) * Macrofauna abundance and richness (e.g., earthworms, termites) * Metabolic quotient (qCO_2) * Litter decomposition * Fauna feeding activity * Food webs (e.g., bioaccumulation, biomagnification)

Table 2: Some Physical, Chemical and Biological Markers Used to Assess Soil Quality and Fertility (48)

Although the pollution of heavy metals in soils is multidimensional, its impact on soil microbial communities, which is one of the important biological parameters of soils, is of particular importance for the ecosystem (4,15,17,20,47,53,54). When the soil is exposed to heavy metal contamination in large quantities, microorganisms take these pollutants from the active or passive pathways to the cell surface. Heavy metal pollutants have different effects depending on heavy metal and concentration of these organisms (Table 5). Heavy metal contamination reduces microbial species diversity in soils and as a result, the microorganism content changes. Accordingly, the microbiological processing density of the soils and consequently the soil enzyme activity is reduced (16,53), which clearly implies that the soil cycles that are the basis of the ecosystems of the soils are impeded in soils that are contaminated by heavy metals. Also, in heavy metal contaminated soils, chemical properties such as humus and physical and pH are affected negatively (16; 20; 54). As a result, the soil cannot perform its tasks within the ecosystem. This situation causes soil degradation (3,4,8,15,16,20,21,48,53).

Basic Elements	**Macronutrienst**	**Micronutrients**	**Heavy Metals**
Carbon (C)	Carbon (C)	Iron (Fe)	Manganese (Mn)
Hydrogen (H)	Nitrogen (N)	Zinc (Zn)	Iron (Fe)
Oxygen (O)	Phosphorus (P)	Manganese (Mn)	Copper (Cu)
Nitrogen (N)	Sulfur(S)	Copper (Cu)	Cobalt (Co)
Phosphorus (P)	Calcium (Ca)	Boron (B)	Nickel (Ni)
Sulfur(S)	Sodium (Na)	Molybdenum (Mo)	Crom (Cr)
	Potassium (K)	Nickel (Ni)	Lead (Pb)
	Magnesium (Mg)	Cobalt (Co)	Beryllium (Be)
		Crom (Cr)	Cadmium (Cd)
		Selenium (Se)	Antimony (Sb)
		Tin (Sn)	Selenium (Se)
			Tin (Sn)
			Silver (Ag)
			Arsenic (As)
			Mercury (Hg)
			Aluminium (Al)
			Vanadium (V)

Table 3: Basic Elements, Macro and Micro Nutrients and Some Heavy Metals in Terms of Organisms, (modified from 4,15,20,48).

Heavy metals have negative effects on soil enzymes, most of which are produced by microbial flora and fauna. The activity of enzymes is mostly inhibited by heavy metals (8,48,53,54-61). Chemical properties and ecological dosage of heavy metals, properties of soil enzymes, physical and chemical properties of soil, biological properties of soil such as vegetation and micro-macro fauna and flora is effective on the inhibition of enzyme activity by heavy metals (8,61,62).

RESULTS

The age of technology, which we have emerged after scientific revolution and industrialization revolution greatly facilitated human life. However, in this industry and technology age, human that wanting to take advantage of the products of this age has also harmed the nature (4,10-15).

In today's environment where most of the environmental pollution is anthropogenic, our atmosphere and our water are not contaminated but also contaminated in our lands (21,49). Soil is important in terms of ecosystems in terms of hosting many living organisms and is the basic element of ecosystems. Therefore, the responses to environmental pollution provide important information about the sustainability and health of ecosystems. At the same time, the health and fertility of the soil due to the execution of many agricultural activities is important for human life.

Table 4: Heavy Metal Sources (modified from 54).

As for air and water pollution, soil pollution may be caused by natural resources such as volcanic activities, soil formation, vegetation and erosion. Today, the largest sources of soil pollutants are human and human activities such as industrialization, urbanization, waste, mining and agricultural activities (3,4,16,20,48,54). Soil pollutants are divided into inorganic pollutants such as organic pollutants and heavy metals such as permanent organic polymers (48).

The most rapid response to soil pollution is observed in soil microorganisms. Due to their biological structure, microorganisms produce faster responses than higher organisms. This is due to the degradation in the activities of soil enzymes (26,51,52), which are very important in the productivity and health of soils. Soil enzymes are biological catalysts in the protein structure and are involved in the catalysis of many biochemical reactions in soil as well as in organism metabolism (23,24). They are especially involved in nutrient cycling, decomposition of organic materials and nutrients up to the forms that can be used by plants (7,25,26,31).

Soil enzymes are divided into intracellular and extracellular soil enzymes. Intracellular enzymes are enzymes involved in the metabolic activities of living organisms in the soil. In this respect, these enzymes are often important in the determination of microbial activity in soils and their status. However, extracellular enzymes are the enzymes that are secreted from the cell by living organisms, or the released of the cells with the death of living organisms, which are mostly responsible for the organic degradation of soil and the nutrient cycling (24,25,27,28).

There are many biological factors such as physiological, pH, chemical and microbial commutation such as soil depth that affect soil enzyme activities. Again, pollutants have important effects on the physical, chemical and biological properties of soil. Especially heavy metals have more important effects on the physical, chemical and biological properties of soils than other pollutants because they cause accumulation (4,15,20,48). Heavy metals are elements with an atomic number greater than 20 and greater than 5 g/cm^3, and about 70 elements are included in this group (12,15-18,20). 20 of these have important effects on cell organisms such as cell division, transcription, protein synthesis and inhibition of intra- and extracellular enzyme activation, DNA and mRNA synthesis damage, cell membrane breakdown (20).

Effects on Microorganisms	**Hg**	**Pb**	**Cd**	**Ni**	**Zn**	**Cu**	**As**
Denaturation of Proteins	+	+	+				
Inhibition of Cell Division	+	+	+	+			
Corruption of Cell Membrane	+	+	+	+	+	+	
Inhibition of Enzyme Activity	+	+	+	+	+	+	
Inhibition of Protein Synthesis	+	+	+	+	+	+	+
DNA Damages	+	+	+				+
Damages of mRNA Synthesis	+						
Inhibition of Transcription	+	+	+				

Table 5. The Effects of Heavy Metal Pollution on the Cellular Level in Microorganisms (20)

Studies on soil enzymes have not only provided important information for the sustainability and health of the environment, but they are also important for the use of the information obtained in this direction to increase the agricultural product and yield in order to meet the nutritional and food needs of the increasing human populations. In particular, it will be possible to obtain or reproduce information about how soil pollution and enzymes correlate, and how nutrient cycles work in natural soils and soils where agricultural activities are carried out. This information not only helps us to understand how natural ecosystems work, but also leads us to reveal how we can achieve a healthy, reliable, and sufficient amount of food production as a result of agricultural activities.

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Bisphenol-A Residue in Foods and Agricultural Environments in Terms of Sustainable Agriculture

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Abstract

Bisphenol-A (BPA) is a synthetic chemical used in polycarbonate plastics, epoxy resins and thermal paper. It is also used in plastic water bottles, plastic boxed products, DVDs and CDs, sports equipment, medical instruments, canned food and bottles. It is one of the most commonly produced chemicals worldwide. BPA is ubiquitous within the environment and it is estimated that > 90 % of people have detectable levels of BPA in their urine. BPA is an environmental health concern due to its widespread exposure as well as its potential toxicity. BPA is an endocrine disruptor which acts as an estrogen mimic. BPA causes a serious decrease in sperm production. BPA also triggers heart disease in women and menstrual irregularity, changing male hormones in men, increasing the risk of breast cancer, enzyme disorders in liver, brain and brain development retardation. Nowadays, bisphenol-A has been detected at trace levels in agricultural fields, cultivating crops or foods, surface water, wastewater, landfill leachate and drinking water in different parts of the world. It is not desirable to have bisphenol-A residues in agricultural areas and surface or groundwater in order to produce healthy crops or food for sustainable agriculture. The aim of this study is; to investigate the sources of bisphenol-A residues, to evaluate the effects of bisphenol-A residue in foods, water and soil for sustainable agriculture and to examine its health effects.

INTRODUCTION

Bisphenol-A (BPA) is the molecular building block for important industrial chemicals, polycarbonate plastics and epoxy resins, which are used in a wide variety of applications. For instance, polycarbonate is used in eyeglass lenses, medical equipment, water bottles, digital media like CDs/DVDs, cell phones, consumer electronics, computers, electrical equipment, household appliances, safety shields, construction glazing, sports safety equipment, and 5automobiles. Among the many uses of epoxy resins, industrial floorings, adhesives, industrial protective coatings, powder coatings, automotive primers, can coatings and printed circuit boards are quite popular. Bisphenol-A is a chemical originally manufactured as a synthetic estrogen. Over 300.000 ton is manufactured every year in the world. This data makes Bisphenol-A one of the most produced chemical.

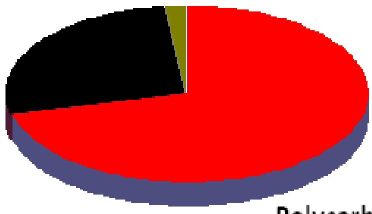
BPA is a small (228 Da) molecule, used as a monomer in the polymerization reaction to produce polycarbonate plastics and epoxy resins. In 1905 Thomas Zincke from University of Marburg first reported that he synthesized BPA. It was then obtained by condensation of phenol with acetone in the presence of a strongly acidic ion-exchange resin in a gel form, as a catalyst. Although Thomas Zincke produced the first BPA he didn't propose any application or use of BPA. Even though Thomas Zincke synthesized BPA a large scale of production began in late 1950 and early 1960's. [1-3].

Over the past 20 years, scientists have detected Bisphenol-A in breast milk, serum, saliva, urine, amniotic fluid and cord blood in Europe, North America and Asia. Bisphenol-A ranks the top 2 % of high production volume chemicals in the U.S., with an annual production exceeding billion pounds and is thus common in products and industrial waste that it pollutes not only people, but also rivers, sediments, house dust, and even air nearly everywhere. BPA is used everywhere since 1950's which makes it one of the most used chemical in the world with production of 300.000 tons. BPA is now used at every sector in the world and this fact effects our environment and health. Recent data shows that Bisphenol-A is found at detectable levels in human urine samples with a rate of 90% which is very high. [5-7].

QUANTITATIVE DESCRIPTION OF BISPHENOL-A-BASED MATERIALS

Figure 1 shows us the distribution of BPA in different commercial materials used. It is used as an intermediate for binding, plasticizing or hardening of plastics, paints/lacquers, binding materials, and filling-in materials. It is also a substrate for the production of polycarbonate resins (71%) and epoxy resins (27%). Furthermore, BPA is used as an additive for flame-retardants, brake fluids, and thermal papers. An historical growth in BPA consumption of 6–8%/year is driven primarily by heavy demand for polycarbonate resins. Automotive applications account to nearly 20% of the total polycarbonate consumption, with resins used in place of traditional materials such as metals and glasses. Its uses in glazing and sheet form in construction and transportation industries make up its further 20% of consumption. Optical media, including audio compact discs (CDs), CD- ROMs, recordable CDs, and digital versatile disks (DVDs) account for the rapidly growing proportion, about 15–20% of the polycarbonate market [8-10]. Production of BPA causes 2 tonnes of emissions to surface water and 1 tonne to air every year. The most important emissions are from production of phenoplast cast resins, PVC and thermal paper.

Figure 16: Usage chart of BPA in polycarbonate, epoxy resins and tetrabromobisphenol-A (TBBA)/other resins



PROPERTIES OF BPA

BPA is in a solid state, which melts only at temperatures considerably above the boiling point of water, i.e. at about 155°C and it has low vapor pressure under ambient temperature conditions. BPA has a boiling point of 220 °C at 4 mm Hg.

Property	Value
Boiling point	220°C at 4 mm Hg, 398°C at 760 mm Hg
Melting point	150-157°C
Specific gravity	1.060-1.195 g/mL at 20-25°C
Solubility in water	120-300 mg/L at 20-25°C
Vapor pressure	$8.7 \times 10^{-10} – 3.96 \times 10^{-7}$ mm Hg at 20-25°C
Log K_{ow}	2.20-3.82
Henry constant	1.0×10^{-10} atm.m^3/mol

Table 1: Properties of BPA

Structure and Properties

Polycarbonate is mainly a condensed polymer of BPA and carbonyl chloride or diphenyl carbonate. Since it is transparent, have excellent heat resistance and impact resistance, which can be used for high-temperature applications and in microwave ovens. BPA is also used in children's tableware, coffee makers and food containers. Table 1 refers to some of Bisphenol A's physical and chemical properties.

COMMERCIAL PRODUCTION AND USE OF BPA

In 1953, Dr. Hermann Schnell of Bayer in Germany and Dr. Dan Fox of General Electric in the United States independently developed manufacturing processes for polycarbonate using BPA as the starting material. Polycarbonate plastic was found to have a unique combination of very useful properties, in particular optical clarity, shatter-resistance and high heat-resistance, which have made it an important commodity in a wide variety of applications. In 1957 commercial production of BPA began in USA then it was followed by Europe in 1958. Approximately at the same time epoxy resins were developed with the versatility to meet a wide range of industrial and consumer needs. Epoxy-based coatings are now used everywhere. If we would like to give an example we can start with tank coatings, structural steel coatings, aircraft finishes, can and drum linings, furniture finishes, in printing inks, in dental, surgical and prosthetic applications, etc. [8-9].

Applications of BPA

As hardware material in construction, PC is used as sheets for roofing, conservatory glassing, architectural glassing, green house glassing, roof lights, covering for solar panels, noise reduction walls for roads and train tracks, carport covers, glassing for bus-stop shelters, road signs, internal safety shields for stadiums, transparent cabins for sky lifts, housings and fittings for halogen lighting systems, road signs, front panels for advertising posters, large advertising displays, dust and water-proof luminaries for street lights and lamp globes, diffusing reflectors for traffic lights etc. (b) Safety related PC applications includes safety goggles, protective visors for welding or handling of hazardous substances, protective visors for motorbikes, snow mobiles, motor bike and cycle helmets, fencing helmets, safety shields for policemen, guards to protect workers from moving machine parts, Sun glasses, transparent building blocks, in toys, mouth pieces for musical instruments, compass housings, binocular housings, seats for sleighs, ball point pen casings, transparent roof modules in caravans, instrumentation housings in boats, suitcase shells. (c) Optical properties of PC finds the many applications in new technological hard wear materials including compact discs, CD-ROMs, digital versatile discs, HD-DVDs, blue-ray discs, holography discs, innovative data storage technology, forgery-proof holographic shadow pictures in ID cards and so on. (d) Electrical & Electronics**:** Housings for cell phones, SLR cameras, electrical razors, hairdryers, steam irons, mixers, computers, monitors, TVs, copiers, printers, telephones, microwaves, coffee makers, Front panels for electric cookers, Electrical kettles, Transparent front panels for vending machines, Interior lighting panels for trains and airplanes, Back light units for TVs, Housings for switch modules, distributor boxes, fuses, battery power stations, sockets, electrical meters, Illuminated rotary switches, Plug connectors, Switches, Sockets, Plugs and Lamp holders.

1. HEALTH HAZARDOUS IN MIGRATION INTO HUMAN BODY

Even though normally resilient, carbonate linkages are prone to can hydrolyze at high temperatures and release BPA. Also, BPA can be liberated from the incompletely polymerized epoxy resins [10]. Being lipophilic, many xenoestrogens can access the human body by ingestion or absorption through the skin and mucosal membranes. The first study [11] detected BPA in a liquid from canned vegetables (10 –20 μg/can, or 50 –100 μm). The second study [12] found 20 –30 μg/ml of BPA in saliva collected from the objects treated with composite dental sealants. The estrogenic activity of BPA was accidentally discovered. After reporting yeast produced estrogens, the authors realized that the estrogenic substance in the conditioned media had leached from polycarbonate flasks during autoclaving of water.

2. EFFECT ON HUMANS

The hazard evaluation process for evaluating the environmental safety of chemicals requires that not only effects, but exposure must be considered. Often, the most difficult part of the evaluation process is the determination of environmental exposure resulting from discharge or spills of chemicals. The toxicology of BPA has been extensively studied by industry, government and academia in short and long term animal tests, including several reproduction studies, multi-generation exposure studies and a cancer bioassay, all of which are part of the open scientific literature. For many years, BPA was treated as neutral to human health. Detection of BPA in the natural environment, in drinking water, and in food products since 1990 has, however, aroused the interest of many researchers. At almost the same time, a negative effect of this compound on human health was established. Consequently, in 1996

BPA was classified by the European Commission as a substance of external origin with a harmful effect on human health. Early studies [13] have revealed that bisphenol A is classified as a xenobiotic disturbing hormonal balance in humans and other animals, a so-called endocrine disruptor. Bisphenol A has been proved to have estrogenic activity even at concentrations below 1 mg/L.

2.1. Alternative to BPA

Polycarbonate is cheap, durable, and lends itself to strict manufacturing processes. These qualities and its esthetic appeal made it the material of choice for most big name bottle companies. This is unfortunate as, according to research, polycarbonate is the biggest offender when it comes to the leaching of BPA. While the controversy rallies on, we will probably not know the true amount of BPA that we consume daily or the exact effects it has on living organisms.

2.2. BPA Free Plastics

Fortunately, it is easy to find alternatives to BPA. Demand for alternative materials has caused a new non-Bisphenol-A industry to arise. Plastic bottle makers, baby gear manufacturers, container companies, and others are eyeing alternative materials for their products while businesses specializing in the sale of safe alternatives are springing up all over the Internet. It is much easier these days to find non-BPA plastics like baby bottles and water bottles which will not risk your health.

3. EFFECT ON SUSTAINABLE AGRICULTURE

Sustainable agriculture is farming in sustainable ways (meeting society's food and textile needs in the present without compromising the ability of future generations to meet their own needs) based on an understanding of ecosystem services, the study of relationships between organisms and their environment. It is a long-term methodological structure that incorporates profit, environmental stewardship, fairness, health, business and familial aspects on a farm setting. It is defined by 3 integral aspects which are: economic profit, environmental stewardship and social responsibility. Sustainability focuses on the business process and practice of a farm in general, rather than a specific agricultural product. The integrated economic, environmental, and social principles are incorporated into a “triple bottom line” (TBL); when the general impacts of the farm are assessed. Unlike a traditional approach where the profit-margin is the single major factor; Agriculture sustainability is also involved with the social and environmental factors.

However, BPA has an effect on agriculture too. Nowadays BPA has been detected at trace levels in agricultural fields, cultivating crops or foods.

CONCLUSIONS

There are growing concers about BPA all around the world and academic researches are being carried everyday. Scientists and companies are working on wide range of materials to get rid of Bisphenol-A. As health and environmental awareness is increasing, people want to use BPA-free products everyday. Manufacturers are now working towards to create alternative ways compared to the traditional materials, especially to avoid the use of BPA in consumer products. Variations of such alternatives to BPA containing water bottles and baby bottles already have begun flow in the market.

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Gaziantep Solid Waste Management: The Effects of the Zero Waste Project

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Abstract

The concept of 'zero waste' management has emerged as an innovative way to tackle waste problems. A number of researchers have already defined the concept in different ways. Zero waste management is a holistic waste management concept that recognises waste as a resource which is produced at the intermediate phase of the resource consumption process. To measure the performance and progress in zero waste management, it is important to have certain indicators that sketch different waste management systems and predict effective development scenarios. A number of indicators on waste management systems have already been developed by researchers in many cities and countries. The "Zero Waste Project" is supported by the Turkish Presidency in Turkey. At the beginning of 2018 Gaziantep Metropolitan Municipality started the "Zero Waste Project" and bought 6 different trash bins for the project. The bins contain metal, glass, plastic, paper, organic and non recyclable. The project is implemented in Metropolitan Municipality buildings for now. Organic waste doesn't directly go to Sanitary Landfill Area. Organic waste that came from the organic waste bins were composted and produced compost was used in parks, gardens and agricultural fields. Sustainable agriculture requires to minimize the agricultural pollution and to maximize the use of available resources for farming where nothing is wasted or contaminated. The aim in this study is to evaluate the effects of zero waste project on the sustainable agriculture and the environment protection.

Keywords: *zero waste, resources, agricultural waste, pollution*

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INTRODUCTION

Solid waste management (SWM) has suddenly become a new threat to global sustainability agenda of United Nation (UN) due to population explosion (Aragaw etal., 2016). By 2050, the worldpopulation has been estimated to be 9 billion (The Economist, 2011). Population explosion often comes with impacts on the environment and one of them is the rapid waste generation. Waste management (WM) has recently drawn attention as a focal point for safe environment activist/environmentalists and researchers in the institutions of higher learning. The anthropogenic activities of man have always been producing wastes which are either disposed indiscreetly to the landfill site (LS) or structurally disposed to organized landfills. Recent researches have shown that among the issues faced by this generation, the prime is the issue of municipal solid waste management (MSWM). This issue can be resolved when waste items are reused and recycled and are channeled as raw materials for other production processes leading to complete diversion of municipal solid wastes (MSWs) from landfills otherwise referred to as Zero waste (Chandrappa, 2012; Chartered Institute of Purchasing & Supply, 2007; Jacobi and Besen, 2011). Zero waste (ZW) is a goal that is directed towards recovering of resources and safeguarding of the limited natural resources when waste is diverted from going to the incinerators and landfills. It involves minimization of waste, composting of waste, recycling, reusing and adjustment in the manner in which people consume the limited natural resources and the need for industries to redesign their products so that waste can be eradicated in the production processes. (Allen et al., 2012).

“Zero waste” is one of the most visionary concepts for solving waste problems. Many cities around the globe such as Adelaide, San Francisco and Stockholm have declared their zero waste vision and these cities are working to be the world’s first zero waste city. But how to transform our existing cities into zero waste cities and how to measure the performance of a zero waste city are the prime questions to answer in zero waste research. The products that we consume every day are primarily produced using virgin materials, energy and water. From resources extraction to waste generation, consumption depletes the environment by contributing greenhouse gases (GHG) to the atmosphere.

DEVELOPMENT OF THE ZERO WASTE CONCEPT

From outer space to the bottom of the ocean, generations ofwaste is accumulating over time. On one hand, the estimated amount of debris put into space by humans and no longer in function has increased from 14,000 pieces in 2007 to 18,000 pieces in 2008 (SSN, 2011). On the other hand, accumulation of waste in the great Pacific Garbage Patch (currently 1,760,000 sqkm, 12 times bigger than Bangladesh) is getting larger every day (MNN, 2010; PPC, 2011).

Currently, the world's cities generate about 1.3 billion tonnes of solid waste per year and the volume is expected to increase to 2.2 billion tonnes by 2025 (Hoornweg and Bhada-Tata, 2012). Waste generation rates will more than double over the next twenty years in lower income countries.

The Concept Of Zero Waste

Zero waste means designing and managing products and processes systematically to avoid and eliminate waste, and to recover all resources from the waste stream (ZWIA, 2004). Working towards zero waste has become a worldwide movement that motivates changes in design that make it possible to disassemble and recycle products. To put it simply, zero waste means no unnecessary and unwanted waste from a product at any stage of its life cycle. The scope of zero waste comprises many concepts that have been developed for sustainable waste management systems, including avoiding, reducing, reusing, redesigning, regenerating, recycling, repairing, remanufacturing, reselling and re-distributing waste resources. Hence, a zero-waste strategy is growing in popularity as best practice. It not only encourages recycling of products but also aims to restructure their design, production and distribution to prevent waste emerging in the first place (UNECE, 2011).

Most modern societies have been implementing integrated waste management systems to recycle and recover resources from waste. However, the concept of zero waste is not limited to optimum recycling or resource recovery; in addition to that zero waste requires elimination of unnecessarywaste creation at the first stage of designing a product. Therefore, zero waste design principles go beyond recycling to focus firstly on avoidance and reduction of waste by innovative product design and then recycling and composting the rest.

ZERO WASTE PROJECT IN TURKEY

Due to the rapid growth of population and urbanization, waste amounts are increasing day by day. Similarly, the population and the amount of waste is continuously increasing in Turkey.

The Ministry of Environment and Urbanization has targeted "Zero Waste" principle so as to make the current system have a more regular, systematic and applicable foundation to the wastes pursuant to sustainable development principles, to leave a clean and advanced Turkey to the next generations and a livable world. Within this context, studies started in June 2017 and started gradual "Zero Waste" application in its main service building.

The Ministry, starting the "Zero Waste" Project in Ankara, plans to implement the project gradually to entire Turkey. The project is aimed to be implemented in the public institutions and organizations, educational institutions, shopping malls, hospitals, entertainment facilities and big business places, and then the whole Turkey by 2023.

"Zero Waste" is a target defined as a waste management philosophy covering the prevention of waste, more efficient use of resources, reviewing and prevention or minimizing the formation of wastes, and separate collection and recycling of wastes. The disposal of wastes without recycling causes serious resource losses in terms of both material and energy. While the population and life standards in the world increase, the consumption also inevitably increases, and this increases the pressure on natural resources and unbalance the world, and our limited resources cannot meet the increasing needs.

Considering this, the importance of the efficient use of natural resources also becomes more prominent. That is why the implementation of zero waste practices is becoming more popular individually, in the institutions and municipalities in the world.

Waste Management In Gaziantep

Since two different landfill sites were planned in Gaziantep and Nizip, the collected data was divided into Gaziantep (Karkamış and Nizip) Municipalities and Nizip and Karkamış district municipalities.

As a result of the analyzes, it has been calculated that 666,748 tons of waste is produced in Gaziantep project area and 55,527 tons of waste is produced in Nizip Project area. The following tables show the production quantities by manufacturer classes and by type of waste.

Material Class	**High Income**	**Medium Income**	**Low Income**	**Commerial**	**Rural**	**Total (ton)**
Organic Waste	56.376	94.642	72.063	56.011	87.520	366.612
Biodegradable Kitchen Waste	53.366	91.950	59.131	42.657	71.814	318.918
Biodegradable Park Garden Waste	3.010	2.692	12.932	13.354	15.706	47.694

Wooden	172	1.180	219	192	266	2.030
Paper / Cardboard	6.335	13.771	5.773	30.586	7.011	63.476
Paper	3.732	7.617	3.929	20.362	4.771	40.412
Cardboard	2.602	6.154	1.844	10.224	2.240	23.064
Pine	2.566	5.150	1.505	9.303	1.828	20.351
Plastic	8.941	15.675	8.001	17.255	9.717	59.590
Textile	1.888	10.246	3.824	3.626	4.644	24.228
Metal	214	443	244	1.110	296	2.306
Dangerous waste	798	1.003	969	1.003	1.177	4.950
Composite Materials	654	1.222	757	857	919	4.409
Electric Electronic Waste	3	47	58	140	70	318
Other Composites	651	1.175	699	717	849	4.091
Inert Waste	1.008	1.159	14.843	3.989	18.027	39.026
Other Classes	9.896	16.034	7.080	4.322	8.598	45.930
Thin Materials from 10 mm	1.611	7.350	8.363	6.357	10.157	33.839
Total	90.460	167.875	123.640	134.613	150.160	666.748

Table 1: Gaziantep Metropolitan Municipality (Excluding Nizip and Karkamış) 2014 Waste Content According to Income Levels

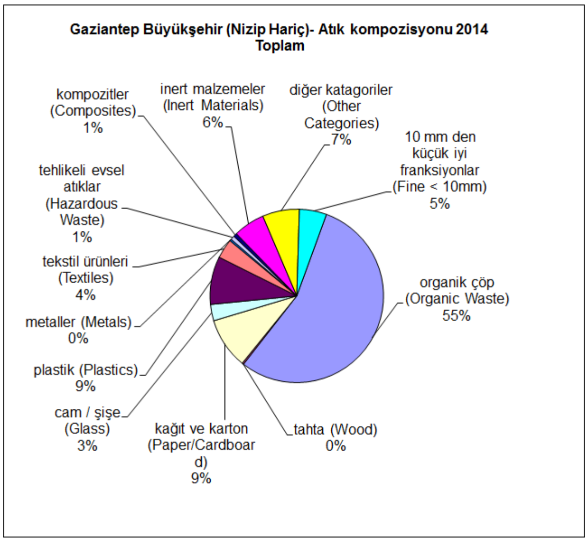

Table 2: Gaziantep Metropolitan Municipality (Excluding Nizip and Karkamış) 2014 Waste Content

Material Class	**High Income**	**Medium Income**	**Low Income**	**Commerial**	**Rural**	**Total (ton)**
Organic Waste	4.734	8.051	6.051	4.703	6.973	30.513
Biodegradable Kitchen Waste	4.481	7.822	4.965	3.582	5.722	26.572
Biodegradable Park Garden Waste	253	229	1.086	1.121	1.251	3.940
Wooden	14	100	18	16	21	171
Paper / Cardboard	532	1.171	485	2.568	559	5.315
Paper	313	648	330	1.710	380	3.381
Cardboard	219	523	155	859	178	1.934
Pine	215	438	126	781	146	1.707
Plastic	751	1.333	672	1.449	774	4.979
Textile	159	872	321	304	370	2.026
Metal	18	38	20	93	24	193
Dangerous waste	67	85	81	84	94	412
Composite Materials	55	104	64	72	73	368
Electric Electronic Waste	0	4	5	12	6	26
Other Composites	55	100	59	60	68	341
Inert Waste	85	99	1.246	335	1.436	3.201
Other Classes	831	1.364	594	363	685	3.837
Thin Materials from 10 mm	135	625	702	534	809	2.806
Total	7.596	14.280	10.382	11.304	11.964	55.527

Table 3: According to 2014 Income Levels in Nizip and Karkamış

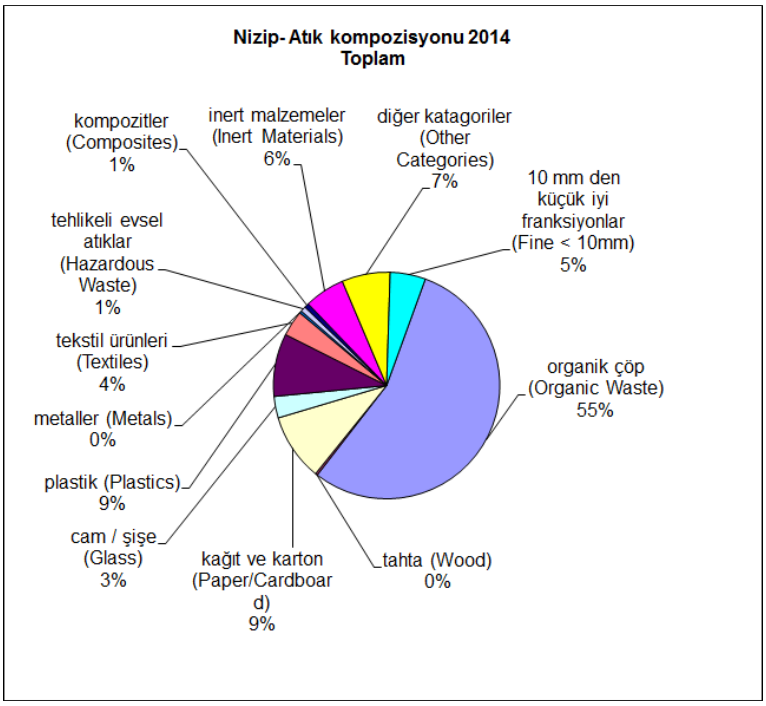

Table 6: 2014 waste content in Nizip and Karkamış

Gaziantep Sanitary Solid Waste Landfill Site

Gaziantep Solid Waste Landfill, whose projects are prepared by the GAP Administration and has an area of 256 hectares, was put into operation in 1996 and its life is 50 years. It has a capacity of 30 million m^3. Between 1996 and 2017, approximately 7 million tons of solid waste was stored. In the Central Solid Waste Landfill, approximately 1800 tons of solid waste is brought daily from Sahinbey, Sehitkamil and Oguzeli districts. Moreover, an average of 120 tons of solid waste is brought daily from the Fevzipaşa Solid Waste Transfer Station. There is also Reverse Osmosis Waste Leachate Treatment Plant in the Central Solid Waste Landfill and has a capacity of 312 m^3 per day. In addition, since 2009, CEV Energy has been producing energy from methane gas in the Central Solid Waste Landfill and has 5 engines. The installed capacity of the facility is 5,65 MW and it meets the electricity needs of approximately 10,000 households.

Nizip Sanitary Solid Waste Landfill Site

The field, which started to be operated in 2009, has a life span of 30 years and a capacity of 2 million m^3. Projects for 1st Lot Rehabilitation and 2nd Lot and 3rd Lot new field construction were prepared in Solid Waste Landfill and designed for 16 years. Solid Waste Landfill Nizip and Karkamis districts bring about 200 tons of solid waste daily. As of 2018, after the completion of the 2nd Lot, which is 25.000 m^2 in size, rehabilitation of Stage 1, which has an area of 35.000 m^2, has been rehabilitated.

Zero Waste In Gaziantep

The "Zero Waste Project" is also supported by the Turkish Presidency in Turkey. As a country Turkey is recycling at every city for years but it is not very efficient. At the beginning of 2018 Gaziantep Metropolitan Municipality started the "Zero Waste Project" and bought 6 different trash bins for the project. The bins contain metal, glass, plastic, paper, organic and non recyclable.

The project is implemented in Metropolitan Municipality buildings for now and metropolitan municipality is also building a Mechanical Biological Treatment Plant for supporting the project. At the end of 2018 Metropolitan Municipality also completed The Biogas Production Plant. 9.939,00 m^3 of biogas will be produced from 150 tons of animal waste daily. 8 million 235 kW electricity, 8 million 840 thousand kW equivalent heat is expected to be produced annually.

According to August 2018 data Gaziantep Metropolitan Municipality saved 287.681 trees and has saved 448.444 m^3 water. In addition, 158,095,695 kW / h of electricity were saved and 636,883 liters of oil was prevented and energy savings of 1 month of consumption of 14,276 households were achieved. Considering these datas Gaziantep Metropolitan Municipality also prevented CO_2 emissions of 611.444 tons.

CONCLUSIONS

There have already been major changes to the way Turkish society manages waste and both waste generation and recycling rates have been constantly going up. However, to make the recycling economy of the 21st century a reality, behavior change and educational programs are needed. Consumers need to be made aware of the fact that waste is a precious resource – for instance the value of food waste, e-waste, glass and packaging cardboard – that waste is valuable, in the same way as legislation is need to make product manufacturers and construction companies operate in a more material-efficient and less wasteful manner. From the datas it is easily to see that Gaziantep is a pioneer city in Turkey.

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Spectacular Functions of *Spirulina platensis*

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ABSTRACT

Spirulina platensis, a multicellular and filamentous cyanobacterium, originates from Mexico and Africa. It has a long-established history as an important source of food for previous people. *Spirulina*, which is still being produced, is an important nutritional supplement for both animals and humans. It grows in water and can be easily harvested and processed. The biochemical composition of *Spirulina* consists of proteins, minerals, antioxidants, carbohydrates, essential oils, vitamins and carotenes, and chlorophyll-a. This microalga is an excellent source of non-toxic, anti-cancer anti-viral and an excellent nutrient-enhancing effect. Recent research has shown that *Spirulina* supplements have important immunomodulatory, anti-inflammatory effects in both animal models and human subjects. Hypolipidemic, hypoglycemic and hypotensive effects can also be produced and this has been proven to be the most beneficial health effects on the selected microalgae. It has also been proven to be of great benefit in the removal of heavy metals and has been completed at a lower cost. Recently, *S. platensis*, a nutraceutical and pharmaceutical partnership has attracted great interest.

Keywords: Nutraceutical; *Spirulina platensis,* Dietary Supplement, Antioxidant

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INTRODUCTION

The majority of the world's biomass consists of more than 25000 algae species (Henrikson, 1997). Scientists have found that algae are a basic dietary component of past cultures and are still consumed by humans. (Kay, 1991). Algae can be grouped into two categories: macroalgae (seaweeds); and microalgae (e.g. species of *Chorella, Dunaliella, Scenedesmus,* and *Spirulina*). These algae are used for human food, animal feed, fertilizers, biochemicals, and the development of pharmaceuticals (Derner, 2006; Henrikson, 1997; Mab et al., 2008). Due to their rich contents, microalgae are considered a suitable nutritional supplement (Figure 1). This rich content is made up of high protein and abundant amounts of vitamins, minerals (Kay, 1991). *Spirulina platensis* are grown naturally in non-contaminated special pools (Henrikson, 1997). The lack of protein for a lot of developing countries is a big problem, so protein sources need to be diversified and different non-traditional protein (Guerrero et al., 2002). Microalgae with high protein is an alternative source (Solento, et al., 2005). Micro-algae species with high protein can meet this need. In addition, it is important to find important pigments in the food, pharmaceutical and cosmetic industries, as well as the high protein content of interest (Derner, 2006). A few filamentous cyanobacteria (blue-green algae) have high protein content and high nutrient content due to the combination of amino acids in addition to high vitamin, essential fatty acids, and minerals.And several factors, including nutrient availability, light intensity, pH and temperature change the composition of microalgae (Colla, et al., 2007) Moreover, the microalgae are very important for the treatment of certain diseases and are a different option for the production of functional foods and nutraceuticals (Ambrosi et al., 2008; Çelekli et al., 2010). *Spirulina* is excellent food, also, without toxic effects for us.(Weid et al., 2000) with the best content defined by mankind, which includes antioxidants, phytonutrients, probiotics and nutraceuticals (Soni et al., 2017). The United Nations in the food conference stated that *Spirulina* is the best food for the future and that it has gained a top-notch reputation (Pulz and Gross, 2004).

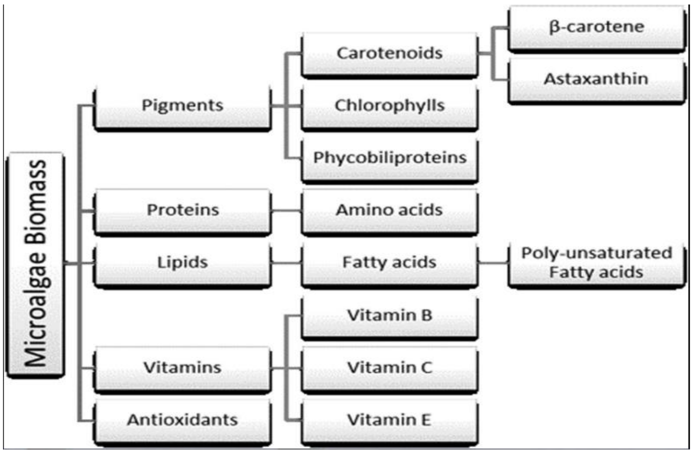

Figure 1. Table of ingredients of *Spirulina* (Koyande et al., 2019)

History of *Spirulina platensis*

Spirulina platensis is produced in the homeland of lagoons in Africa and Latin America. However, since it has the capacity to adapt to every environment, it has begun to grow in hot countries around the world (Belay et al., 1996; Lupatini et al., 2017). Optimal growth conditions include saline media (>30 kg m^{-3}), alkaline media (pH 8.5-11.0), high gloss, and temperatures between 35 and 40 ° C, but the presence or absence of nutrients may affect the growth rate. *Spirulina* has been used until today by the digestion of high essential amino acids and proteins that have been lost for centuries by Hitler (Lupatini et al., 2017). Kanembous collected these algae on the shores of the lakes, later dried and molded into small tablets (Figure 2) (Bertoldi et al., 2008); Likewise, the Aztecs had dried them in small layers before using them (Lupatini et al., 2017).

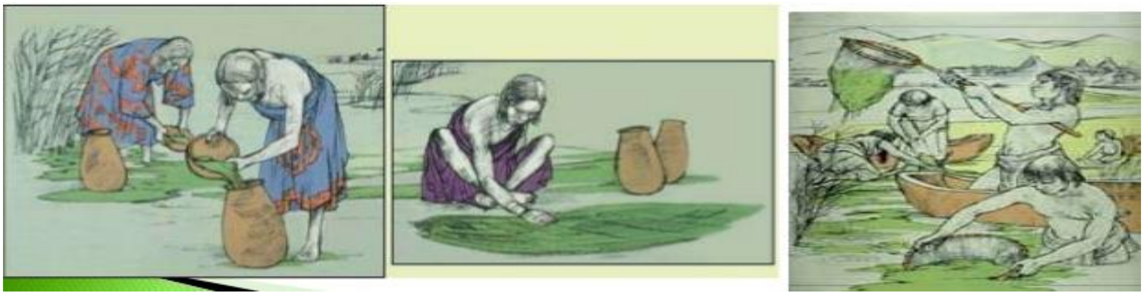

Figure 2. *Spirulina platensis* is harvested and dried by Kanembous.

Spirulina platensis is selected as a future food source by the Microbiology Association in 1967 (Lupatini et al., 2017). After then, an effective study on the physiology of *Spirulina* was carried out. Many microalgae species, including *Spirulina*, are identified by European, US, and Japan Food and Drug Administration them as non-toxic food (Mohanty and Samanta, 2017).

Taxonomy and Biology of Spirulina platensis

Spirulina platensis, is a Cyanobacteria, also known as *Arthrospira platensis* in Oscillatoriaceae family (Vonshak and Tomaselli, 2000). *Spirulina platensis* is the best known species in this genus. *Spirulina* has helical filaments that can easily grow and easily destroy the cell wall, (Chronakis et al., 2000; Yagui et al., 2004)) showing high tolerance to the alkaline environment (Figure 3). It also has a length of 200-300 μm and a width of 5-10 μm (Vonshak, 1982; Borowitzka, 1992). In addition, it can easily grow and grow in water under high alkali conditions and high temperature in daylight. (Vonshak et al., 1982)

Figure 3. ***Spirulina platensis*** (obtained from UTEX Culture Collection)

This type of algae multiplies by cross binary fractions, gives uniseriate trichomes and leads to the formation of a new filament. *Spirulina* has a multi-layered cell wall and is coated with cellulose-free polysaccharide, which facilitates digestion by organisms. Taxonomy of *S. platensis* is

Empire	: Prokaryota
Kingdom	: Eubacteria
Phylum	: Cyanobacteria
Class	: Cyanophyceae
Order	: Spirulinales
Family	: Spirulinaceae
Genus	: *Spirulina*
Species	: *Spirulina platensis* (Gomont) Geitler 1925 (Algaebase, 2019).

Benefits of *Spirulina platensis*

Nutritional content of Spirulina

Spirulina has been used for many years since its nutrient content is very high and it has many therapeutic and protective properties for the health (Howe et al., 2006). Today, it is a great supplement that grows spontaneously in tropical climates, alkaline lakes and seas. *Spirulina* contains all the components that are practically complete in practice (Anupama, 2000). *Spirulina* consists of about everything that should be found in a food that is considered ideal (Figure 4). It is also a source of abundant carotenoid and fatty acid, such as gamma-linolenic acid (GLA), which is very important for health (Howe et al. 2006). In addition, *Spirulina* is a good animal feed because of its high protein and mineral contents (Belay et al., 1993; Doreau et al., 2010).

Unlike other algae, *Spirulina* is easier to digest and defeat. *Spirulina platensis* is also known as "super food", is a label issued by the World Health Organization (WHO). It contains up to 70% protein. At the same time it is a wonderful source of important vitamins (A, B1, B2, and B12), GLA and a lot of wounded pigmented like xanthophylls, Chlorophyll (Yagui et al., 2004) and carotenoids (Figure 3). We cannot synthesize these bio-active ingredients, so *Spirulina* or *Arthrospira* is important to us. In 7 grams dried biomass of *Spirulina*, 1 gram of oil are PUFAs such as omega-3, omega-6 fatty acids, and 11-15% RDA has been detected (Colla et al., 2004). It is reported that spirulina regulates blood sugar, lowers bad cholesterol levels and normalizes blood pressure. *Spirulina* is also reported to contribute to the immune system and elevate hemoglobin levels in the elderly. The World Health Organization and NASA have decided that *Spirulina* sp. is a good option for the long journey of astronauts. Less than 670% compared to tofu, 180% compared to milk, 5100% compared to spinach, ro-carotene with iron 3100% compared to carrots (Koyande et al., 2019)

6 Tablet (3 gram) Spirulina Pacifica™'nın için Besin Öğeleri Tipik Analizi

Genel		**Mineraller**	
Toplam Kalori	10 cal	Kalsiyum	11 mg
Protein	2 g	Demir	5 mg
Toplam Karbonhidrat	< 1 g	Fosfor	30 mg
Toplam Yağ	<0,15 g	İyot	15 mcg
Doymuş Yağ	0 g	Magnezyum	15 mg
Kolesterol	0 mg	Çinko	0,1 mg
Şeker	0 g	Selenyum	5 mcg
Vitaminler		Bakır	0,05 mg
Vit A (Beta karoten olarak)	8000 IU	Mangan	0,2 mg
Vitamin K1 ve K2	40 mcg	Krom	65 mcg
Tiamin (B1)	3 mcg	Molibden	<12 mcg
Riboflavin (B2)	179 mcg	Sodyum	35 mg
Niasin (B3)	465 mcg	Potasyum	43 mg
Vitamin B6	21 mcg	**Karotenler ve Diğer Fitobesinler**	
Folik asit (B9)	5 mcg	Gamma Linolenik Asit (GLA)	32 mg
Vitamin B12	9 mcg	Zeaksantin	2,5 mg
Biotin (H)	<1 mcg	Toplam Karotenler	12 mg
Pantotenik Asit (B5)	5 mcg	Klorofil	21 mg
		Fikosiyanin (c, allo)	225 mg

Figure 4. Nutritional Composition of *Spirulina* (obtained from Hawaiian *Spirulina* Pacifica Company)

Protein

It has the richest protein content. It is reported to contain 60-70% protein. It is very important for the market (meat-free) because plant proteins are abundant (Balasubramani et al., 2016)

Vitamins

Vitamins found naturally in *Spirulina* are B1, B2, B12, E. *Spirulina* also has B1, B2, B12, E, β-carotene, and the content of β-carotene is incredibly high and 30 times more than in carrot β-karoten content (Figure 5). It is also quite high in terms of B12. It's hard to get a B12 with a vegetarian's diet because they don't contain grain legumes and vegetables B12. *Spirulina* has been reported to contain four times more vitamin B12 than raw liver which is thought to be the best source of B12. *Spirulina* is also known as an excellent source of vitamin E compared to those found in wheat. It has also been reported that it has an outstanding vitamin E compared to that of wheat (Yin et al., 2017). To sum up, the primary antioxidants have vitamin E, β-carotene and B12.

Minerals

Spirulina has minerals such as magnesium, iron, phosphorus, selenium, and calcium (Figure 5). *Spirulina* attracts attention with its magnificent iron content. It contains 20 times more Iron compared to the grams. Iron is a mineral obtained mostly from red meat, milk and chicken and fish (Balasubramani et al., 2016; Roberto, 2015). That's why *Spirulina* is a great advantage for those with iron deficiency.

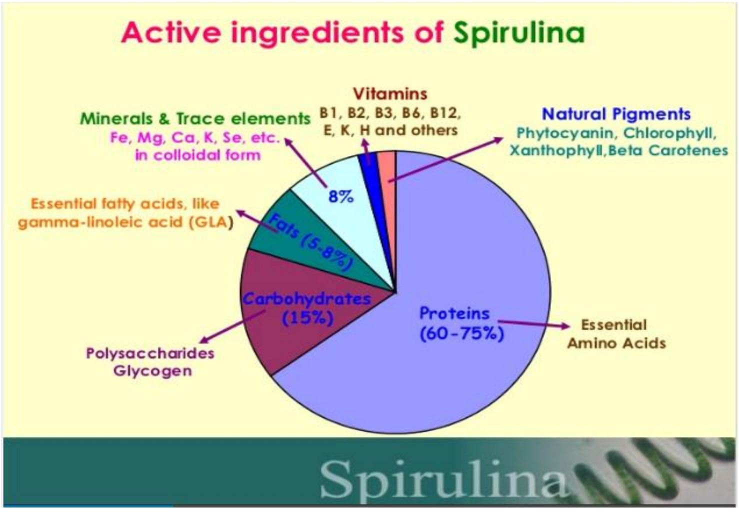

Figure 5. Active ingredients of *Spirulina* (obtained from Slideplayer by Janardhanan, K. *Spirulina*- An Excellent Functional Food)

Gamma-Linolenic Acid Effects And Spirulina

Gamma linolenic acid (GLA) is an essential fatty acid. This fatty acid functions in a very basic event in the body. Examples include blood pressure and cholesterol synthesis. PGE1 is translated into the GLA by a delta-6-desaturase enzyme and is usually formed from linolenic acid. Delta-6-desaturase has been reported to be easily inhibited by substances common to modern life, including saturated fats and alcohol, thus resulting in GLA deficiency and suppressed PGE1 formation (Tudge, 1981). Clinical studies show that GLA may be able to treat dietary intake of arthritis (Kunkel, 1982), heart disease (Kernoff, 1977), obesity (Vadaddi and Horrobin, 1979) and zinc deficiency (Huang, 1982). Aging, alcohol dependence, schizophrenia, depression, manic depression have been reported as GLA deficiency in the cause of important diseases. (Horrobin, 1981a, b; Horrobin and Huang, 1983).

Figure 6. Comparison of fruits with *Spirulina* (from smartpepcan.com/project/spirulina-powder/)

Pharmaceuticals and nutraceutical applications

Spirulina is a good source of protein, chlorophyll, GLA, enzymes, superoxides, RNA DNA, Vitamin B, glycolipids, antioxidants (JE et al., 2001) and is a good food source that can complement what is missing in many people (Soni et al., 2017). Such nutrients help prevent and treat discomfort. We call them nutraceutical food. As demand for many products with nutraceuticals and food supplements increases, the demand for organisms is increasing. *Spirulina* is an effective nutraceutical and pharmaceutical for anti-cancer, anti-viral, hypocholesterolemic and therapeutic agents.

Health benefits of *Spirulina*

Spirulina has many healthy advantages (Soni et al., 2017). Use of *Spirulina's* biomass as different formats (Figure 7).

- ❖ stimulates tissue repair and also improves contagion,
- ❖ regulates cholesterol level, lowers bad cholesterol and stimulates good cholesterol so it prevents heart attack
- ❖ works as an anti-inflammatory agent,
- ❖ reduces the inflammation of arthritis,
- ❖ reduces appetite and accelerates metabolism,
- ❖ increases the immune system with antiviral, anti-tumor and interferon stimulating effects
- ❖ helps weight loss, gives a feeling of fullness, no need to eat,
- ❖ strengthens memory and improves mental clarity,
- ❖ anti-cancer; does not want carcinogens, but activates the immune systemProvides energy and power to athletes for a long time,
- ❖ feeds people,
- ❖ does not allow diabetes,
- ❖ reduces stress, and
- ❖ lowers depression.

Figure 7. Different formats of *Spirulina*

Commercial applications of microalgae

Microalgae productions have been begun to develop very recently. In addition, many production facilities have been established in a very short time and sheds light on important applications. For example, some animals are missing the nutrients that are supplemented with feeds to increase the nutritional value in this way, such as fish farming and cosmetic applications are also available (Spolaore et al., 2006). For example, polyunsaturated fatty acid (PUFAs) oils are fortified in infant formulas and likewise very important in pigment production and dye formation. The determination of stable isotope biochemistry becomes light in metabolic diseases (Spolaore et al., 2006). Future research will believe that it will shed more light on them, and will reveal many more to be discovered. Microalgal productions will be diversified and have a serious market for the economy.

Therapeutic effect of *Spirulina*

Arsenic (AS) is one of the most important environmental single chemical toxicants that has long been seen as carcinogenic and genotoxic. *Spirulina* sp. is a potent dietary anti-inflammatory, anti-cancerous properties and phytoantioxidant. The protective role of *Spirulina* as supplementary feeds was studied in Nile tilapia (*O. niloticus*) against arsenic-induced cytogenotoxicity (Sayed et al., 2015). The combined treatment of *Spirulina* was significantly reduced apoptosis the induction of erythrocyte alteration and micronuclei formation induced by arsenic intoxication. (Sayed et al., 2015).

Effects Against Hyperlipidemia:

Serum cholesterol study was first performed in rats in (Devi and Venkataraman, 1983) and *Spirulina's* cholesterol level was reduced (Figure 8). In many studies done so far, this information was confirmed by scientists. Kato et al. (1984) reported that *Spirulina* diets decreased two different types of lipoproteins as low-density lipoproteins (LDL) and very low-density lipoproteins (VLDL) in the blood cholesterol and phospholipids in the subjects having high total cholesterol.

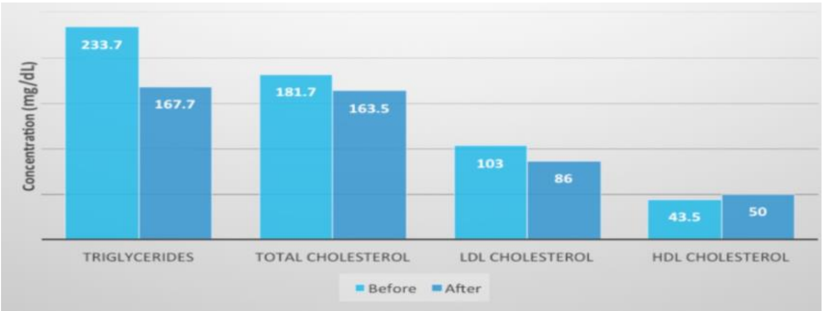

Figure 8. Lipid profile before and after *Spirulina (By Neel Duggal Sep 17, 2015)*

BIOREMEDIATION

Spirulina sp., *Chlorella* and other algae species are used to remove undesired compounds such as heavy metal and dyes from the wastewaters (Çelekli et al., 2009; Bwapwa et al., 2017). They have proved the capacity of separation. They function differently for different elements. In addition, *Spirulina* has high alkalinity to precipitate heavy metal during the separation (Bwapwa et al., 2017). However, many more studies are needed for more solutions. Algae strains such as *Spirulina* sp., *Chlorella*, and *Cladophora* have showed the capacity to remove a considerable volume of heavy metals .

Nature Marker

Biochemical compounds of *Spirulina* are used as a natural marker (Çelekli et al., 2016). The biochemical compositions of micro-algae are affected by many environmental factors such as pH, heavy metal ions, nutrients, and hardness (Çelekli et al., 2017). While there is a direct relationship between the nutrients, especially the protein content of nitrate and pigment and filamentous algae. In particular, it has been reported that there is a direct relationship between nutrient nitrates and pigments and algae protein. On the contrary, it was observed that there was an inverse relationship between the heavy metals and pigments and protein content (Çelekli et al., 2017). In this way, stress is thought to be reduced and defined as natural marker. Amount of malondealdehyt, total thiol group, H_2O_2, proline, and total phenolic compounds by filamentous algae were closely related with heavy metal contents of ecosystems. Significant increase in biochemical compounds of filamentous algae seemed to be an important strategy for alleviating metal-induced oxidative stress as natural biomarkers.

CONCLUSION

Many countries are looking for alternative sources because of the lack of protein microalgae is a very good option. Proteins extracted from *S. platensis* are much better when compared to many proteins of different origin because they are much higher than both animal and vegetable proteins. In addition, many studies show that the benefit to humanity is inevitable by using technological and functional aspects

Despite the many benefits of *S. platensis*, there are few studies in the literature. Although *Spirulina* is a miraculous nutrient, the number of studies is too low and not enough for this wonderful meal. The growing need for food in the world pushes us to look for new alternatives from microlagae, so it draws attention to the rich content of *Spirulina*. Due to their rich contents, microalgae are considered a suitable nutritional supplement, it is believed. At the same time; these microalgae, which contains essential proteins, carbohydrates, essential fatty acids, vitamins, minerals, carotenes, chlorophyll and phycocyanine, is also thought to have many health benefits. Thus, it will shed light on nutraceuticals and pharmaceutical studies. It is imperative to develop and diversify *Spirulina*-fortified foods and to create awareness of spin spite of malnutrition. The two biggest obstacles to the success of microalgae are low awareness of and not supporting healthy foods.

When these obstacles are solved, the microalgae will achieve serious success. This will be an important step taken by humanity.

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Determination of Suitable Areas for The Solar Power Plant (Spw) In The Araban District of Gaziantep by Gıs and Remote Sensing Methodology

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Abstract

Many ecological problems occur during the use of fossil fuels or consumable energy sources. In this context, the use of these resources is both limited and not ecologically sustainable. Recently, due to excessive increase prices of fossil fuel resources, renewable energy sources are encouraged in Turkey and in the World. One of these sources is Solar Power Plants (SPW).

It is an important issue to determine the places where SPWs will be established in a correct and planned way. In order to ensure the conformity of SPWs, the places where the sunshine duration is high, do not not harm the ecological diversity and do not narrow the 1st class agricultural lands need to be determined.

Conformity analyzes with Geographic Information Systems and Remote Sensing methodology has been frequently performed. In this study, it is aimed to determine the suitable areas with respect to the both ecological and high energy efficiency and economic context in Araban District. Sunshine duration is relatively high but the climatic suitability of Araban for SPW has not been evaluated hitherto.

In this study, by using GIS, parameters are determined by multi-criteria decision-making method and place conformity analysis is performed. Along with the present study, various layers were formed for SPW area compatibility using GIS and remote sensing methods. These are lithology, land surface temperature (LST), land use capability classes, land use map, vegetation map, slope, elevation and elevation maps.

The results of the study show that there are suitable areas for the establishment of SPW areas in Araban District. These areas are the agriculturally inefficient basalt surfaces facing the southern slope, which lacks slightly sloping vegetation. The SPW areas to be established in these areas will not only create ecological damage but also will be economically profitable with high energy efficiency.

Keywords: SPW, Renewable Energy, Araban, Multi Criteria Decision Making Method.

1. INTRODUCTION

Electricity generation from solar energy has become a topic of increasing importance with the developing technology. Energy from sources such as gasoline, coal and natural gas is both expensive and harmful to the environment by polluting the environment. Besides, it is estimated that fossil fuels of petroleum type will be depleted within 50-60 years. Renewable energy sources such as the renewed energy solar power plant (SPWs) are gaining importance.

One of the important advantages of solar energy is that it is an endless source of energy besides being clean energy. Solar energy rays reach anywhere in the world and you don't need an effort to get the light. Even in cloudy weather, sunlight can be energized (Table 1). According to experts, sunlight is shown to be the most popular energy source of the future (Gençoğlu, 2002; Satman, 2007; Çukurçayır and Sağır, 2008; Kannan and Vakeesan, 2016; Doğanay and Coşkun, 2017).

In this study, we seek the the answer to the question of where might be the most suitable areas both in the context of generating high energy and in the context of not destroying the agricultural fields and what is the most suitable areas in terms of the least ecological damage to the nature? In this context, Araban County was determined as the study area (Figure 1).

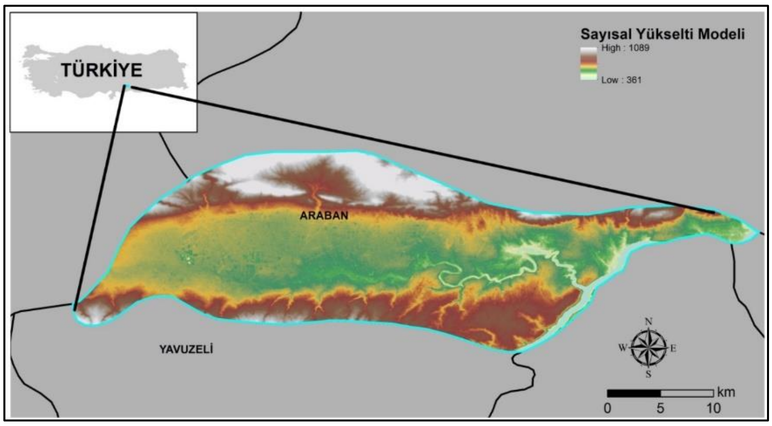

Figure 1. Work area location map.

1.1. Environmental Impacts of SPWs

Today, solar energy is both abundant and free as well as being a continuous and renewable energy sourceand also takes attention for being ecofriendly. Solar energy technologies; it has become and will continue to be a common alternative energy source for reducing environmental impacts from fossil fuels in recent years due to its low pollutant waste, local application, ease of operation and non-dependence. With the help of the industrial revolution and the oil crises in the 1970s, energy use has become one of the most wanted and important issues in all sectors. Although the main concern during the oil crisis in the early 1970s was related to energy prices, especially in the last 20 years, this concern was replaced by environmental damage and environmental risks. Various factors that have emerged with the increasing impact of people on the environment caused environmental problems and destruction to increase (Saner, 2015).

There are many environmental impacts of solar power plants including impacts on land use, impacts on water resources and soil, impacts on ecosystem and biological diversity, effects from emissions of chemicals, air pollution effects, visual effects, noise pollution impact and environmental impacts related to material and production used (Table 1).

Advantages	Disadvantages
Solar energy is an abundant and inexhaustible resource	Very high cost in initial installation
It does not dissipate waste that will harm the environment during or during energy production.	Large areas are needed to generate electricity
It is an energy source that can be obtained from all over the world.	Energy production stops after sunset
	Energy must be accumulated in giant batteries to provide energy at night
Maintenance costs of panels producing electricity from solar energy are very low	
The cost of obtaining energy after starting to produce energy is almost zero	
Each house can easily produce its own electricity with panels placed on house roofs	

Table 1. Avantages and disavantages of Solar Power.
Source: http://www.enerjiatlasi.com/

The countries that are leading in the production of solar energy are also the leading countries in the field of technology. While some countries are at the forefront because of their high potential for solar energy others are at the forefront becouse of their advance technology.When we look at Table 1, countries like China, Japan, Germany, the United States and Italy, which are the first in solar energy production, are not the leading countries in terms of solar energy potential. However, it shows that high technology can produce high solar energy. Countries that make the most economic use of solar energy are among the top countries in terms of technology. (Table 2).

Row	Country	Board Power	Update
1.	China	102.470	June 2017
2.	Japan	42,750	December 2016
3	Germany	42.710	October 2017
4.	US	40,300	December 2016
5.	Italy	19.279	December 2016
6.	United Kingdom	11.630	December 2016
7.	India	9.010	December 2016
8.	France	7.130	December 2016
9.	Spain	6,730	July 2017
10.	Australia	5.900	December 2016
11.	South Korea	4.350	December 2016
12.	Belgium 3.	422	December 2016
13.	Canada 2.	715	December 2016
14.	Greece 2.	610	December 2016
15	Turkey	2246	November 2017

Table 2. Distribution of Solar Power production in the world.

Source: http://www.enerjiatlasi.com/

2. DATA and METHOD

Firstly, Landsat 8 satellite data was downloaded from https://www.usgs.gov/. The ground surface temperatures (YYS / LST) of the study area were calculated from Landsat data. Then the land cover map of August 2017 was produced. Finally, Normalized Difference Plant Index (NFBI / NDVI) was obtained by using close and red band. Besides, the soil map database was created by the General Directorate of Rural Services (KHGM). With this data, the land use ability (ACL) classes of the study area were created. From this data, numerical elevation model (DEM), slope and maintenance maps were obtained (Figure 2). The data obtained were processed using ArcGIS and Erdas programs as remote sensing software in GIS environment. Then, each of the processed data was overlaid by using mapalgebratool in ArcGIS software.

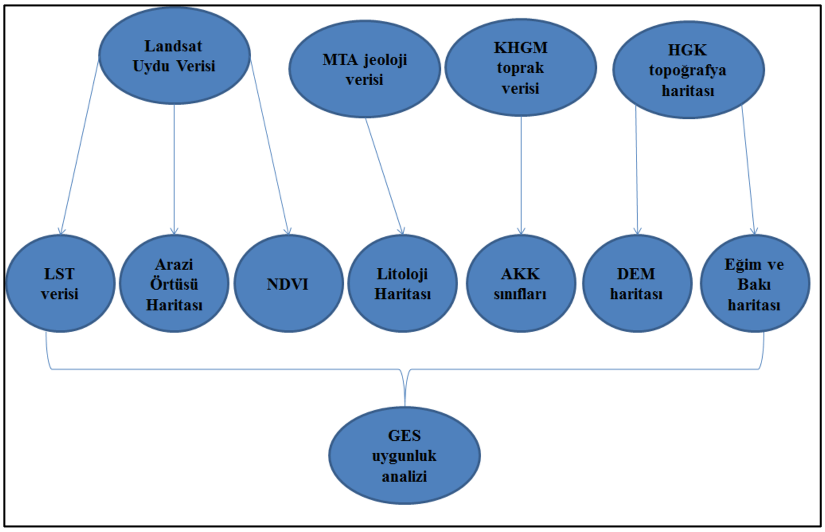

Figure 2. Work flow chart of the study

As a result of all these processes, GIS based SPWs analysis was performed and where is the most suitable area for SPWs construction in Araban District? The answer to the question has been reached. Research on the determination of suitable areas for the construction of solar power plants by using remote sensing and GIS has recently become intense (Polo et al., 2015; Wong et al., 2016; Groppivd., 2018; Yushchenkovd., 2018; Firozjaei et al., 2019).

3. FINDINGS

In July, the warmest period of the study area, the average Land Surface Temperature (LST) is around 45 ° C. Maximum temperatures reach 51 ° C in this period. LST values are the highest in July. The LST values at the bottom of the plain vary between 48 and 51 ° C. The land between 48 and 51 ° C corresponds to 13% of the district area. The south-facing slopes of the mountainous mass located to the north of the plain floor are another section where the LST values are high in the Araban. LST values in these areas vary between 45-48 ° C. Lands with a temperature of 45-48 ° C correspond to 20% of the district area. Araban District is a trough surrounded by mountainous areas from the north and south. While the high units in the north and south are generally lined with shrubs and pastures, agriculture in the district is carried out on the plain floor which is flat and having 1st class land use. In addition, peanut farming in the north and east of the county is gaining intensity. For SPWs, the factor factor is important. The slopes of the lands, especially in the south and southeast, are the most suitable areas for SPWs because these areas are more heated than the parts facing the north. In this context, 12% of the Araban District is facing the southeast while 20% is facing the south (Figure 3)

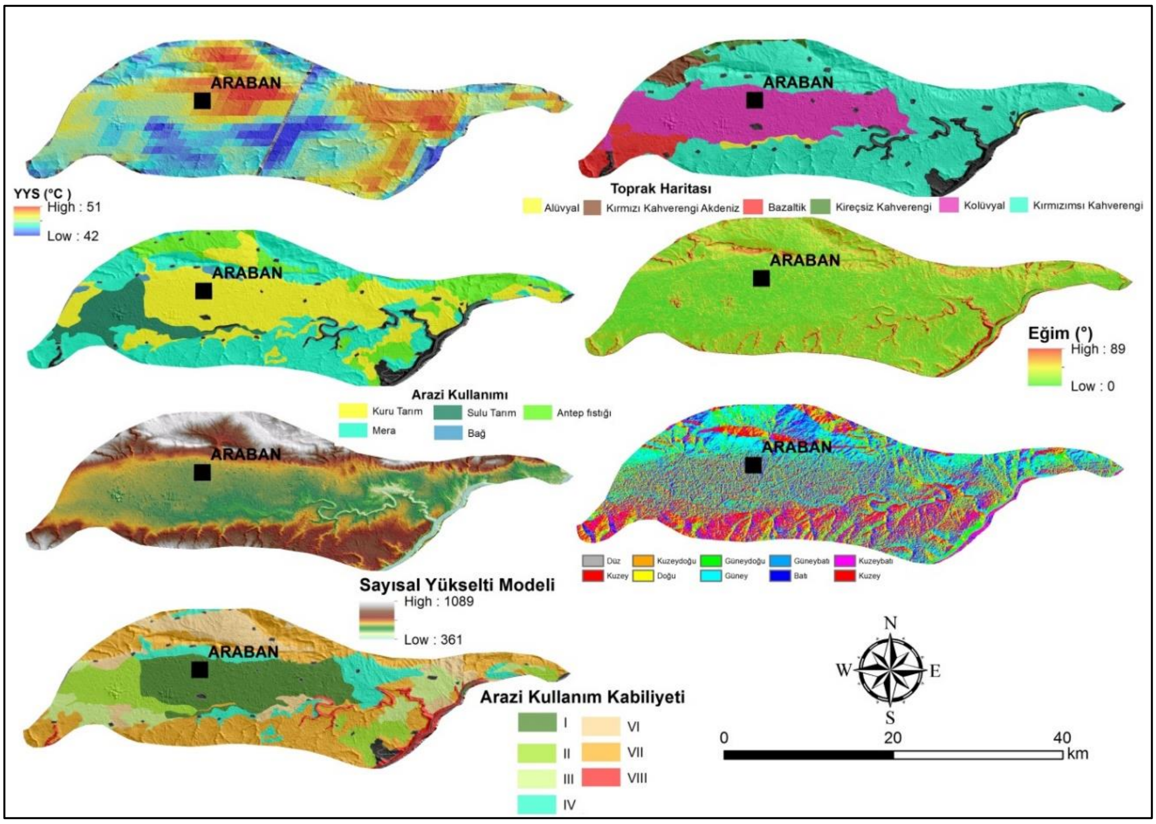

Figure 3. Layers used for SPWs compliance analysis.

In the determined area, both the slope is too high and not suitable for agriculture VII. The fact that the class has land use capability (ACO) increases the suitability of this area for SPWs. The power plants to be installed in this area of approximately 20 km² are one of the most beneficiaries of solar energy in the district in economic context. At the same time, this area is VII. Class land use is not suitable for agriculture (Figure 4).

Figure 4. The most suitable area for SPWs in Araban District.

As a result of the conformity analysis of the Solar Power Plant, the part located northwest of the Araban District was identified as the most suitable area. Although this region is more than the slope, VII. it is not suitable for farming in the context of having class land capability. This area is also in the south and southeast direction. In this context, it is 2 ° C warmer than the average YYS of Araban district.

LST	SLOP	DEM	ASPE CT	Landu se	SOIL	Landu se
47°C	18°	645 m	South and Southeast	VII.	Reddish Brown	Pasture

Table 3. Geographic characteristics of the area designated as suitable area for SPWs

4. CONCLUSION

The negative impacts of fossil fuels on the environment, as well as being expensive and not being renewable, have made renewable energy sources such as solar energy important. In this context, many developed countries are transitioning from fossil energy sources to renewable energy sources. Duration of sunshine for solar power plants is quite high in a country like Turkey, it seems quite as attractive an option. It is important to obtain a higher efficiency than this energy, and to ensure that this energy does not occupy fertile agricultural areas.

In this study, conformity analysis was conducted for SPWs in Araban District. For this purpose, GIS and remote sensing methodologies are integrated. As a result, the location to the north-west of the area is determined as the most suitable SPWs area. This area covers an area of approximately 20 km². LST values of the detected area are 2 ° C higher than the LST values of Araban District. At the same time, this area is not suitable for agriculture. The fact that this area has a south and southeast view makes it an appropriate space for SPWs. In this context, our study provides support to relevant institutions and organizations where the SPWs can be established in Araban.

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Hypericum perforatum L. as Natural Antioxidant and Antimicrobial Agents

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ABSTRACT

In the study, total phenolic content, antioxidant and antimicrobial activities of the fixed oil of *Hypericum perforatum* L. grown in Eskisehir were investigated. The total phenolic content of the fixed oil was determined as 5096 mg GAE/kg using Folin-Ciocalteau method. According to DPPH method, the total antioxidant capacity of the sample was determined as IC50 of 43 µg/mL. The antimicrobial activity of *H. perforatum* L. fixed oil was determined using two different methods (disc diffusion and broth dilution) against seven microorganisms (*Bacillus subtilis* ATCC 6037, *Enterococcus faecalis* ATCC 29212, *Escherichia coli* ATCC 1103, *Escherichia coli* O157:H7 ATCC 43895, *Listeria monocytogenes* Scott A, *Salmonella* Typhimurium NRRLB 4420, *Staphylococcus aureus* 6538P). The highest inhibition zones were observed against *E. coli* ATCC 1103 and *L. monocytogenes* Scott A (8±0.7 mm). However, according to broth dilution method, *E. faecalis* ATCC 29212 was found as the most sensitive bacteria to *H. perforatum* L. fixed oil (5%, v/v). These results showed that, *H. perforatum* L. fixed oil could be used in food industry as natural antioxidant and antimicrobial products.

Key words**:** *Hypericum perforatum* L., *antibacterial, antioxidant, total phenolic content*

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ÖZET

Bu çalışmada Eskişehir'de yetişen *Hypericum perforatum* L. bitkisine ait sabit yağın toplam fenolik içeriği, antioksidan ve antimikrobiyal aktiviteleri incelenmiştir. Folin-Ciocalteau yöntemi kullanılarak sabit yağın toplam fenolik içeriği 5096 mg GAE/kg olarak belirlenmiştir. DPPH yöntemine göre örneğin toplam antioksidan kapasitesi IC50 43 µg/mL olarak belirlenmiştir. *H. perforatum* L. sabit yağının antimikrobiyal aktivitesi iki farklı yöntem kullanılarak (disk difüzyon ve broth dilüsyon) yedi farklı mikroorganizmaya

(*Bacillus subtilis* ATCC 6037, *Enterococcus faecalis* ATCC 29212, *Escherichia coli* ATCC 1103, *Escherichia coli* O157:H7 ATCC 43895, *Listeria monocytogenes* Scott A, *Salmonella* Typhimurium NRRLB 4420, *Staphylococcus aureus* 6538P) karşı belirlenmiştir. En yüksek inhibisyon zonu, *E. coli* ATCC 1103 ve *L. monocytogenes* Scott A'ya (8 ± 0.7 mm) karşı gözlenmiştir. Bununla birlikte, broth dilüsyon yöntemine göre, *H. perforatum* L. sabit yağına (%5) karşı en duyarlı bakteri, *E. faecalis* ATCC 29212 olarak bulunmuştur. Bu sonuçlar, *H. perforatum* L. sabit yağının gıda endüstrisinde doğal antioksidan ve antimikrobiyal ürünler olarak kullanılabileceğini göstermiştir.

INTRODUCTION

There is increasing interest in natural antioxidants in medicinal plants (Silva et al, 2005: 157). The plants include various active compounds such as alkaloids, coumarins, flavonoids, phenolics, organic acids, saponins, terpenoids and thiosulfinates (Hayek et al., 2013: 911; Gyawali and Ibrahim, 2014: 413). It has been reported that flavonoids found in plants are more effective than synthetic oxidants as free radical scavengers (Hollman and Katan, 1997: 306; Pietta, 2000: 1039; Zou et al., 2004: 5032). At the same time, consumers do not want to consume synthetic products in recent years, thus their tendency towards natural products are increased (Sengun et al., 2018: 1).

Hypericum is a perennial herbaceous plants which belong to Hypericaceae family with approximately 500 species (Morshedloo et al., 2015: 565; Rusalepp et al., 2017: 41; Napoli et al., 2018: 162). *H. perforatum,* also called as St. John's Wort, is an important member of *Hypericum* and widely cultivated in Europe, Asia, Africa and North America (Fathi and Ebrahimzadeh, 2013: 68). It has been used in traditional medicine as a healing plant since the 5th century (Saddiqe et al., 2010: 512). The consumption of products containing *H. perforatum* L. has increased considerably in recent years and its extracts are commonly used in the food industry (Silva et al., 2005: 158). It is rich in important fatty acids such as oleic, linoleic, palmitic, stearic and myristic acids (Hosni et al., 2017: 2738). *H. perforatum* L. is of great importance as the natural source of active components such as aphthodianthrones, biflavones, flavonoids, phenylpropanes, phloroglucinols, proanthocyanidins, and less amounts of amino acids, essential oils, tannins and xanthones (Fathi and Ebrahimzadeh, 2013: 68; Morshedloo et al., 2015: 565). It is traditionally used as a therapeutic agent against many diseases such as eczema, burns, psychological and digestive system disorders

(Yesilada et al., 1995: 151; Butterwock, 2003: 540; Silva et al., 2005: 158; Dogan et al., 2019: 293). *H. perforatum* L. have positive effect on human health such as antidepressant (Butterweck, 2003: 540), antibacterial (Saddiqe et al., 2010: 516), antifungal (Milosevic et al., 2007: 239), anticonvulsant (Hosseinzadeh et al., 2005: 208), antiviral (Serkedjieva et al., 1990: 99) anti-HIV/anti-AIDS (Wood et al., 1990: 651), anti-inflammatory (Mascalo et al.,1987: 29) and analgesic (Ozturk and Ozturk, 2001: 138).

The antioxidant and antimicrobial properties of *H. perforatum* L. collected from different geographical regions have been investigated in many studies. However, to the best of the knowledge of authors, there is no study on the bioactive properties of *H. perforatum* L. grown in Eskisehir in open literature. Hence, the objectives of this study were; 1) to determine the total phenolic contents and antioxidant properties of fixed oil of *H. perforatum* L. grown in Eskisehir, 2) to investigate the potential antibacterial action of fixed oil of H. *perforatum* L. against seven different bacteria (*B. subtilis* ATCC 6037, *E. coli* ATCC 1103, *E. coli* O157:H7 ATCC 43895, *E. faecalis* ATCC 29212, *L. monocytogenes* Scott A, *S. aureus* 6538P, *S.* Typhimurium NRRLB4420).

MATERIALS AND METHODS

Collection and Extraction of the Plant Materials

H. perforatum L. collected in Eskisehir, Turkey were identified by Prof. Dr. Ersin YUCEL. Samples washed with tap and distilled water, were dried on paper filter at room temperature. The materials were grained after drying through a hammer mill and stored in tight plastic containers for further use.

Fixed oil of *H. perforatum* L. seeds was obtained using cold press and was pressed at room temperature without any thermal treatment (Kiralan et al., 2014: 53).

Total Phenolic Content

Total phenolic content of *H. perforatum* L. seed fixed oil were determined by the Folin–Ciocalteu colorimetric method (Singleton and Rossi, 1965: 150). After 2 g of the sample was dissolved in 1 mL of hexane, the phenolic compounds were extracted with 1 mL of methanol: sterile water solution (60:40, v/v) for 2 minutes and the mixture was centrifugated for 10 minutes at 3500 rpm for phase separation. After centrifugation, the hexane phase was re-extracted with 1 mL methanol-sterile water solution. The methanolic extracts were combined and diluted with sterile water to a total volume of 2 mL.

500 µL Folin-Ciacalteu reagent was added to the tube containing 6 mL ultra pure water. 500 µL Folin-Ciacalteu reagent was added to the tube containing 6 mL ultra pure water, followed by the addition of 100 µL of methanolic extracts and it was kept in the dark at room temperature for 8 minutes. Then, 1.5 mL sodium carbonate solution (20%, w/v) was added to the reaction mixture and the absorbance of the solution was measured using a spectrofotometer (Agilent Technologies, Carry60 UV-Visible) after 1 hour against a blank sample at 765 nm. The calibration curve was constructed using standard solution gallic acid and results were expressed in mg gallic acid equivalents (GAE)/kg.

Antioxidant Capacity

The total antioxidant capacity of the sample was analyzed by DPPH radical scavenging activity (Naik et al., 2011: 15). 1 mL methanolic extract at different concentrations (20, 40, 60, 80 and 100 µg/mL) of the sample was mixed with 4 mL of DPPH solution (0.1 mM in methanol). The mixture was kept in the dark at room temperature for 30 minutes. The absorbance was measured using a spectrophotometer (Agilent Technologies, Carry60 UV-Visible) at 515 nm. Methanol was used as control and results were expressed in IC50 values.

Antimicrobial Activity

Bacterial Strains

The antimicrobial activity of fixed oil of *H. peroforatum* L. were determined against seven different microorganisms (*B. subtilis* ATCC 6037, *E. coli* ATCC 110, *E. coli* O157:H7 ATCC 43895, *E. faecalis* ATCC 29212, *L. monocytogenes* Scott A, *S. aureus* 6538P and *S.* Typhimurium NRRLB 4420) using two different methods (Disc diffusion and Broth dilution). Test cultures used in the study were obtained from Ege University, Department of Food Engineering, Food Microbiology Research Laboratory and the cultures were transferred to Tryptic Soy Broth (TSB, pH 7.3±0.2, Oxoid) for the activation and incubated at 37°C for 24 hours. The optimized bacterial cultures (DEN-1 McFarland Densitometer, Grant-bio), equivalent to 0.5 McFarland turbidity standard, were used in the analyses.

Disc Diffusion Method

Preliminary antibacterial activity of the fixed oil was determined by disc diffusion method (Deng et al., 2014: 186). Initially, suspension of test bacteria was spreaded on Mueller

Hinton Agar (MHA, pH 7.3±0.2, Oxoid) plates and the the paper discs (6 mm in diameter) impregnated with the fixed oil (40 mg/mL) were placed on the surface of the inoculated plates. The plates were incubated at 37°C for 24 hours. The antibacterial activity of fixed oil was expressed by measuring the diameter of inhibition zone (DIZ). Ampicillin and gentamycin (10 µg/mL) were used as positive controls and the sterile water as negative control.

Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC)

The minimum inhibitory concentration (MIC) described by Deng et al. (2014: 186) was used for the determination of antimicrobial activity of the fixed oil. The MIC values of the fixed oil were determined using 96-well "U" type sterile microplates. 100 µL Mueller Hinton Broth (MHB, pH 7.3±0.2, Oxoid) was added to each well and 100 µL fixed oil dissolved in DMSO (5%) was transferred into the wells of the first row. Serial two-fold dilutions of the samples prepared with MHB (a total volume of 200 µl) were dispensed into wells of the microplate. The final concentrations of the samples in the wells were; 10%, 5%, 2.5%, 1.25%, 0.625%, 0.313%, 0.156%, 0.078%, 0.039%, 0.020% (v/v), respectively. Then, 100 µL of inoculum were added to each well and the plates were incubated at 37 °C for 18 hours. At the end of the incubation period, 20 µL of 0.5% 2,3,5-triphenyltetrazolium chloride (TTC, Merck) was added to each well and the plates were incubated at 37 °C for 30 minutes. The lowest concentration of the sample required to inhibit visible growth of the test culture (no color formation) was selected as MIC value.

Samples were taken from the first wells where no growth was observed and streaked on Mueller-Hilton Agar (MHA, pH 7.3±0.2, Oxoid) for the determination of the minimum bactericidal concentration (MBC).

RESULT AND DISCUSSION

Total Phenolic Content

Total phenolic content of *H. perforatum* L. fixed oil were determined as 5096 mg GAE/kg (5.096 mg GAE/g) (Table 1). Similarly, the total phenolic contents of *H. perforatum* L., grown in Estonia and collected in 2010 and 2011, were reported as 4.62 and 6.93 mg GAE/g, respectively (Rusalepp et al., 2017: 43). In another study, the total phenolic content of *H. perforatum* L. grown in Iran and extracted by methanol, was determined as 505.7 mg GAE/g

(Fathi and Ebrahimzadeh, 2013: 70). In another study, *H. perforatum* L. grown in Greece divided into five different parts (shoots with leaves, non flower-bearing branches, flower-bearing branches, floral buds and flowers) and were extracted by two different solvents (organic and aqueous). The total phenolic contents of organic and aqueous extracts of *H. perforatum* L. were determined in the range of 133-257 mg GAE/g and 125-228 mg GAE/g, respectively (Gioti et al., 2009: 400). These results indicated that the total phenolic contents of *H. perforatum* L. might may show differences depending on some properties such as extraction method and solvent type used, geographical locations and harvesting periods.

Table 1. Total Phenolic Content and Antioxidant Activity of Fixed Oil of *H. perforatum* L.

Analysis	**Results**
Total phenolic content (mg GAE/kg)	5096±5.19
IC50 (µg/mL)	43±3.46

Antioxidant Activity

In this study, antioxidant activity of *H. perforatum* L. fixed oil was examined by using DPPH radical scavenging activity. The IC50 value of the fixed oil, which indicate the concentration of sample required to scavenge 50% of the DPPH free radicals, was determined as 43 µg/mL (Table 1). In a study performed by Silva et al. (2005: 162), IC50 values of ethanolic extract of *H. perforatum* L. grown in Braga (Portugal) were reported as 21 µg/mL. In another study, the IC50 value of flavonoid-rich extract of *H. perforatum* L. grown in Tianjin (China) was found as 10.63 µg/mL. In the study conducted by Fathi and Ebrahimzadeh (2013: 70), IC50 values of methanolic extract were reported as 96 µg/mL. In another study, antioxidant activities of ethanolic extracts of *H. perforatum* L. collected from Bagheria (Italy), were determined as 2.72 mmol TE/g and 1.03 mmol TE/g by DPPH and ORAC methods, respectively (Napoli et al., 2018: 168).

Antimicrobial Activity

DIZ values

Preliminary antimicrobial activity of *H. perforatum* L. fixed oil were determined against seven bacteria using disk diffusion method. Inhibitive effect of the sample were found in the range of 7 mm-7.5 mm on test microorganisms, except *B. subtilis* ATCC 6037, *S. aureus* 6538P, *S.* Typhimurium NRRLB 4420 (Table 2). In a study performed by Nazli et al. (2019:

226), antimicrobial effects of ethanolic extract of *H. perforatum* L. grown in Mugla (Turkey), were investigated against three microorganisms (*Candida albicans* ATCC 10239, *E. coli* ATCC 25922 and *S. aureus* ATCC 25923) and it was determined that the inhibitive effect was only against *S. aureus* (23 mm). In another study, antimicrobial effects of crude polysaccharides from the *H. perforatum* L. collected from Iran, were determined against five different bacteria (*E. coli* ATTC9763, *Shigella dysenteriae* PTTC188, *S. typhi*, *B. cereus* and *S. aureus* ATCC25923) and *S. dysenteriae* was found as the most sensitive microorganism, while *B. cereus* and *S. aureus* were the most resistant ones (Heydarian et al., 2017: 293).

Table 2. DIZ Values of *H. perforatum* L. Fixed Oil Against Test Microorganisms (mm)

Test Microorganisms	**DIZ**	**P.C.**		**N.C.**
		Amp.	**Gen.**	**SW.**
B. subtilis ATCC 6037	6 ± 0	29 ± 1	29.5 ± 0.5	6 ± 0
E. coli ATCC 1103	7.5 ± 0.7	20.5 ± 0.5	21.5 ± 1.5	6 ± 0
E. coli O157:H7 ATCC 43895	7 ± 1.4	11.5 ± 0.5	18 ± 0	6 ± 0
E. faecalis ATCC 29212	7 ± 0	21 ± 1	14.5 ± 0.5	6 ± 0
L. monocytogenes Scott A	7.5 ± 0.7	28 ± 2	28.5 ± 1.5	6 ± 0
S. aureus 6538P	6 ± 0	35.5 ± 0.5	22.5 ± 0.5	6 ± 0
S. Typhimurium NRRLB 4420	6 ± 0	18 ± 2	20 ± 0	6 ± 0

*P.C.: positive control; N.C.: negative control; Amp.: Ampicillin; Gen.: Gentamycin; SW.: sterile water

MIC and MBC values

The MIC values of *H. perforatum* L. fixed oil were examined against seven bacteria using broth dilution method. It was determined that *E. faecalis* ATCC 29212 was the most sensitive microorganism against fixed oil (MIC of 5%). MIC values of the fixed oil against *E. coli* ATCC 1103 and *L. monocytogenes* Scott A was observed as 10%. However, the sample did not show inhibitive effect at concentrations under 10% against *B. subtilis* ATCC 6037, *E. coli* O157:H7 ATCC 43895, *S. aureus* 6538P and *S.* Typhimurium NRRLB 4420. No bactericidal activity was determined on test microorganisms for the concentrations under 10% (Table 3). In the study performed by Tusevski et al. (2018: 305), the antimicrobial effect of *H. perforatum* L. extracts (obtained from flower shoots, non-flower shoots, roots) grown in Macedonia, were investigated against nine microorganisms (*B. subtilis*, *S. aureus*, *E. coli*, *Pseudomonas aeruginosa*, *C. albicans*, *Saccharomyces cerevisiae*, *Rhodotorula rubra*, *Aspergillus niger* and *Rhodotorula rubra*). MIC values of *H. perforatum* L. extracts were observed ranging between 18 µg/mL-625 µg/mL and *B. subtilis* was the most sensitive microorganism against root extract. In another study, *H. perforatum* L. (untreated root extracts and chitosan-treated root extracts) grown in Italy, showed antifungal activity on various test cultures (*C. albicans*, *C. krusei*, *C. glabrata*, *C. parapsilosis*, *C. tropicalis*, *Cryptococcus neoformans*, *Trichophyton mentagrophyte*, *T. rubrum*, *Microsporum gypseum* and *M. canis*). MIC values of untreated and chitosan-treated root extracts were ranged between 42.7-109.7 and 13.3 µg/mL-90.7 µg/mL, respectively (Tocci et al., 2012: 55). These studies showed that the antimicrobial activity of the plants show differences depending on the plant properties, extraction methods and test microorganisms used.

Table 3. MIC and MBC Values of *H. perforatum* L. Fixed Oil Against Test Microorganisms (v/v, %)

Test Microorganisms	**MIC**	**MBC**
B. subtilis ATCC 6037	>10	>10
E. coli ATCC 1103	10	>10
E. coli O157:H7 ATCC 43895	>10	>10
E. faecalis ATCC 29212	5	>10
L. monocytogenes Scott A	10	>10
S. aureus 6538P	>10	>10

S. Typhimurium NRRLB 4420	>10	>10

CONCLUSION

This study showed that fixed oil of *H. perforatum* L. has significant antioxidant and antimicrobial effects. Antimicrobial activities of the fixed oil were determined against seven different microorganisms. The highest inhibitive activity was observed against *E. coli*, *E. faecalis* and *L. monocytogenes*. The antioxidant and antimicrobial activities of *H. perforatum* L. is changed depend on some conditions such as extraction methods and test microorganisms used, geographical structure, climate of the region and the harvesting period of the plant. *H. perforatum* could be used in food industry as natural antioxidant and antimicrobial products. Hence, further studies including food applications of fixed oil of *H. perforatum* L. are needed.

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The Production, Adequacy Level, World Trade and Competition Power of Almonds in Turkey

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ABSTRACT

This study examined the production, adequacy level, world trade and competition power of almonds in Turkey, which has an important place in the production of hard-shell fruits in the world. The evaluations were made using Balassa's index explained revealed comparative advantages (RCA). 2017 in Turkey, according to the FAO, 72 thousand tons were produced almonds. The amount of almonds produced in Turkey constitutes 3,23% of world total production. Turkey's adequacy level almonds 93,5% in 2008 while in 2017 it is observed that this rate decreased to 83%. In recent years, Turkey's total exports of almonds 19,1 thousand tons, while imports at the level of 36,2 thousand tons. According to this data, Turkey meets 36,7% of the almond demand through imports.

Turkey has important advantages in terms of almond cultivation due to its climatic characteristics. However, the current economic indicators show that the production of this fruit is insufficient. For this reason, it is thought that by increasing the production quantity of almonds, important contributions will supply to the economy of our country.

Key words: *Turkey, almond, export, competition power, production.*

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INTRODUCTION

Almond (*Prunus dulcis*) is belonging to genus Amygdalus the subfamily Prunoideae of the family Rosaceae. [1], [2], [3], [4]. Almond, walnut, hazelnut, and pistachio are in the group of nuts [5], [6], [7]. Turkey is the motherland of almond fruit species and has been cultivating in many regions for many years. Almond is affected by the late spring frost because it is a flowering fruit species in the early period. Due to this situation, the lack of regular products from the tree every year played an important role in the development of commercial almond cultivation. The people of Anatolia it was not significant to almond species in the past as much as other fruit species. Usually used as a boundary marker on the edges of fields, vineyards, and gardens [8].

Almond has a wide range of applications such as green almond, dried nuts, candies, chocolate, pastry, cosmetics, and pharmaceutical industry [9], [10], [11], [4]. Almonds are rich in nutrients and contain high levels of unsaturated fatty acids, as well as protein, vitamins, and minerals [12], [6]. During the first five years of the export list of Turkey's traditional agricultural products, figs, raisins, nuts, pistachios, and dried apricots are included and it is known that these products have comparative advantages. However, it is reported that there is no specialization in almond and walnut and that there is a competitiveness disadvantage [13].

In this study, economic parameters such as almond production, competency level, competitiveness and foreign trade in Turkey were analyzed. In addition, the production potential of almonds in our country has been evaluated.

MATERIAL AND METHOD

In this study, evaluations were made using the statistical data from the United Nations Food and Agriculture Organization and Turkish Statistical Institute in order to determine Turkey's almond production, competency level, competitiveness, and foreign trade situation.

The competition power of almond fruit species was classified using the 'Explanatory Comparative Advantage' (ECA) coefficient developed by Balassa [14], [15].

The ECA value of a product is categorized such as $0 < ECA \leq 1$ does not have competitiveness, $1 < ECA \leq 2$ a weak competitiveness, $2 < ECA \leq 4$ moderate competitiveness, 4 <AKÜ strong competitive [16].

RESULTS AND DISCUSSION

The World and Turkey Almond Production Values

Total almond production is growing both in the world and Turkey. Therefore, world almond production increased to 2.23 million tons in 2017 while it was 1.81 million tons in 2008. According to this, world almond production increased by 123.58% in 2017 compared to

2008 (Table 1). In parallel with the world's almond production, Turkey’s almond production increase not at the same rate also been seen is an increase in question. Almond production in Turkey continued to rise to 90 thousand tons in 2017, while 52 thousand tons in 2008. Turkey’s almond production has increased by 170.63% during the period 2008-2017. Turkey’s share in world production of almonds, while 2.91% in 2008, has on the increase of 4.01% in 2017 (Table 1). Increase in Turkey’s almond production based on these data is greater than the increase in world production. 5th between Turkey almond producing countries has the highest production. Important almond producing countries in the world are the United States, Spain, Morocco, Iran, Turkey, Italy, Australia, Syria, Tunisia and Algeria in the form. These 10 countries, which have a significant share in almond production, realize 87.5% of the almond production in the world (Table 2).

Table 1. The World and Turkey Almond Production Values. [17]

Years	World		Turkey		Turkey’s Share in World Production of Almonds (%)
	Production (ton)	Change (%)	Production (ton)	Change (%)	
2008	1.812.217	100.00	52.744	100	2.91
2009	1.822.586	100.57	54.844	103.98	3.00
2010	1.899.884	104.83	55.398	105.03	2.91
2011	2.099.416	115.84	69.838	132.40	3.32
2012	2.027.161	111.86	80.261	152.17	3.95
2013	2.017.883	111.34	82.850	157.07	4.10
2014	1.937.458	106.91	73.230	138.84	3.77
2015	2.019.713	111.44	80.000	151.67	3.96
2016	2.145.426	118.38	85.000	161.15	3.96
2017	2.239.697	123.58	90.000	170.63	4.01

Table 2. Important Almond Producers in The World. [17]

Country	Production (ton)	Share (%)
USA	1.029.655,0	46.0
Spain	255.503,0	11.4
Morocco	116.923,0	5.2
Iranian	111.845,0	5.0
Turkey	90.000,0	4.0
Italy	79.599,0	3.6
Australia	75.373,0	3.4
Syria	71.813,0	3.2
Tunisian	67.000,0	3.0
Algeria	61.943,0	2.8
Total (10 Country)	1.959.454	87.5
World Almond Production Quantity	2.239.697	100.00

Almond is cultivating intensively in Aegean and Mediterranean regions in our country. In addition, this species of fruit is grown in regions where the first spring late frosts are not seen. Also, almond 55-60% of the production is carried out in 10 provinces. Mersin is the most produced almonds in Turkey. This province is followed by Adıyaman, Antalya, Çanakkale, and Şanlıurfa. (Table 3).

Table 3. Important Almonds Producers in Turkey Provinces. [18]

Provinces	Production (ton)	Share (%)

Mersin	14.141	14.14
Adıyaman	11.747	11.74
Antalya	6.358	6.35
Çanakkale	5.098	5.09
Şanlıurfa	4.515	4.51
Adana	3.324	3.32
Diyarbakır	2.899	2.89
Karaman	2.730	2.73
Isparta	2.700	2.70
Gaziantep	2.673	2.63
Total (10 İl)	56.185	56.18
Total (Turkey)	100.000	100.00

Foreign Trade and Proficiency Level

Turkey's almond yearly production has been increasing regularly year. In addition, the number of almonds annual per person in 2017 was as range 1 from 1.2 kg. Along with the increase in population, almond consumption is also increasing. However, Turkey is not a country self-sufficient in the production of almonds. Moreover, the almond qualification level was 93.5% in 2008 while this value decreased to 83% in 2017 (Table 4). As a result, Turkey meets the needs of almonds through import. Considering this situation, Turkey's almonds trade must be analyzed in detail.

Turkey is both importing and exporting almonds. When analyzed considering Turkey's almond export value of foreign trade is constantly increasing, although the period 2008-2017 showed a fluctuating situation. In 2014, it reached the highest level with 22 thousand tons and regressed to 12 thousand tons in 2015-2016 and reached to 19 thousand tons again increased in 2017. Turkey's exports of almonds past 10 years, and whereas in 2008, 6.653 tons, is 19.149 tonnes in 2017 (Table 4). The total export value of Badem has risen in parallel with the increase in the world between 2008 and 2017, but fluctuating in Turkey (Table 5).

On the other hand, exports to the world's almonds in Turkey, in 2013 to 1.96%, in 2016 decrease to 1.28%.

Table 4. Turkey's Almonds Foreign Trade and Proficiency Level. [18]

Years	Export (ton)	Imports (ton)	Adequacy Level (%)
2008	6.653	10.130	93.5
2009	9.349	19.674	83.4
2010	9.475	22.035	81.1
2011	13.433	23.030	85.0
2012	19.537	34.626	82.0
2013	19.664	25.774	92.8
2014	22.670	30.413	91.3
2015	12.636	18.542	92.4
2016	12.696	20.921	90.5
2017	19.149	36.241	83.0

In this study, Turkey's almond import value between 2008-2017 years was examined. However, at the beginning of the period examined Turkey's almond imports (in 2008) and whereas at the end of 10 thousand tons (in 2017) has increased to 36 thousand tons (Table 4). These data indicate that import increased in importance in meeting domestic market demands.

According to this data, Turkey imports of almonds on foreign trade, and the country has a higher import amount than export. This situation is affecting the competitiveness of Turkey.

Competitive Power

Turkey is a country that's foreign trade deficit in almond. Turkey's competitiveness during the 2008-2016 was examined in this study. First of all, our country's almond export value increased from 28.8 million dollars while 2008 to 66.3 million dollars in 2016 (Table 5). Comparative Superiority Index tends to decrease in the period of 2008-2016. This trend has been reducing to 1.3 in 2016, is more than 2 in the period of 2008-2009-2011-2012-2013 (Table 5). If the index value is greater than one, it is said that the country has a comparative advantage in the relevant sector. If the index value is less than one, the country has a comparative disadvantage in the relevant sector [15].

Table 5. Badem's Total Export Value and Competitiveness. [17]

Years	World Almond Export ($1000)	Turkey Export Almond ($1000)	Turkey's Share in World Production of Almonds (%)	Explanatory Comparative Advantage (ECA)	Competition Power
2008	2.214.101	28.890	1.30	2.4	Medium
2009	2.142.074	38.633	1.80	2.2	Medium
2010	2.628.845	36.451	1.38	1.7	Weak
2011	3.066.105	47.574	1.55	2.4	Medium
2012	3.564.454	65.189	1.82	2.8	Medium
2013	4.669.085	91.566	1.96	2.7	Medium
2014	5.498.026	70.710	1.28	1.7	Weak
2015	6.203.599	64.477	1.03	1.3	Weak
2016	5.168.344	66.392	1.28	1.3	Weak

According to the results of this study, Turkey owned competitiveness in the export of almonds and according to the year examined changed Turkey's almonds export competitiveness has been found that fluctuated.

CONCLUSION AND RECOMMENDATIONS

Although Turkey important be a hard-shelled dry fruits ones in, almond which works to increase the production of has not yet come to a self-sufficient state. Increasing population and increases with the demand for almonds, self-sufficiency has resulted in a declining trend in the period of 2008-2017. Due to the fact that domestic needs could not be met with production, imports increased in the period examined. There are defects in the foreign trade of Turkey almond fruit species. Turkey may increase its export and competitiveness through measures to take in the almond sector.

Fruits and vegetables are more labor intensive compared to other agricultural products. Therefore, it is necessary to focus on products with high export opportunities in these species. Modern techniques should be included in all stages of almond production to meet national and international market standards; high value-added, products should be encouraged besides foreign trade. According to this data, in order to increase the self-sufficiency level in almonds, firstly increase the production of almonds with standard fruit properties and orchards should be created with varieties less affected damage by frost. Thus, when Turkey's potential has taken into account that, with the measures to take in the almond industry; can increase production, export quantity and competitiveness.

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A Review of Phytoplankton In The Lentic Ecosystems

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ABSTRACT

The objective of this review was undertaken for the better understanding of the phytoplankton distribution in the lentic ecosystems under various environmental variables. Phytoplankton is defined as free-floating unicells and colonies that phototrophically grow with chlorophyll pigments that enable them to fix solar energy by means of photosynthesis, converting carbon into an energy form, which is transferable to other part of aquatic food web in aquatic environment. Phytoplankton is crucial important organisms in ecosystems with playing a key role in primary production and global element cycles of the Earth. The seasonality of phytoplankton is characterized by sequences of dominant organisms. Phytoplankton composition is not only affected by lake structure and water level, but also stimulated or inhibited by environmental requirements. Phytoplankton relies on a few important environmental factors such as temperature, light, and nutrient for their growth. The European Union Water Framework Directive includes phytoplankton as one of main biological quality component at the five biological indicators to be used to assess the ecological status of surface waters. Increasing attention has been given to studies about limnoecology of phytoplankton in Turkey due to the still poor knowledge.

Key words: *Freshwater Ecology, Lentic ecosystems, Phytoplankton, Water Quality*

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ÖZET

Bu derleme çalışmanın amacı; fitoplankton lentik ekosistemlerde dağılışının, çeşitli çevresel değişkenler altında daha iyi anlaşılması için gerçekleştirilmiştir. Fitoplankton serbest asılı duran tek hücreler ve koloniler olarak, klorofil pigmentleri ile foto-ototrofik olarak çoğalan, su enerjisini fotosentez yoluyla güneş enerjisini sabitlemelerini sağlayan, karbonu su ortamındaki diğer su besin ağının diğer bölümlerine transfer edilebilen bir enerji formuna dönüştüren tanımlanır. Fitoplankton, birincil üretimde ve Dünya'nın küresel element döngülerinde kilit bir rol oynayan ekosistemlerdeki önemli organizmalardır. Fitoplanktonun mevsimsellik baskın organizmaların grupları ile karakterize edilmektedir. Fitoplankton

bileşimi sadece göl yapısından ve su seviyesinden etkilenmez, aynı zamanda çevresel gereksinimler tarafından uyarılır veya inhibe edilir. Fitoplankton, büyümeleri için ışık, sıcaklık ve besin gibi birkaç önemli çevresel faktöre dayanmaktadır.

Avrupa Birliği Su Çerçeve Direktifi, yüzey sularının ekolojik durumunu değerlendirmek için kullanılacak zorunlu beş biyolojik göstergeden biri olarak fitoplanktonu içermektedir. Türkiye'de halen bilgi yetersiz olması nedeniyle fitoplanktonun limnoekolojisi hakkında yapılan çalışmalara artan ilgi gösterilmektedir.

INTRODUCTION

Water is the one of most essential abiotic factor for all living beings and a heritage which must be protected. Waters in the community are under pressure from the continuous growth in demand for sufficient amount of good quality water for all requirement. Phytoplankton is one of mandatory five biological quality components of lakes depending on the Water Framework Directive (Quevauviller et al., 2008; European Communities, 2009)

Phytoplankton is crucial significant organism in aquatic ecosystems with taking a key role in primary production and global element cycles of the Earth (Figure 1) (Reynolds, 1984, 2006).

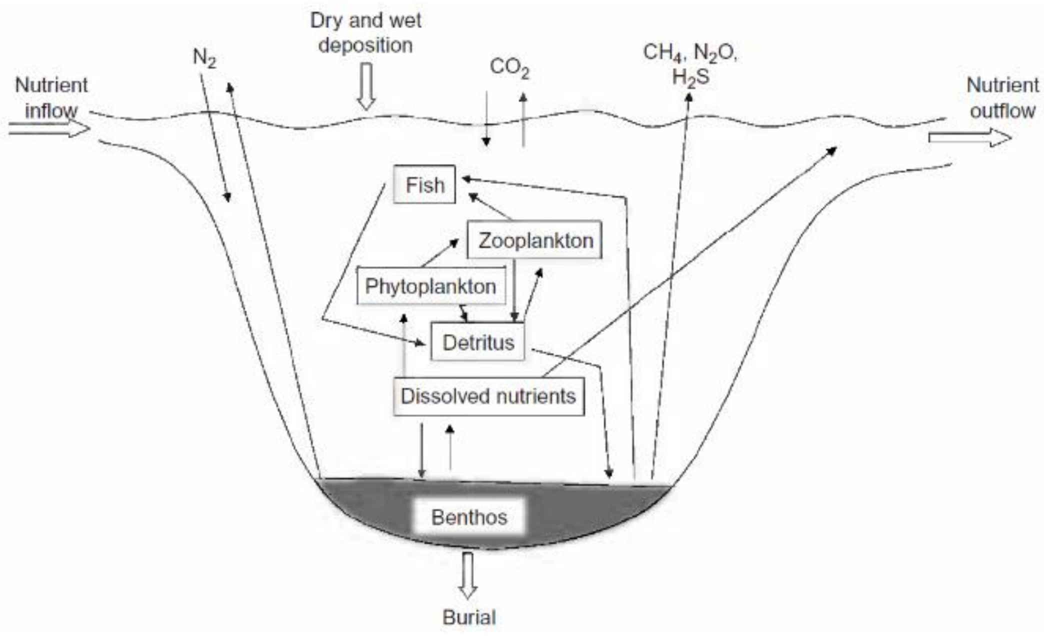

Figure 1. Phytoplankton in the food web of lentic ecosystem (Dodds and Whiles, 2010)

Phytoplankton is defined as free-floating unicells and colonies (Figure 2) that grow phototrophic with chlorophyll pigments that enable them to use solar energy by photosynthesis, converting carbon into an energy form, which is transfered to other part of aquatic food web in surface water environments (Hutchinson, 1967; Reynolds, 1984, 2006). Large populations of phytoplankton can make waters green or other type of colors. Color variations reflect differences in the types and amount of blue-green, red, orange, brown and golden accessory pigments accompanying the green of chlorophyll. Phytoplankton is one of the five biological quality components as ecological indicator recommended by the EU Water Framework Directive for the assessment of ecological status lentic ecosystems (Çelekli and Külköylüoğlu, 2006; European Communities, 2009; Philips et al., 2013; Çelekli and Öztürk, 2014).

Phytoplankton require nutrient such as carbon, phosphate, nitrate, calcium and silicate at various levels based on the species (John et al., 2002; Naselli-Flores et al., 2003; Reynolds, 2006; Çelekli and Öztürk, 2014). Some phytoplankton can fix nitrogen and they can grow in aquatic ecosystems where nitrate concentration levels are low. The oldest oxygen producer phytoplankton growth depends on the availability of carbon dioxide, sunlight such as physical conditions; and nutrients such as chemical conditions (Hutchinson, 1967; Reynolds, 2006). However, another factors of influence phytoplankton growth rate, including water depth, salinity, water temperature, wind, and what kinds of predators are grazing on them. Phytoplankton as a biological carbon pump, produce huge amount of oxygen in the atmosphere (Wehr et al., 2015). On the other hand, phytoplanktons are the primary producers of the aquatic food web and feeding every living being from microscopic creatures, like zooplankton to multi-ton whales. (Figure 1). Phytoplankton account for <1 % of the photosynthetic biomass on Earth, but are nevertheless responsible for nearly 50 % of global net primary production and are the primary energy source for aquatic ecosystems (Field et al., 1998). Even small changes of phytoplankton growth may affect atmospheric carbon dioxide concentrations, that would feed back to global surface temperatures (Lindsey et al., 2010).

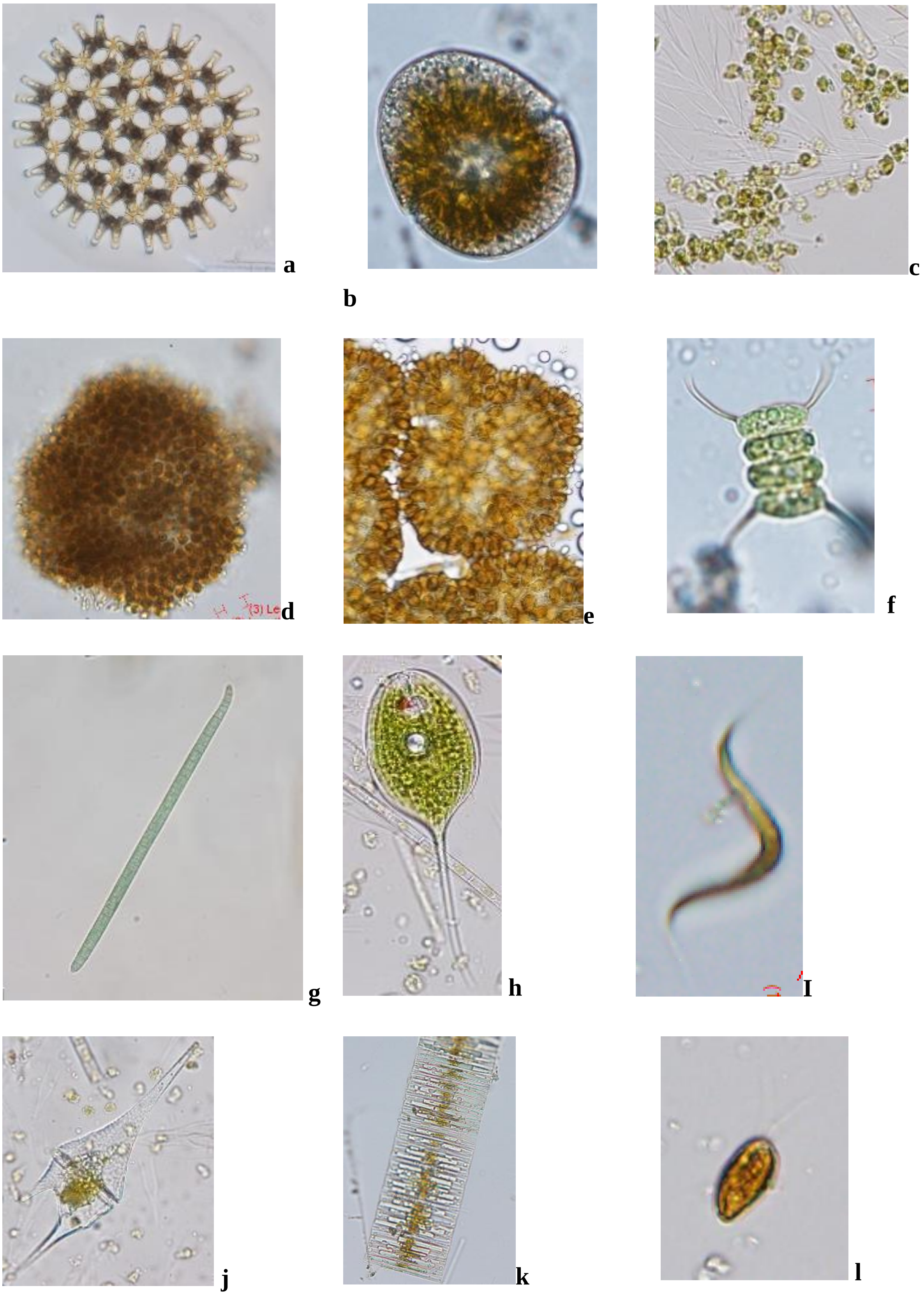

Figure 2. Diversity of phytoplankton. **a.** *Pediastrum duplex*, **b.** *Gymnodinium uberrimum*, **c.**

Dinobryon sociale, **d.** *Microcystis aeruginosa,* **e.** *Snowella lacustris,* **f.** *Scenedesmus communis,* **g.** *Oscillatoria tenuis,* **h.** *Phacus longicauda,* **i.** *Monoraphidium contortum,* **j.** *Ceratium furcoides,* **k.**, *Fragilaria capucina,* **l.** *Plagioselmis nannoplanctica*

Phytoplankton are bio-indicators of water quality in lentic ecosystems (Reynolds, 2006; Padisák et al., 2003, 2009). Some species of phytoplankton produce biotoxins and this case is making them responsible harmful algal blooms. Toxic blooms can kill aquatic life and people who consume direct/indirectly water or eat contaminated seafood. Production of cyanobacterial toxins at environmentally relevant concentrations includes human and animal health hazards, which can present risks of diseases and mortality (Codd et al., 2005; Bláhová et al., 2007; 2008). Therefore, cyanotoxins are an important chemical compoundsalso from viewpoints of ecotoxicology.

Lentic Ecosystem

Freshwater systems have two types of water ecosystems as and lotic ecosystem (riverine ecosystem in Figure 3) and lentic ecosystems (lacustrine ecosystem in Figure 4). These surface waters are important ecosystems for life of biota on the Earth.

Figure 3. Lotic ecosystem from Aras River Basin Photograph, Prof. Dr. Abuzer Çelekli

Figure 4. Lentic ecosystems from Ceyhan River Basin Photograph, Prof. Dr. Abuzer Çelekli

A lentic ecosystem (Figure 4) include a body of standing water, ranging from ditches, seeps, ponds, seasonal pools, basin marshes and lakes (Hutchinson, 1967). Deeper waters, such as lakes, may have layers and influenced by light (Figure 4). Lentic ecosystems, due to their having lighter penetration, are able to support a diverse range of water life's. Some lentic ecosystems are relatively shallow, with considerable light penetration. This ecological factor can closely affect phytoplankton production in the lentic ecosystems, support a variety of aquatic life's (Figure 1 and 5).

Water of lentic ecosytems is mixed well top to bottom at fall and spring seasons, but there are great seasonal changes in wind, temperature, precipitation, evaporation and stratification (Hutchinson, 1967; Çelşekli, 2001). Inconsistent habitat with imbalance closely affects the seasonality of phytoplankton composition. Environmental variables such as light penetration, temperature range, and oxygen concentration are important factors especially arge and deep lakes, which can affect stratification, water cirqulation and photic dept. The biota of lakes in terms of distribution and adaptation to changes of environmental factors is affected by sorting from top to bottom. Seasonal variations are gradual and include spring and fall overturns of water and summer (Figure 6) and winter stratification. Three major zones of habitat are usually introducing (Figure 5):

1. Littoral zone, the shallow-water with light penetrating to the bottom and supporting rooted plants and bottom-dwelling animals;

2. Limnetic zone is the water open to effective light penetration, supporting phytoplankton,

floating plant, and zooplankton; and

3. Profundal zone is the bottom and deepwater area beyond light penetration, supporting dark-adapted organisms (Hutchinson, 1967; Horne and Goldman, 1994).

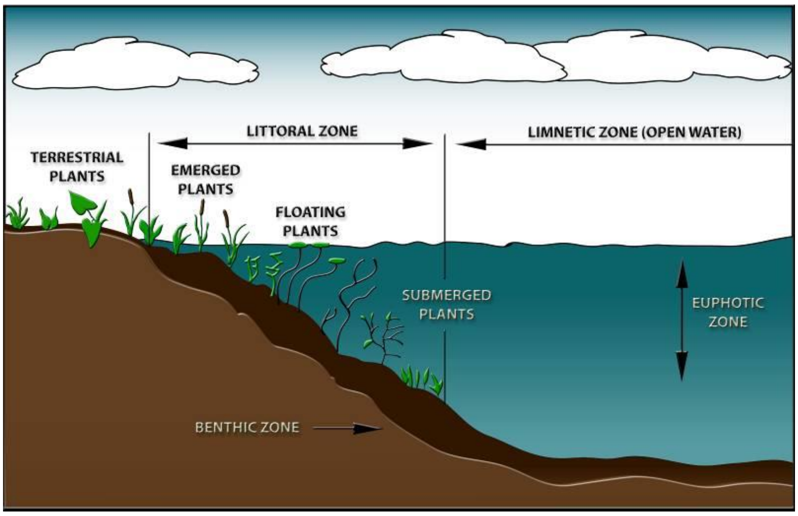

Figure 5. The benthic and pelagic zones of lakes
(https://www.studyblue.com/notes/note/n/env-bio-ch-6/deck/6705963)

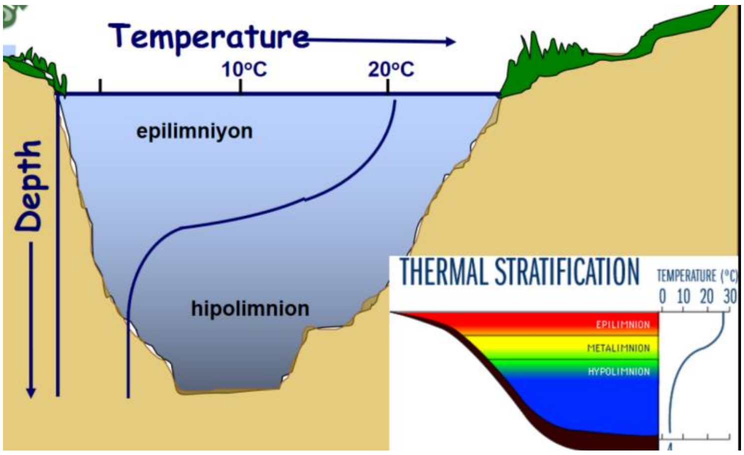

Figure 6. Thermal stratification of lakes
(http://www.lakeaccess.org/ecology/lakeecologyprim4.html)

Eutrophication is characterized by excessive algal and plant growth due to the increased availability of growth factors needed for photosynthesis such as carbon dioxide, light, nutrient, and temperature (Schindler 2006; Bhagowati et al., 2018). Eutrophication occurs naturally over centuries as lakes age and are filled in with sediments (Hutchinson, 1967; Bhagowati et al., 2018). However, both non-point loadings of limiting nutrients, such as nitrogen and phosphorus and point-source discharges into aquatic ecosystems by human activities accelerate the rate and extent of eutrophication (Hutchinson, 1967; Bhagowati et al., 2018). Lentic ecosystems become overly enriched with minerals and nutrients which stimulate excessive algae (especially cyanobacteria) and plants growth. Trophic status of lentic ecosystems are determined using chlorophyll-a, phytoplankton biomss, Sechhi dept, total phosphorous (Carlson, 1977; Vollenweider and Kerekes, 1982)

Eutrophication is when a mass of water becomes overly enriched with minerals and nutrients which induce excessive growth of algae and plants (Figure 7) (Bhagowati et al., 2018). After this process, oxygen depletion occurs at hypolimnion part of the lentic ecosytems. An algal bloom or pretty increase of phytoplankton in a water mass as a reaction to increased levels of nutrients. Eutrophication is often caused by domestic/industrial liquid waste the dumping phosphate or nitrate-containing detergent or fertilizers into an aquatic system Eutrophication is often induced by the discharge of nitrate or phosphate-containing detergents, fertilizers or sewage into an aquatic system (Hutchinson, 1967; Horne and Goldman, 1994; Bhagowati et al., 2018). As a result of the water pollution eutrophication, is called "well-nourished", has become a major environmental problem around the world.

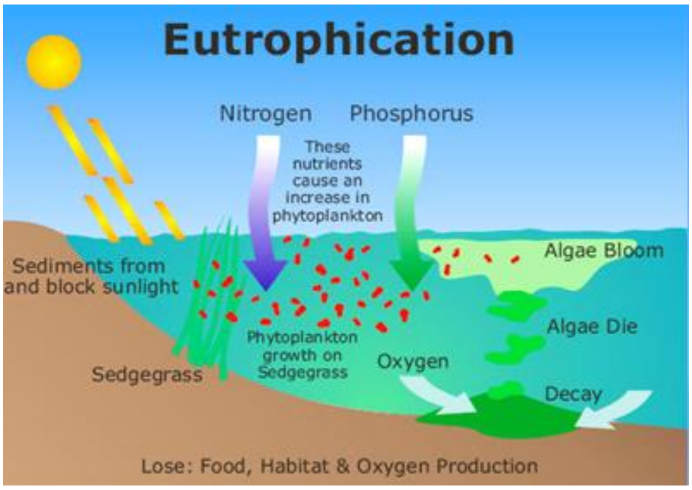

Figure 7. Eutrophication of lakes (from https://onlinesciencenotes.com/eutrophication-causes-effects-and-controlling-measures/, 2018)

CONCLUSION

The European water framework directive requires 5 ecological quality components such as phytobenthos, phytoplankton, macrophytes, fishes and benthic invertebrates to evaluate the ecological quality of surface waters. In order to assess the ecological status lentic ecosystems, phytoplankton is the most important group among the biological quality components. Environmental factors especieally nutrients, light penetration, and water temepratture strongly affect phytoplankton composition in the lentic ecosystems. These seasonal changes in phytoplankton composition closely the associated physicochemical consequences in the aquatic ecosytems. Therefore, composition, abundance, and biomass of phytoplankton give us noteworthy information about the trophic conditions of lentic ecosystems.

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Probiotic Fruit and Vegetable Based Beverages

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ABSTRACT

Probiotics are live microorganisms which taken in sufficient amounts, can provide health benefits. Lactic acid bacteria and bifidobacteria are formed the majority of probiotics and some other bacteria and yeast species may also exhibit probiotic properties. The main health benefits of probiotics are the reduction of lactose intolerance and cholesterol levels, increased absorption of minerals, relief from constipation, anticarcinogenic, antihypertensive, antimicrobial and antimutagenic effects. Probiotics are naturally found in human and animal gastrointestinal system and breast milk. Fermented products, which are produced from milk, cereal, meat, fruit and vegetables, are also important sources of probiotics. In recent years, other than foods naturally containing probiotics, new probiotic foods are continuously developed in food industry including yogurt, cheese, milk, ice cream, fruit and vegetable-based products, fermented sausage, chocolate, cereal based and oat-based products. Dairy products are the most popular products among this group, but the consumption of these products is limited for vegans and people suffering from lactose intolerance and hypercholesterolemia. Therefore, it is very important to develop nondairy probiotic products as an alternative for dairy probiotic foods. Fruits and vegetables are ideal substrates for developing nondairy probiotic foods and beverages, since they include high amount of nutrients, sugars, vitamins, polyphenols and dietary fibers which support the growth and survival of probiotics. Pineapple, cantaloupe, melon, cashew apple, apple, orange, tomato and carrot are some of the fruit and vegetable products used for the production of probiotic beverages. In this review, applications of probiotics in fruit and vegetable based beverages are discussed in detail.

Key words: *Probiotics, probiotic beverages, fruits, vegetables, beverages.*

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INTRODUCTION

Probiotics were defined as “live microorganisms which taken in sufficient amounts, can provide health benefits” (WHO/FAO, 2002: 1). Lactic acid bacteria and *Bifidobacteria* are formed the majority of probiotics and some other bacteria such as *Bacillus*, *Bacteroides*, *Enterococcus*, *Escherichia* and *Propionibacterium* and yeast species such as *Saccharomyces boulardii* may also exhibit probiotic properties (Rivera-Espinoza and Gallardo-Navarro, 2010: 1; Tripathi and Giri, 2014: 225; Kerry et al., 2018: 927). The main health benefits of probiotics are anticarcinogenic, antidiabetic, antihypertensive, antimicrobial, antimutagenic and antiobesity effect, also they improve immune system, treat ulcerative colitis, prevent acute diarrhea and *Helicobacter pylori* infection and effect respiratory system (Sgouras et al., 2004: 518; Fujimori et al., 2009: 520; Taipale et al., 2010: 1; Guandalini, 2011: 149; Grover et al., 2012: 1; Lollo et al., 2013: 118; Nishiyama et al., 2014: 1; Karimi et al., 2015: 1; Marinelli et al., 2017: 190).

Probiotics are naturally presented in breast milk, human and animal gastrointestinal system (Gibson et al., 2017: 491). Also, fermented products, which are produced from milk, cereal, meat, fruit and vegetables, are important food sources of probiotics (Kandylis et al., 2016: 58). In recent years, other than foods naturally containing probiotics, new probiotic foods are continuously developed in food industry including yogurt, cheese, milk, ice cream, fermented sausage, chocolate and fruit, vegetable and cereal based products (Khan, 2014: 71; Tripathi and Giri 2014: 225; Kandylis et al., 2016: 58; Shori, 2016: 1). Dairy products are the most popular products among this group, but the consumption of them is limited for vegans and some people suffering from lactose intolerance and hypercholesterolemia. Therefore, it is very important to develop nondairy probiotic products as alternative foods for people especially who could not consume dairy origin foods (Ranadheera et al., 2010: 1; Peres et al., 2012: 31; Martins et al., 2013: 764). In this study, the applications of probiotics in fruit and vegetable-based beverages are discussed in detail.

Fruit and Vegetable Based Probiotic Beverages

Fruits and vegetables could be used for developing nondairy probiotic foods, since they include high amount of dietary fibers, nutrients, polyphenols, sugars and vitamins, which support the growth and survival of probiotics (Ding and Shah, 2008: 219; Granato et al., 2010: 292). Apple, beetroot, cashew apple, cantaloupe, carrot, cherry, cranberry, melon, pear, pineapple, plum, pomegranate, red-fruit, orange and tomato are some raw materials for the production of probiotic beverages. Also, in this products, *Lactobacillus acidophilus, L. casei, L. paracasei, L. plantarum, L. rhamnosus, L. reuteri, Bifidobacterium lactis, B.*

bifidum, *Saccharomyces boulardii* are used as probiotic (Rakin et al., 2007: 599; Sheehan et al., 2007: 279; Kun et al., 2008: 816; Koh et al., 2010: 428; Ankolekar et al., 2012: 221; Sheela and Suganya, 2012: 1; Fonteles et al., 2012: 2819; Perricone et al., 2014: 421; Nematollahi et al., 2016: 49; da Costa et al., 2017: 195).

Two methods are used in producing probiotic foods. First one, probiotics are added into foods and storage. In the other one, adding probiotics then the food is fermented. It was reported that fermentation methods have some advantages such as production of some antimicrobial metabolites during fermentation (Pereira and Rodrigues, 2018: 279).

Fruit Based Probiotic Beverages

In recent years there is a big interest in developing fruit-based functional beverages containing probiotics. These beverages have a good refreshing taste and consumed by people from all age groups (Tuorila and Cardello, 2002: 561). There are some studies investigating in developing fruit based probiotic beverages (Table 1).

Table 1. Using of Probiotics in Fruit Based Beverages

Raw Material	Used Probiotic/ Inoculation level	Fermentation/ Storage Condition	Results	References
Cashew apple juice	*L. casei* (7.48 log CFU/mL)	Fermentation at 30°C for 16 h, storage at 4°C for 42 days	The counts of *L. casei* were increased to 8 log CFU/mL during storage period while brightness-yellowness increased and redness decreased.	Pereira et al., 2011: 1276
Coconut water beverage	*L. casei* (10^8 CFU/mL)	Fermentation at 35°C for 48 h	The number of probiotic (9.47 log CFU/mL), antioxidant activity (58.4 and 69.2%), total phenolic content (72.1 µg GAE/mL) and vitamin B12 content (11.47 µg/mL) were increased during fermentation period. Honey (15%) and coconut flavor addition has improved the sensory properties of the beverage.	Giri et al., 2018: 1976
Mango juice	*L. acidophilus*, *L. casei*, *L. delbrueckii*, *L. plantarum* (>10^5 CFU/mL)	Fermentation at 30ºC for 72 h, storage at 4ºC for 4 weeks	At the end of storage period, the counts of *L. acidophilus, L. casei, L. delbrueckii* and *L. plantarum* were determined as $1.5x10^7$, $1.0x10^6$, $1.6x10^6$ and $1.4x10^7$ CFU/mL, respectively.	Reddy et al., 2015: 120

Pineapple, strawberry-apple juices	*B. animalis* subsp. *lactis* (10^8 CFU/mL)	Fermentation at 37°C for 24 h, storage at 8 and 22°C for 28 days	The counts of probiotics in pineapple juices were decreased by 1.7 log CFU/mL after 28 days of storage at 8°C and 22°C. In strawberry-apple juices, no live cells were detected at 22°C after 14 days, while after 28 days the counts of probiotic was found as 3.5 log CFU/mL in samples stored at 8°C.	Horackova et al., 2018: 288
Pomegranate juice	*L. acidophilus, L. plantarum, L. delbrueckii, L. paracasei* (10^7 CFU/mL)	Fermentation at 30°C for 72 h, 4 weeks of storage at 4°C	The numbers of *L. plantarum* ($3.6x10^8$ CFU/mL) and *L. delbruekii* ($3.9x10^8$ CFU/mL) within 2 weeks of storage were increased and then the numbers were decreased dramatically after 4 weeks.	Mousavi et al., 2011: 123
Soursop juice	*P. pentosaceus* (10^7 CFU/mL)	Fermentation at 37°C for 72 h, storage at 4°C for 4 weeks	The counts of *P. pentosaceus* in soursop juice were found higher than 10^6 CFU/mL during storage period while sensory properties were also found acceptable.	Akpeji et al., 2017: 1

Vegetable Based Probiotic Beverages

Vegetable based probiotic beverages are presented many advantages such as containing beneficial nutrients and refreshing products like fruit juices (Vinderola et al., 2017: 809). There are various studies investigating the suitability of using of probiotics in vegetable beverages (Table 2).

Table 2. Using of Probiotics in Vegetable Based Beverages

Raw Material	**Used Probiotic/ Inoculation level**	**Fermentation/ Storage Condition**	**Results**	**References**
Beetroot juice	*L. rhamnosus, L. plantarum, L. delbrueckii* (7 log CFU/mL)	Fermentation at 37°C for 24 h	Antioxidant activity, total phenolic and flavonoid contents of probiotic beverages were found higher than fresh fruit juice and as 78.1%, 24.32% and 3.85%, respectively.	Panghal et al., 2017: 257
Beet, carrot, celery juice	*L. acidophilus, L. casei, S.*	Fermentation at 37°C for 8-9 h, storage at	At the end of the storage period, the numbers of probiotics were determined as 7.65-8.50 log CFU/mL	Profir et al., 2015: 11041

	boulardii (6 log CFU/mL)	4°C for 21 days	for bacteria, and 7.04-7.46 log CFU/mL for yeast.	
Mixture of apple, beet and carrot juices	*L. casei* ($1.5x10^6$ - $1.5x10^7$ CFU/mL)	Fermentation at 37°C for 48 h, storage at 4°C for 28 days	The sample including 14% apple, 12% beet and 14% carrot found containing the highest number of probiotic (10^6 CFU/mL), this sample was the most unfavorable juice in terms of sensory properties, but malt extract or glucose may be added to the juice for improving the sensory properties.	Zandi and Berenjy, 2016: 17
Tomato juice	*L. acidophilus*, *L. plantarum*, *L. casei* (2.47-$2.49x10^8$ CFU/mL)	Fermentation at 37°C for 72 h	The results showed that pH and sugar content of the product decreased while the counts of probiotic increased at the end of fermentation period.	Kaur et al., 2016: 212

Factors Affecting the Probiotic Viability in Fruit and Vegetable Based Beverages

The properties of probiotics such as adaptation to the processing environment, stability during storage and the effects on sensory properties should be considered during the improvement of probiotic beverages (Champagne and Gardner, 2008: 539). On the other hand, the other properties of probiotics such as resistance to enzymes in the gastrointestinal system, antioxidative ability, sensitivity to oxygen and phenolic compounds (because of amino acid hydrolyzation) and adhesion to animal cells should be considered. Therefore, using multiple strains would be more beneficial due to all properties cannot be seen in a single strain (Champagne and Gardner, 2008: 539). Also, as the viability of probiotic is strain-dependent (Do Espirito Santo et al., 2011: 377; Corbo et al., 2014: 1192; Tripathi and Giri, 2014: 225), they should be at least 10^7 CFU/mL during storage period of the beverages, which approximately corresponds to 10^9 CFU/portion (Nualkaekul and Charalampopoulos, 2011: 111).

To increase the stability of probiotics in fruit and vegetable based beverages, prebiotics such as cellulose and dietary fiber or some ingredients that have protective effect on cells could be added during in the production of beverages. Also, the viability of probiotic can increase in the products enriched with amino acids, antioxidants, minerals and vitamins (Rakin et al., 2007: 599).

CONCLUSION

Probiotics are live microorganisms that can provide health benefits when taken in sufficient amounts. Fruits and vegetables include healthy substrates such as high amount of nutrients, sugars, vitamins, polyphenols and dietary fibers, therefore they are suitable substrates for developing probiotic beverages, as an alternative for vegans and people suffering from lactose intolerance and hypercholesterolemia. The juices of banana, beetroot, carrot, cashew apple, melon, pear, pineapple, orange and tomato are the products developed by addition of probiotics. Besides, probiotics such as *L. acidophilus*, *L. casei*, *L. fermentum*, *L. paracasei*, *L. plantarum*, *L. rhamnosus* and *B. bifidum* have been commonly used in producing many fruit and vegetable based beverages.

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Using *Urtica dioica* L. as Functional Ingredients in Foods

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ABSTRACT

Urtica dioica L. is a plant belonging to the family of *Urticaceae* and widely distributed in different parts of the world. It is commonly called as "Nettle" or "Stinging Nettle" and has a long history of traditional medicinal uses. The main chemical constituents of nettle are flavonoids, chlorophiles, carotenoids and their derivatives, proteins, organic acids, essential oils, vitamins and minerals. Nettle is known for its extraordinary biological activities and beneficial effects on human health such as antiulcer, anticancer, antiinflamatory, immunomodulating, diuretic, etc. Hence, it is extensively used in pharmaceutical formulations. It also used as a food, fiber source and nutritious addition to the diet. As the demand of consumers for functional foods increases, the use of plants in foods as teas, juices, energy bars increases day by day. *U. dioica* leaves, which contain considerable amounts of essential fatty acids, essential amino acids, minerals (especially iron) and vitamins (especially A and C), are often used as food ingredients in some foods such as in chocolate, cheese, sausage, pasta and meat products. In this paper, recent studies on the potential use of nettle as functional ingredient in foods were reviewed.

Key words**:** *Urtica dioica* L., *nettle, functional food, food ingredient.*

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ÖZET

Urtica dioica L., Urticaceae familyasına ait olan ve dünyanın farklı bölgelerinde yaygın olarak yetişen bir bitkidir. Bu bitki genellikle ''Isırgan'' veya ''Dikenli Isırgan'' olarak adlandırılmakta ve geleneksel tıbta uzun yıllardan beri kullanılmaktadır. Isırganın temel kimyasal bileşenleri arasında flavonoidler, klorofiller, karotenoidler ve bunların türevleri, proteinler, organik asitler, uçucu yağlar, vitaminler ve mineraller yer almaktadır. Isırgan otu yüksek biyolojik aktivitesi ve antiülser, antikanser, antiinflamatuar, immüno-modülatör, diüretik etkiler gibi insan sağlığı üzerindeki faydalı etkileri ile bilinmektedir. Bu nedenle, ısırgan otu farmasötik formülasyonlarda yaygın olarak kullanılmaktadır. Aynı zamanda gıda, lif kaynağı ve yiyecekler için sağlıklı bir katkı olarak da kullanılmaktadır. Tüketicilerin fonksiyonel gıdalara olan talebi arttıkça, bitkilerin çay, meyve suları, enerji barları gibi gıdalarda kullanımı günden güne artış göstermektedir. Önemli miktarda esansiyel yağ asitleri, esansiyel amino asitler, mineraller (özellikle demir) ve vitaminler (özellikle A ve C) içeren *U. dioica* yaprakları, çikolata, peynir, sosis gibi bazı gıdalarda, besin bileşenleri olarak kullanılmıştır. Bu makalede, ısırgan otunun gıdalarda fonksiyonel bileşen olarak kullanım potansiyeli üzerine yapılan son çalışmalar derlenmiştir.

INTRODUCTION

In recent years interest in functional foods in the food industry has increased significantly. The main reason for the increase in functional food research, to get better functional foods and improve nutraceutical knowledge (Marchetti et al., 2018: 547). The functionality of foods is largely depend on the bioactive chemical components consumed within food, which can prevent diseases or increase the well-being of consumers with their nutritional role (Silvia et al., 2018: 1). Many bioactive agents can be used to produce functional foods such as phenolics, vitamins, minerals, carotenoids, fatty acids, fibre and others (Arvanitoyannis and Van Houwelingen-Koukaliaroglou, 2005: 385). Hence, various plants which contain bioactive ingredients can be used in foods especially as natural antimicrobial and antioxidants.

Urtica dioica is a thorny herb that is a member of Urticaceae family. *U. dioica* also known as ‘’Nettle’’ or ‘’Stinging Nettle’’ (Krystofova et al., 2010: 3804). It is a plant rich in vitamins, mineral, fatty acids, proteins, saponins, carotenoids, quercetin, ursolic acid and chlorophyles as well as phenols and flavonoids (Rafajlovska et al., 2013: 26; Bourgeois et al., 2016: 1090; Carvalho et al., 2017: 485). The seeds, leaves and roots of nettle have a significant place in pharmacy for long times. It can be also used as a vegetable, tea and juice. The demand for the nettle has increased with the determination of its medicinal importance, the chemical structure of the main active agents and their pharmaceutical properties. Nettle, which has stable protein composition and high amounts of minerals and vitamins, has been shown to be of great nutritional interest (Said et al., 2015: 8). In traditional medicine, it is used as diuretic, antiulceric, emmenagogue, anthelminthic, immunostimulator, and blood purifier (Binaii et al., 2014: 46; Joshi et al., 2015: 120). Nowadays, this plant became an important place not only in medicine but also in food industry for its bioactive properties. This review will describe the various properties *U.*

dioica and its importance in food industry as food ingredient, especially for producing functional foods.

***Urtica dioica* L.**

Urtica dioica L. is a serviceable plant which belongs to the Urticaceae family and grows in Europe, Asia, North America and North Africa (Ahmadi et al., 2014: 85). It's leaves are characterised by stinging, sharp, ctenoid shape (Upton, 2013: 9; Ahmadi et al., 2014: 85; Di Virgilio et al., 2015: 42). "Nettle" or "Stinging Nettle" is a world wide name of *U. dioica* and it's names in other languages are shown in Table 1 (Ahmadi et al., 2014: 85). Nettle has an irritating property due to the fact that the sting on the surface of the leaves contain various chemical substances, such as histamine, choline, formic acid, serotonin and these subtances may cause allergenic reactions (Akgül et al., 2011: 26). The pharmacological properties of nettle were attributed to its secondary metabolites. Nettle's main flavonoids are quercetin, kaempferol and rutin. These flavonoids have extraordinary biological activities and also beneficial health effects like anticancer, antiulcer, antiinflamatory, immunomodulating, diuretic, etc. (Koch, 2001: 489; Gulcin et al., 2004: 205; Golalipour and Khori 2007: 1200; Said et al., 2015: 8; Carvalho et al., 2017: 485; Jan and Singh 2017: 423). They also have many other effects such as the inhibition of lipid peroxidation of liver mitochondria and blood cells and have been also shown to have antibacterial and antiviral properties (Chusnie and Lamb, 2005: 343; Kataki et al., 2012: 38; Kumar and Pandey, 2013: 1; Said et al., 2015: 8).

As the leaves have a high nutritional value, they can be incorporated into human consumption as a natural source of food, for strengthening the body and preparation of soup or production of functional food (Wetherilt et al., 2003: 84; Jan ve Singh, 2017: 423).

Nettle root has a beneficial effect upon enlarged prostate glands and it is used for the treatment of rheumatic gout, externally is applied to bruises (Kk and Parsuraman, 2014: 6).

Table 1. Common names of Nettle (Said et al., 2015: 8)

Language	**Names**
Latin	*Urtica dioica*
English	Nettle; Common nettle; Stinging nettle; Tall nettle; Slender nettle;
French	Ortie dioïque; Grande ortie; Ortie piquante; Ortie élevée
Arabic	Hourriga; Kerrass ;القراص ;لحريكة
Spanish	Ortiga; Ortiga gran; Ortiga grossa; Ortiga major; Ortiga inayor
German	Brennesslbatter; Brennessel-kraut; Nesslkraut; Haarnesselkraut.

Chemical Composition

Nettle leaves and seeds have significant amount of chemical compounds. These are flavonoids, chlorophylls, carotenoids, proteins, fatty acids, minerals, vitamins, organic acids, phenolics and essential oils. The major compounds are acetophenone, acetylcholine, agglutinin, alkaloids, astragaline, butyric acid, caffeic acid, carbonic acid, catechins and epi-catechins, chlorogenic acid, chlorophyll, ferulic acid, gallic acid, syringic acid, choline, coumaric acid, folacin, formic acid, frideline, histamine, kaemferols, koproporipirin, lectins, lecithins, lignans, linoleic acid, linolenic acid, lutein isomers and isomers of beta-carotene, neoolilivil, palmitic acid, pantothenic acid, quarcetin, quinic acid, scopoletin, serotonin, sigmasterol, steroid, succinic acid, terpenes, violaxanthin and xanthophylls (Table 2) (Chrubasik et al., 2007: 568; Rutto et al., 2013: 1; Ahmadi et al., 2014: 85; Adhikari et al., 2016: 119). Nettle shoot also contains 3.7% protein, 0.6% fat, 2.1% ash, 6.4% dietary fiber, 7.1% carbohydrate and 45.7 kcal/100 g total energy. In addition, nettle is a rich source of vitamin A, vitamin C, calcium, iron and sodium (Rutto et al., 2013: 1; Adhikari et al., 2016: 119).

Table 2. Chemical Composition of Nettle (Said et al., 2015: 8)

Part	**Composition**	**References**
Aerial parts	*Flavonoids:* Quercetin-3-O-rutinoside (rutin), kaempferol-3- O-rutinoside and isorhamnetin-3-O-glucoside	Ellnain-Wojtaszek et al., 1986: 131 Chaurasia and Wichtl, 1987: 432 Otles and Yalcin, 2012: 1
	Organic acids: Caffeic acid and its esters, ferulic acid, chlorogenic, citric, fumaric and phosphoric acids.	Bakke et al., 1978: 181 Otles and Yalcin, 2012: 1
	Essential oil: Carvacol, carvone, naphthalene, (E)-anethol, hexahydrofarnesyl acetone, (E)-geranyl acetone, (E)-βionone and phytol.	Gul et al., 2012: 666

	Minerals and trace elements: Calcium, Potassium, Magnesium, Phosphorus, Iron, Sulphur, Zinc, Manganese, Copper, Nickel and Selenium.	Kavalali, 2003: 47 Sekeroglu et al., 2006: 185 Mustafa et al., 2009: 2765 Rafajlovska et al., 2013: 26 Rutto et al., 2013: 1 Mihaljev et al., 2014: 385 Pradhan et al., 2015: 155
	Vitamins: vitamin A (retinol), vitamin B2 (riboflavin), vitamin B5 (pantothenic acid), vitamin B9 (folic acid), vitamin C (ascorbic acid), vitamin K (phylloquinone).	Wetherilt, 1992: 15 Rutto et al., 2013: 1
	Other constituents: Tannins, chlorophyll and carotenoids.	Wetherilt, 1992: 15
Root	*Acidic polysaccharides:* glucans, arabinogalactans and rhamnogalacturonans.	Seliya and Kothiyal, 2014: 207
	Flavonoids: myricetin, quercetin, kaempferol, quercetin-3-O-rutinoside (rutin), kaempferol-3-O-rutinoside and isorhamnetin.	Wagner et al., 1989: 452
	Minerals and trace elements: Calcium, Magnesium, Zinc, Manganese and Copper	Rafajlovska et al., 2013: 26
	Lectins: Urtica dioica agglutinin (UDA), consisting of a single-chain polypeptide made of 89 amino acids and rich in glycines, cysteines and tryptophans.	Shibuya et al., 1986: 215 Van Damme et al., 1988: 598
	Phytosterols: β-sitosterol; β-sitosterol-3-O-β-glucoside, (6'-O-palmitoyl)-sitosterol-3-O-β-D-glucoside; 7β–hydroxysitosterol; 7α-hydroxysitosterol; 7β-hydroxysitosterol-β-D-glucoside; 7α-hydroxysitosterol-β-glucoside; 24Rethyl-5α-cholestane-3β, 6α-diol; stigmasterol, campesterol, stigmast-4-en-3-on, hecogenin.	Chaurasia and Wichtl, 1987: 434 Seliya and Kothiyal, 2014: 207

	Lignans: neo-olivil, secoisolariciresinol, dehydrodiconiferyl alcohol, isolariciresinol, pinoresinol, and 3,4-divanillyltetrahydrofuran.	Chaurasia and Wichtl, 1986: 1559 Schöttner et al., 1997: 529
	Coumarins: Scopoletin	Chaurasia and Wichtl, 1986: 1559 Seliya and Kothiyal, 2014 : 207
Seeds	*Fixed oil:* saturated and unsaturated fatty acids. *Carotenoids:* β-carotene, lutein and violaxantin. Polysaccharides.	Guil-Guerreroa et al., 2003: 111

Antioxidant Activity

Antioxidants are the chemicals that protect foodstuffs and living organisms against the oxidative damage of free radical molecules such as nitrogen type and reactive oxygen. The most important source of antioxidant compounds are plants. Antioxidants reduce the free radicals or reactive components which is formed by human or taken by foods (Benzie et al., 2003: 113) Hence, they prevent cell damage and provide cell renewal (Serteser et al., 2008: 643).

Phenolics are one of the most effective natural antioxidants, perform antioxidant effect by forming chelates with metals, binding free radicals and inhibiting lipoxygenase enzyme (Gok and Serteser, 2003: 2; Nichenametla et al., 2006: 161). Polyphenols are phenolic compounds with antioxidant properties but they must have 2 properties to be used as antioxidant; 1) to retard oxidation even at low concentrations 2) remain in a stable form when it turns into free radicals (Scalbert et al., 2005: 215; Pellegrini et al., 2009: 12).

There are many methods to evaluate antioxidant activity including total antioxidant activity, reductive power, DPPH assay, metal chelating, active oxygen type quenching assays. These are commonly used to evaluate the antioxidant activity of extracts (Duh et al., 1999: 269; Amarowicz et al., 2000: 957; Chang et al., 2002: 347; Gulcin et al., 2004: 205). The compounds obtained from herbs and spices contain many phytochemicals which have potential antioxidant activity in foods. These properties of herbs and spice extracts are due to the presence of many bioactive ingredient such as flavonoids, vitamins, minerals, carotenoids and phytoestrogens (Hygreeva et al., 2014: 47; Grâmatina et al., 2017: 453). The use of different medicinal plants and their extracts has increased in order to fortify and enhance the antioxidant capacity of foods such as cheese (El-Aziz et al., 2012: 77), jelly (Skouroliakou et al., 2009: 1105), candies (Gramza-Michalowska and Regula, 2007: 43), bread (Glei et al., 2006: 182), pasta (Bonetti et al., 2016: 4222), chocolate (Belščak-Cvitanović et al., 2015: 7723) and meat products (Ryan et al., 2009: 893). Among these plants, nettle has high antioxidant capacity. The antioxidant capacity of the nettle is attributed to various mechanisms such as strong hydrogen donating ability, metal chelating ability and their effectiveness as scavengers of hydrogen peroxide, superoxide and free radicals, and depend largely on many bioactive compounds showing antioxidant activity such as rutin (3-caffeoylquinic acid (3-CQA) and caffeoyl malic acid), 5-0-caffeoylquinic acid, 2-O-caffeolymalic acid, phenolic caffeic acid derivatives, isoquercitrin, chlorogenic acid, quercetin 3-O-glucoside, kaempferol 3-O-rutinoside and isorhamnetin 3-O-rutinoside and ascorbic acid (Gulcin et al., 2004: 205; Pinelli et al., 2008: 9127; Almasi et al., 2016: 449). The abundant bioactive compounds showing antioxidant activity in *U. dioica* extracts are rutin, quercetin, 5-0-caffeoylquinicnacid and isoquercetrin. The antioxidant activity of the nettle was determined by many researchers by using different methods (Gulcin et al., 2004: 205). These studies showed that the antioxidant activity of nettle is its most important functional aspect (Jan and Sing, 2017: 423).

In a study performed by Belščak-Cvitanović et al. (2015: 7723), the antioxidant activity of nettle extracted with water was measured by using ABTS and FRAP methods and the values were found as 5.75±0.29 mM Trolox and 13.47±0.69 mM Fe(II), respectively. Gulcin et al. (2004: 205) indicated that nettle extracted with water had higher antioxidant activity than butylated hydroxyanisole (BHA), quercetin and α-tocopherol. They also reported that nettle extracted with water had a strong antioxidant activity against various oxidative systems and could be used in food industry as an accessible natural ingredient. In the study performed by Mavi et al. (2004: 702), DPPH radical scavenging activity of *Urtica dioica* was determined as 9.1%, 18.3%, 38.5% and 74.0% of DPPH inhibition for the extract concentration of 50, 100, 250, 500 mg/L, respectively. In another study, DPPH radical scavenging activity, ABTS radical scavenging activity (4.5 and 7.4 pH) and Ferric reducing power (FRAP) values were determined for three species of *Urtica* (*U. dioica, U. membranacea* and *U. urens*). According to the results of the study using ethanol and water (50%, v/v) as solvent, for *U. dioica*, *U. urens* and *U. membranacea*, the values were reported DPPH, 2.89±0.33, 10.60±1.53, 7.73±1.02; ABTS (4.5 pH), 11.95±0.90, 21.69±0.72, 20.74±0.86; ABTS (7.4 pH), 2.60±0.14, 11.42±1.11, 4.41±0.38; FRAP, 3.81±0.32, 10.11±1.59, 7.71±0.85, respectively, in terms of Trolox equivalents (*N*=5). The results showed that the antioxidant activity of *U. dioica* was higher than *U. membranacea* and *U. urens* (Carvalho et al., 2017: 485). Consequently, *U. dioica* has an important antioxidant activity, phenolic and flavonoid content and the most important functional aspect of *U. dioica* is the antioxidant activity. These properties have been determined by different researches (Table 3).

Table 3. Antioxidant Activity, Phenolic and Flavonoid Content of Different Parts of *U. dioica*

Part	Extract Type	DPPH (%)	Phenolic content	Total flavonoid	References
Leaves	Methanolic	98.35[b]	6.35[a]	-	Kataki et al., 2012: 38
Flowers	Aqueous ethanolic	48.7	160.6±8.0[b]	103.0±5.3[f]	Güder et al., 2012: 913
Leaves	Aqueous ethanolic	54.2	132.0±6.5[b]	65.8±3.5[f]	
Roots	Aqueous ethanolic	46.2	164.0±8.4[b]	21.0±0.8[f]	
Seeds	Aqueous ethanolic	60.5	213.6±11.1[b]	19.1±0.9[f]	
Leaves	Aqueous ethanolic	-	90.09±82[b]	31.03±1.93[f]	Moldovan et al., 2011: 299

*[a]mg GAE/g extract; [b]µg/mg catechin equivalent; [d]mg/100g; [f]mg quercetin/g d.w.

Effects of *Urtica dioica* L. on Human Health

Plants are the drugs of traditional medicine used in the oldest known treatment methods for centuries. The health effects of these plants have always been the subject of research since their first use in treatments. These effects can be achieved with the chemical compounds contained in the plants as mentioned in the previous sections. The effects of *U. dioica* on health were determined in many studies (Table 4). It is known that biological activities such as antioxidant, anti-inflammatory, anti-ulcer, anti-spasmodic, anti-septic, anti-viral, anti-tumor, anti-proliferative and many others are caused by phenolic acid derivatives and flavonoids (Di Carlo et al., 1999: 337; Ćetković et al., 2007: 1013; Juana et al., 2012: 115; Roleira et al., 2015: 235; Đurović et al., 2017: 18). The presence of such components in the *U. dioica* makes it an indispensable healing center. In addition to these effects, the identification of the mechanisms of action that explain how these effects occur is of importance for the development of active combinations and pathways.

Table 4. Medicinal Effects of *Urtica dioica*

Effects	Referances
Anti-inflammatory	Gulcin et al., 2004: 205; Mavi et al., 2004: 702; Carvalho et al., 2017: 485; Jan and Singh, 2017: 423
Anti-ulcer	Gulcin et al., 2004: 205; Jan and Singh, 2017: 423
Anti-colitis	Krystofova et al., 2010: 3804
Anti-viral	
Anti-cancer	Koch, 2001: 489
Anti-androgenic	Nahata and Dixit, 2014: 592
Immunomodulatory	Golalipour and Khori, 2007: 1200
Hypocholesterolemic	
Hypoglycemic	Golalipour and Khori, 2007: 1200; Suryawan et al., 2017
Cardiovascular	Alisi, 2008: 102
Anti-hemorrhagic	
Natriuretic	Joshi et al., 2014
Analgesic	Joshi et al., 2014; Jan and Singh, 2017: 423
Hypotensive effect	
Hepatoprotective effect	
Anti-rheumatic	Suryawan et al., 2017: 1; Jan and Singh, 2017: 423
Diuretic effect	
Renal ischemia	Jan and Singh, 2017: 423
Reperfusion injury	
Anti-helmintic	
Anti-anemic	Suryawan et al., 2017: 1
Anti-gout	
Anti-eczematic	
Anti-hypotension	

Anti-benign prostatic hyperplasia activities	
Anti-arthritis	
Anti-allergic rhinitis	
Anti-hyperlipidemic	Jan and Singh, 2017
Anti-diabetic	

U. dioica L as Functional Ingredient in Food Products

In recent years, as the living standard and healthy eating habits increase, consumers have started to buy foods that have positive effects on health. According to the Functional Food Center (FFC), functional foods are defined as “natural or processed foods that contains known or unknown biologically-active compounds; the foods, in defined, effective, and non-toxic amounts, provide a clinically proven and documented health benefit for the prevention, management, or treatment of chronic disease” (Martirosyan and Singh, 2015: 209). Food additives, vitamin and mineral supplements, herbs, phytochemicals and probiotics are known as functional foods. Herbs such as nettle and their extracts are called nutraceuticals and are used as synonymous with functional foods.

The consumption of plants/herbs and their use as ingredient in foods has become widespread because they contain antioxidants, which form a protective shield against the effects of oxygen and other harmful substances (Etherton et al., 2002: 41; Meral et al., 2012: 45). The use of plants as natural preservatives in foods can eliminate the use of synthetic additives and also increase the nutritional value of foodstuffs (Grāmatiņa et al., 2017: 453). Thereby, the number of studies on functional foods increase day by day. Functional foods enriched with herbs include teas, juices, snack chips and energy bars etc. (Belščak-Cvitanović et al., 2016: 7723). Nettle has a great interest to product developers and nutritionists because of its potential physiological benefits and unique functional properties.

Thus, Nettle and its extracts have been used to fortify, increase the sensory properties and enhance the antioxidant capacity of chocolate (Belščak-Cvitanović et al., 2016: 7723), sausage (Latoch and Stasiak, 2017: 1745; Aksu and Kaya, 2004: 591), meat products (Oz, 2014: 1356; Kilincceker, 2014: 47), pork sausage (Grāmatiņa et al., 2017: 453), pasta (Bonetti et al., 2016: 4222) and cheese (Fiol et al., 2016: 19). The studies on using potential of nettle as a functional ingredient in foods are shown in Table 5.

Table 5. Using Potential of Nettle in Food Product

Food Product	Usage of nettle	Aim	Result	References
Chocolate	Freeze dried extract and concentrated extracts	Improve the functional properties of chocolate.	The freeze dried extract showed a higher increase in polyphenol content and dark chocolates enriched with nettle are preferred over milk and semisweet ones.	Belščak-Cvitanović et al., 2016: 7723
Sausage	Water extract nettle and dried nettle leaves	Determine the efficacy of nettle leaves in reducing lipid oxidation and ensuring color stability of sausages.	The water extract of nettle can be used successfully in sausages to reduce lipid oxidation, to ensure the color stability and enhance the functionality of product.	Latoch and Stasiak, 2017: 1745
Meatballs	Lyophilized nettle water extract	Evaluate the effect of lyophilized nettle water extract on some attributes of meatball.	The water extract nettle at level of 250 ppm could be used in meatball production.	Oz, 2014: 1356
Pork sausage	Nettle extract with ethanol/water	Investigate the potential use of herbal extracts for preserving the quality of pork sausage.	Negative changes were observed in the sensory properties of meat samples containing nettle extract on 22 days of storage.	Grāmatiņa et al., 2017: 453
Pasta	Dry powdered nettle leaves	Evaluated the BAC, BAV and antioxidant activities of phenolic compounds of nettle present in foods and supplements.	The consumption of pasta enriched with dried nettle leaves instead of traditional pasta causes a significant increase in the antioxidant capacity of gastrointestinal lumen.	Bonetti et al., 2016: 4222

Fish meatballs	Nettle extracts	Determine the effects of salvia and nettle extracts on some quality characteristics of fish meatballs with edible coating.	Sensory properties were acceptable for all samples and the use of salvia and nettle extract as food coating component could be beneficial.	Kilincceker, 2014: 47
Cheese	Nettle leaves	Investigate the use of nettle leaves as coating to increase the flavor of the cheese and to improve its appearance	The use of nettle as a component increased the sensory properties of cheese, contributed to the formation of new recipes and led to a new way of producing fermented milk.	Fiol et al., 2016: 19
Sausage	Dried nettle	Investigate the effect of dried nettle on the microbiological and sensory properties of sausage.	The addition of nettle into sausage improves its sensory properties.	Aksu and Kaya, 2004: 591

In a study performed by Belščak-Cvitanović et al. (2016: 7723), chocolates enriched with freeze dried and concentrated with nettle extracts were produced and their polyphenol contents, antioxidant capacities and sensory properties were investigated for during storage period 12 months. It has been reported that total polyphenol, chlorogenic acid and flavonoid derivative contents of chocolates enriched with nettle were increased. It has been reported that freeze dried extracts showed higher increase in the polyphenol content than the concentrate. It was indicated that dark chocolates enriched with nettle were preferred over milk and semisweet ones.

In a study performed by Latoch and Stasiak (2017: 1745), it was aimed to determine the efficacy of water extracted and dried *Urtica dioica* L. leaves in reducing lipid oxidation and ensuring color stability of sausages. For this purpose, four types of sausages were prepared: control (without nettles), sausages enriched with water extract of nettle (300 ppm and 600 ppm) and sausages enriched with dried nettle leaves. TBARS (Thiobarbituric acid reactive substances/lipid deterioration) values, color parameters, oxidation–reduction potential (ORP), pH, a_w and sensory properties of the products were examined. It has been indicated that the addition of nettles did not affect the pH values, a_w and the ORP of the sausages. It has been reported that the addition of nettle water extract (600 ppm) reduced the TBARS value and increased the color stability of sausages during storage period. According to the results, it was reported that the water extract of nettle could be used successfully in sausages to reduce lipid oxidation, to ensure the color stability and enhance the functionality of the product.

In a study performed by Oz (2014: 1356), it was aimed to evaluate the effect of lyophilized *Urtica dioica* L. water extract (LUWE) on some attributes of meatballs. For this purpose, meatballs were produced in five different formulations: control (meatballs processed without LUWE or vitamin E), meatballs with 250 ppm LUWE, meatballs with 500 ppm LUWE, meatballs containing 250 ppm vitamin E and meatballs containing 500 ppm vitamin E. The obtained samples were stored under aerobic conditions at 4°C for 9 days. It was indicated that only pH and TBARS values were affected in meatballs enriched with water extracted nettle or vitamin E. According to the obtained results, it was reported that water extract nettle at the level of 250 ppm could be used in meatball production.

In a study performed by Grāmatiņa et al. (2017: 453), it was aimed to investigate the potential use of herbal extracts with ethanol/water application for preserving the quality of pork sausage for 32 days. For this purpose, four different plants grown in Latvia were chosen: nettle (*Urtica dioica* L.), lovage (*Levisticum officinale* L.), oregano (*Origanum vulgare*) and horseradish (*Armoracia rusticana* L). It has been reported that the sensory properties of meat samples containing nettle extract were changed in negative way on 22 days of storage.

In a study performed by Bonetti et al. (2016: 4222), it was aimed to evaluate the bioaccessibility (BAC), bioavailability (BAV) and antioxidant activity of phenolic compounds of nettle present in foods and supplements. It was observed that the adding dry powdered nettle leaves to pasta formulations increases the functional properties of the food effectively and provides protection against oxidative stress in the gastrointestinal environment. It has been reported that the simulation of colonic metabolism confirmed that phenolic compounds were fermented by the intestinal microflora and further investigations should be made on the effects of phenolic compounds on the colon. It has been observed that the consumption of pasta enriched with dried nettle leaves instead of traditional pasta causes a significant increase in the antioxidant capacity of the gastrointestinal lumen.

In a study performed by Kilincceker (2014: 47), it was aimed to determine the effects of salvia and nettle extracts on some quality characteristics of fish meatballs with edible coating. Fish meatballs were coated with sodium alginate containing 0.4% and 0.6% salvia and nettle extract and were packed in vacuum and were stored at -15±2°C for 120 days. Coated fish meatballs were investigated in terms of pH, thiobarbuturic acid (TBA), total volatile nitrogenous substance (TVB-N), total microorganism count, color and sensory properties. At the end of the study, the difference between total microorganism count, pH, TBA and TVB-N results was found insignificant in raw samples and it was indicated that the lowest number of total microorganism was found in products containing 0.6% of salvia and nettle extract. Sensory properties were acceptable for all samples during storage period. It was concluded that the use of salvia and nettle extracts as food coating components could be beneficial.

In a study performed by Aksu and Kaya (2004: 591), it was aimed to investigate the effect of dried *U. dioica* L. on the microbiological and sensory properties of the sausage. The dried *U. dioica* L. (0%, 1%, 3% and 5%) was added in sausage and microbiological analyzes were performed on the days 0, 3, 7, 10 and 14 of the ripening period. According to the results, it was indicated that level of *Urtica dioica* L. and ripening time had a significant effect on total aerobic mesophilic bacteria, lactic acid bacteria, *Micrococcus*/*Staphylococcus*, yeast-mold and *Enterobacteriaceae* counts. It has also been reported that the addition of *Urtica dioica* L. in sausage improved the sensory properties.

In a study performed by Fiol et al. (2016: 19), it was aimed to investigate the use of nettle leaves as coating to increase the flavor of the cheese and to improve its appearance. Lactic acid bacteria obtained from fresh nettle leaves were inoculated into milk and milk was coagulated. According to the results, the use of nettles increased the sensory properties of vegetarian cheeses and yogurts, contributed to the formation of new recipes and led to a new way of producing lactic fermented products.

CONCLUSION

Plants including various bioactive components are important sources for pharmaceutical and food industries. Among these plants, *Urtica dioica* L. (Nettle) is one of the most important medicinal plant grown in different parts of the world. This review has presented different chemical composition of various parts of nettle. It has high nutrient content and bioactive compounds such as polyphenols, proteins, vitamins, minerals and organic acids and can be used as both food and herbal medicine. Hence, nettle is a miraculous plant. It can be a good source of antioxidant because of its extract is a rich source of rutin, 5-O-caffeoylquinic acid, quercitrin and isoquercitrin compounds. Various researchers have been focused on this plant because of its positive effects on human health. Literature reviews show that there is scientific evidence for its beneficial properties. Major effects of nettle and/or its extracts are anti-inflammatory, immunomodulatory, anti-eczematic, hypoglycemic and anti-ulcer. This plant also has been used as food ingredient and studies proved that nettle can be used as ingredient to improve organoleptic properties, to obtain functional food and also extend the shelf life of foods.

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Usage of Microalges in Wastewater Treatment

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Abstract

Due to reasons such as urbanization, increasing population, industrialization, and wastewater treatment plant, clean freshwater resources operation decreases with time. Giving domestic and industrial wastes to receiving environments such as rivers, streams, creeks, and lakes without adequate purification cause serious environmental problems and health problems for ecological systems. Many wastewater treatment plants have been developed at the beginning of this century and have been developed depending on factors such as climate and energy costs to treat wastewaters. Microalgae are used in the biological treatment of wastewaters because of their photosynthetic abilities and their being in the first step of the food web. Algae are important for the biological treatment process for two reasons. Algae in wastewater ponds increase the amount of dissolved oxygen in the aquatic system by producing oxygen with photosynthesis. They provide oxygen in the treatment of aerobic bacteria and ensure the effective functioning of the pools. Secondly, algae have a role in the treatment of wastewater by taking their suggestions in the treatment of biological treatment processes and in the treatment of the preferred nutrients such as nitrate and phosphate in the system. Therefore, the removal of nitrogen and phosphorus in treatment processes has gained importance. Not only does it purify the wastewater with microalgae species, but also bioenergy is obtained by algal wastewater treatment. In the case of biological treatment with microalgae in the future, it is important to reveal different solutions depending on time and environment conditions. Therefore, the biological treatment of microalgae and wastewater will be a fundamental issue and a green revolution will occur with the development of microalgae technology.

Keywords: *Biological Treatment, Microalgae, Wastewater*

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INTRODUCTION

With the increase in population, agricultural activities and industrialization, underground and surface waters are insufficient and many countries are turning to wastewater reuse to meet water needs (Hermanowicz, 2006). Many wastewater treatment plants are being developed in order to treat wastewater, and at the beginning of this century, depending on factors such as climate, energy and energy costs (Yücel, 1997). Water scarcity is one of the major problems of the 21st century in the world, and the lives of billions of people and creatures depend on the direct management of water. People primarily need freshwater for urban, industrial, and agricultural uses (Urkiaga et al., 2008). No adequate water resources and deteriorated water quality pose serious concerns for many municipalities, industries, agriculture and the environment in many regions of the world (Asano, 2001). Microalgae have very good potential for phosphate and nitrogen removal. The main techniques are; ingestion of wastewater into the cell, nutrient removal with the help of algae and high pH of ammonia is leaving (Metcalf, 1991). One of these systems is wastewater treatment systems. Discovering new parameters and elements every day, methods that are more economical and efficient processes are revealed (Umble ve Kechum, 1997).

Wastewater Treatment and Methods

Wastewater is the waters that people use for different purposes; domestic wastewater can be defined as a combination of wastewater from houses, institutions, commercial and industrial establishments, and a combination of underground, surface and rainwater (Figure 1) (Metcalf and Eddy 2003). Everything that causes poor conditions on water and adversely affects the use of water is defined as contamination. Nitrate and phosphate in wastewaters from artificial fertilizers and some industrial wastes used in agriculture promotes the growth of algae under certain conditions, causing water to pollute (Arceivala, 1998).

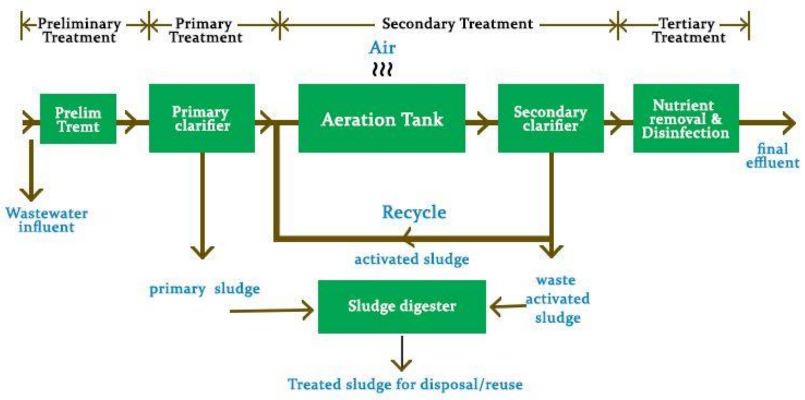

Figure 1. Activated Sludge Waste Water Treatment Flow Diyagram (Metcalf and Eddy,2003)

Physical treatment (primary treatment): Physical treatment includes processes for the removal of solids, dissolved organic and inorganic substances and gases of various sizes that can be deposited in the wastewater (Dölgen, 2004).

Chemical treatment: Chemical oxidation process in water and wastewater treatment, optional chemical substances and some toxic compounds are removed from the water by making them harmless or inconvenient (Şengül, 1995).

Biological treatment: If the organic management system and the plants need to be oxidized due to the device in the case of hanging, colloid or eliminated wastewater, they become new bacterial mass and become collapsible tangles or transform into inorganic compounds such as CO_2 (Eroğlu, 2008). The living groups used in biological treatment are shown in table 1.

It has the highest rate of distribution of wastewater treatment plants by types (Fig.2)

Table 1. Live groups used in the biological treatment

Prokaryotic	**Eukaryotic**
Bacteria	Fungus
Archaea	Protozoa
	Metazoa (Rotifera)
	Algea

Natural treatment: Natural treatment systems, in principle, are facilities that can make the wastewater harmless by using the self-cleaning power of nature (Güneş, 2000; Akça, 2004).

Advanced treatment: Advanced treatment of contaminants such as AKM, dissolved substance, organic substances (especially nitrogen, phosphorus, and etc.), which are left in treated wastewater at the exit of classical treatment systems, is called refinement (Öztürk et al., 2005).

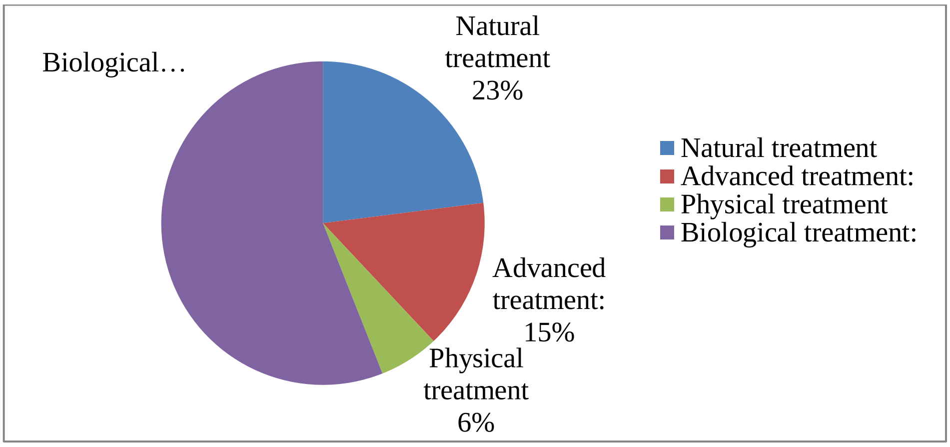

Figure2. Distribution of Wastewater Treatment Plants by Type at the End of 2016 (TUİK)

Microalgae and Wastewater Treatment

Microalgae are single/multicellular with diverse cellular structures and photosynthetic eukaryotes or prokaryotes, used in bioremediation process or biological treatment process in treatment systems. High biomass efficiency of microalgae grown in wastewater ensures that microalgae in wastewater as renewable and sustainable resources are a suitable approach (Zhou, 2012).

There are two important reasons for using microalgae in their production. The first one is the activation of the biosystem ecology by assisting the oxygenation of oxygen-poor wastewater ponds by eliminating the ability of microalgae to produce oxygen by photosynthesis (Şişman Aydın, G., 2017). Second, nitrogen and phosphorus rich sea (Şişman-Aydın ve ark., 2009, Şisman-Aydın, 2012, Şişman-Aydın ve ark., 2013, Şişman-Aydın ve ark., 2014) and organisms that can rapidly proliferate in inland waters and take part in excessive reproduction events due to these properties. (Figure 3)

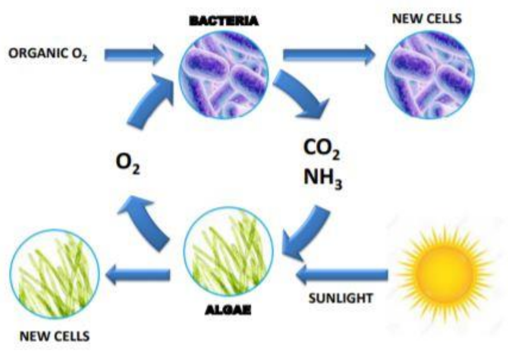

Figure 3. Symbiotic relationship of microalgae and bacteria in wastewater treatment (www.thepoultrysite.com)

Due to these properties, it is possible to use nitrogen and phosphorus in the treatment of contaminated water and the treatment efficiency is very high (Klausmeier et al., 2004; Aslan and Kapdan, 2006; Abdel-Raouf et al., 2012).

Most of the nitrogen in algal cell bound to proteins which compose to 45-60% of dry weight and phosphorus is essential for the synthesis of nucleic acids, phospholipids, and phosphate esters. Algae using nitrogen and phosphorus in growth may remove to nutrients load of wastewater from a few hours to a few days (Lovaie and Noüe, 1985)

Microalgae Production in Wastewater

Various synthetic culture media are used to provide the nutrients required for microalgae production (Aitken and Antizar-Ladislao, 2012). Industrial production of microalgae is not economically feasible due to the high cost of synthetic culture media used and low level biomass production (Figure 4). Therefore, the use of natural complex environments such as wastewater is seen as an interesting alternative with the advantage of wastewater treatment and microalgae production (Rawat et al., 2011; Sydney et al., 2011).

The most important inorganic nutrients for algae growth are nitrogen and phosphorus. They are generally found in the environment as nitrate, ammonia and phosphate. In the microalgae, the amount of light and the carbon source must be sufficient for the photosynthesis to occur (Kaewpintong, 2004; Moheimani, 2005). Metabolism of microalgae is very diverse and has the ability to change metabolism due to changes in environmental conditions (Chojnacka et al., 2004). The most important parameters that regulate algal growth are; the quality and quantity of nutrients are light, pH, turbulence, salinity, and temperature (Table 2) (Utting, 1985). Algae cultures need a light source. Because light is the energy source of photosynthesis. The photosynthetic speed against light intensity increases linearly. High light intensities inhibit photosynthesis. The intensity and duration of light are important for the efficiency of cultures (Cirik and Gökpınar, 2006).

Table 2. Average production conditions of microalgae (Eliçin et al., 2009).

Parameters	Limit Values	Optimum Conditions
Temperature (ºC)	16-40	18-24
Salinity (g/l)	12-40	20-24
Light intensity(lux)	1000-10000	2500-5000

Light time	-	16:8 min.
(day and night: h)		24:0 max.
pH	7-9	8.2-8.7

Figure 4. Microalgae production in wastewater (Photos: Prof. Dr. Şevket GÖKPINAR, 2014)

The efficacy of a wide range of microalgae such as *Chlorella, Scenedesmus, Phormidium, Botryococcus, Chlamydomonas* and *Spirulina* for the treatment of domestic wastewaters (Figure 5) has been reported to be promising (Rawat, 2011). Algal biomass should be efficiently removed to be effective in improving wastewater. Harvesting usually involves a solid-liquid separation followed by dehydration and drying (Richmond and Becker, 1986).

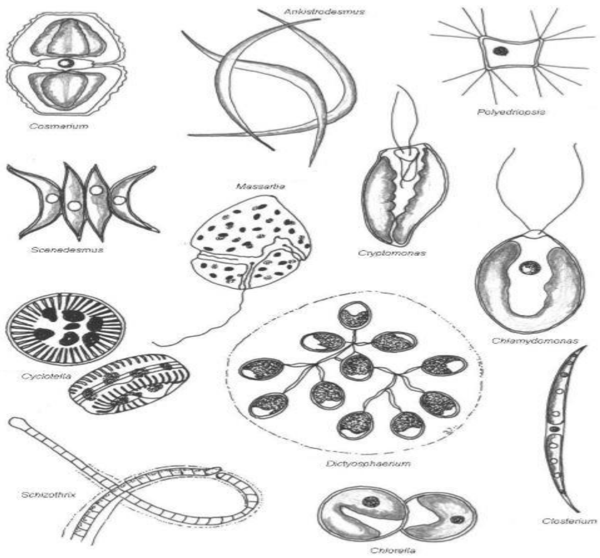

Figure 5. Common algae of wastewater treatment pools (Şen and Nacar, 1988).

Efficient cost, low energy requirement, useful biomass production, reduction in sludge formation, success in removal of metals, containing more than 50% fat in biomass, reevaluation of biomass obtained, and high efficiency of purification; Advantages of using microalgae in wastewater treatment (Şişman-Aydın, 2017, 2018). On the other hand, the basic considerations in the construction of an integrated wastewater treatment and biofuel production system are the selection of suitable species, the necessity of modulated lighting conditions, the high nutrient removal capacity expectancy, the high biomass yield and the efficient algae harvesting capacity (Figure 6) (Mahapatra et al., 2014).

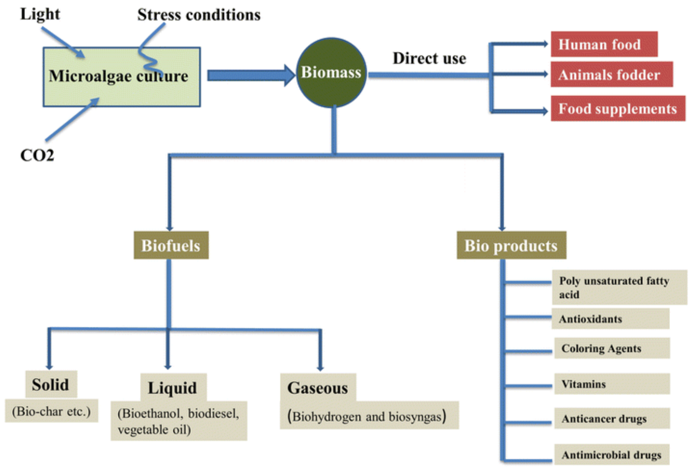

Figure 6. Products obtained from microalgae and usage areas (Khan et al., 2017).

CONCLUSION AND RECOMMENDATIONS

Algae were made as a source of high-valency compounds. In wastewater, nutrients, heavy metals, pesticides, organic and inorganic toxins, radioactive substances, such as the ability to remove hazardous pollutants for the natural environment, wastewater treatment has an important place among the organisms widely used. Systems utilizing algal-bacterial interactions for urban and industrial wastewater treatment perform a treatment equivalent to secondary treatment systems using mechanical vehicles and chemicals, but are one of the most preferred treatment systems in the world due to their low cost and operating costs. For a sustainable environment; Inevitability of microalgae is obvious in many areas that we cannot foresee in today's energy, water resources, food supply, reduction of greenhouse gas emissions. Apparently, microalgae will be the most fundamental issue for the sustainable environment, sustainable energy and sustainable economy in the coming years, and a green revolution will take place with the development of microalgae technology. Supporting the studies to be carried out on this issue will be the subject of many biotechnological and industrial studies in the future as it will provide both environmental and economic benefits.

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Blackberry Concentrate: Physicochemical Properties and Thermal Degradation Kinetics of Anthocyanin and Colour

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ABSTRACT

Many *Rubus* (*Rubus fruticosus* sp.) species are defined as blackberries. In recent years, besides their being natural colorant, anthocyanins have begun to attract great interest due to their antioxidant properties and beneficial health effects. Since anthocyanins are highly unstable and tend to degrade, the anthocyanin stability must be maintained while processing anthocyanin rich nutrients. Thermal processing is one of the most widely used methods for preserving and extending the shelf life of foods and also, an important parameter that affects the anthocyanin stability. Blackberry is anthocyanin rich short-season fruit. To increase shelf-life, freshly squeezed blackberry juice was concentrated from 12.0 to 45.28 °Brix by rotary vacuum evaporator at 40 C. Objectives of present study were to analyze the physicochemical properties (pH, titratable acidity, total monomeric anthocyanin, total phenolics and total antioxidant activity) and to investigate thermal degradation kinetics of anthocyanins and Hunter colour parameters of blackberry concentrates at 60, 70 and 80°C. Titratable acidity, pH, total monomeric anthocyanin, total phenolic matter and total antioxidant activity of blackberry concentrates were determined as 1.63 % (as percent citric acid), 3.04, 2423 mg/L, 3600 mg GAE/L and 84 % reduction, respectively. Monomeric anthocyanin degradation fitted to a first order reaction kinetics. The half-life values for anthocyanin degradation were 3.9, 2.8 and 2.0 h at 60, 70 and 80°C, respectively. Temperature dependence of anthocyanin degradation rate constants was expressed as activation energy, E_a, and E_a was calculated as 33.07 kj/mol between 60-80°C (R^2=0.9996). Hunter colour parameters of L^*, a^*, b^* were found as 0.73, 0.12, 0.10, respectively, and total colour difference (TCD^*) was calculated from those values. TCD^* was fitted to zero-order, first-order and combined kinetics model and, generally, all of them gave good fits (R^2>0.8516) but, rather better fits with both first-order and combined kinetics models.

Key words: *anthocyanin, blackberry, colour, concentrate, kinetics, thermal degradation*

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INTRODUCTION

Several species of *Rubus* (*Rubus fruticosus* sp.) are called blackberries. Blackberries are one of the easiest to grow and are extremely tolerant of site and soil conditions. Some species of blackberries are upright and require no support but others are trailing and require a trellis (Kafkas, Koşar, Türemiş, and Başer, 2006:732). Blackberries are widely distributed around the world; it is believed that as many as 300 species of blackberries exist throughout the world (Cabral, Orrego-Alzate, Gabas, and Telis-Romero, 2007:589). Turkey is one of the origins of blackberries; blackberry cultivation started in the Marmara region several decades ago and now has been introduced as a new crop in the Mediterranean region. Besides, blackberry growing can be done in all parts of Turkey until irrigation is supplied. The blackberry fruits can be used in various food products such as ice cream, juice, jam, marmalade, cake, etc (Kafkas et al., 2006:732). Blackberries have relatively high nutritional value due to being rich in vitamins, dietary fiber, phenolics (such as anthocyanins, flavonols, flavanols, ellagitannins, gallotannins, proanthocyanidins, and phenolic acids). The latter ones have many beneficial biological functions such as antioxidant, anticancer, anti-neurodegenerative, and anti-inflammatory activities (Du, Finn,and Qian, 2010:1127). Besides, flavonols, phenolic acids, ellagic acid, vitamins C and E, folic acid and b-sitosterol are the natural chemopreventative phytochemicals of blackberries (Bowen-Forbes, Zhang, and Nair, 2010:554). In line above, objectives of the current study were to analyze the physicochemical properties (pH, titratable acidity, total monomeric anthocyanin, total phenolics and total antioxidant activity) and to investigate thermal degradation kinetics of anthocyanins and Hunter colour parameters of blackberry concentrates at 60, 70 and 80°C.

MATERIAL & METHODS

Materials

Blackberry (*Rubus fruticosus* sp.) fruits were collected in Gaziantep, Southeast Anatolia, Turkey. Pectolytic enzyme, Panzym XXL, was kindly gifted by Sinerji A.Ş., Mersin, TURKEY. The free radical 2,2-dipheynl-1-picrylhydrazyl (DPPH), Folin–Ciocalteu's reagent, and gallic acid were purchased from Sigma Chemical Co. (St. Louis, MO, USA). All the other reagents were of analytical grade.

Preparation of Blackberry Concentrate

All the foreign materials such as pieces of branches and leaves and also unripe and damaged fruits were removed by hand. The cleaned fruits were washed under cold tap water, stalks and seeds were removed. Fruits were ground by using a laboratory blender. Juice was immediately filtered through muslin to remove pulp from the juice. Then the juice was depectinized with 1.0 % (v/w) Panzym XXL at 50 ^{o}C for 2 h. The depectinized juice was allowed to rest at 4^{o}C for 24 h. The juice was again filtered through five layer muslin and finally double layer filter paper to obtain a clear juice. Clear juices were concentrated using BÜCHİ Rotary Evaporator (Rotavapor R-3 model, BÜCHI Loborthechnik AG, Flawil, Switzerland) at 40 ^{o}C.

Physicochemical Properties

Total soluble solid content (TSS) was measured with a digital refractometer (PTR 46X, England) at 20 ^{o}C. pH measurements were done by using Nel-890 Model pH meter (Ankara, Turkey) calibrated with pH 4 and 7 buffers. Total acidity was determined potentiometrically by titrating the sample with 0.1 NaOH until the pH reached 8.2 and expressed as grams citric acid per liter.

Determination of Total Phenolics

The total phenolic content in blackberry concentrate samples were determined colourimetrically by the Folin-Ciocalteu method (Singleton and Rossi, 1965:144). 100 µL of sample (diluted 1:5 (v:v) with methanol) was mixed with 6 ml of twice distilled water and 500 µL of Folin-Ciocalteu reagent was added. After waiting 5 minutes at room temperature, 1.5 mL of sodium carbonate (20% w/v) was added to adjust optimum pH for the reaction. The mixture was vortexed and incubated at room temperature (~23^{O}C) for 2 h and then the absorbance was measured at 765 nm using a UV-VIS Lambda 25 spectrophotometer (Perkin Elmer, Shelton, USA). Gallic acid was used as a standard and total phenolic content was expressed in mg gallic acid equivalents (GAE) per liter of concentrate. A mixture of water and reagents was used as a blank. All analyses were done in triplicate (n = 3).

Determination of Total Anthocyanins

Total anthocyanin content of blackberry concentrate was determined using the pH-differential method described by Giusti and Wrolstad (2001), using two buffer systems: potassium chloride buffer, pH 1.0 (0.025 M), and sodium acetate buffer, pH 4.5 (0.4 M). The concentrate samples were diluted in a ratio of 1:10 with twice distilled water. A 0.4 ml of diluted sample was mixed with 3.6 ml of corresponding buffers and allowed to equilibrate for 15 minutes at room temperature. The absorbance of each equilibrated solution was measured at 510 nm (λ_{max}) and 700 nm for haze correction, using UV-VIS Lambda 25 spectrophotometer (Perkin Elmer, Shelton, USA). Total monomeric anthocyanins were calculated as mg cyanidin-3-glucoside per liter concentrate according to the following formula:

Total anthocyanins (mg/L) = A x MW x DF x 1000 / (ε x l)

where $A = (A_{510} - A_{700})_{pH\ 1.0} - (A_{510} - A_{700})_{pH\ 4.5}$; MW (molecular weight) = 449.2 g/mol for cyanidin-3-glucoside; DF = dilution factor (10) as final volume per initial volume; 1 = pathlength in cm; ε = 26,900 molar extinction coefficient in L/mol/cm for cyanidin-3-glucoside; 1000 = conversion factor from g to mg. All analyses were done in triplicate (n = 3). Glass cuvettes of 1 cm path-length were used and all measurements were carried out at room temperature (~23^{o}C). Absorbance readings were made against twice distilled water as blank.

Determination of Antioxidant Activity

DPPH assay was done according to the method of Brand-Williams, Cuvelier, and Berset (1995:25) with some modifications. The stock solution was prepared daily by dissolving 1.2 mg DPPH with 50 mL methanol and special care was taken to minimize the loss of free radical activity of the stock solution during the course of sample preparation. 100 μL of diluted sample in the ratio of 1:10 (v:v) with methanol was mixed with 3900 μI of $6x10^{-5}$ mol L^{-1} DPPH in methanol. The mixture was vortexed and left to stand for 30 min in dark place at room temperature. Then the absorbance was measured spectrophotometrically at 515 nm using using UV-VIS Lambda 25 spectrophotometer (Perkin Elmer,Shelton, USA). The percent of reduction of DPPH was calculated by the formula reported by Tural and Koca (2008:363).

% DPPH reduction = $[(A_C - A_S)/A_C]$ x100

where A_C = absorbance of a control (t = 0 min), A_S = absorbance of a tested sample at the end of the reaction (t = 30 min). Glass cuvettes of 1 cm path-length were used and all measurements were carried out at room temperature (~23^{o}C). Absorbance readings were made against methanol as blank and control sample was prepared with the same volume of methanol mixed with DPPH stock solution. All analyses were done in triplicate (n = 3).

Colour Measurements

The visual colour was evaluated using a HunterLab Colourflex (A-60-1010-615 Model Colourimeter, Hunter Associates Lab. Inc. Reston VA, USA). The instrument was standardized each time with a black and a white (L = 91.10, a = 1.12, b = 1.26) tile. The colour values were expressed as $L*$ (lightness), $a*$ (redness/greenness) and $b*$ (yellowness/blueness). Total colour difference (TCD*) parameter was calculated and modeled. Colour values were the means of triplicate measurements.

Degradation Kinetics of Anthocyanins

Thermal degradation of blackberry concentrate was studied in 45.28° Brix concentrate at 60, 70 and 80°C. Aliquots of 10 mL of blackberry concentrates were put into screw-cap test tubes to prevent evaporation and test tubes were placed into oven preheated to a given temperature. At regular time intervals (0, 2, 4, 6, 8, and 10 h), samples were removed from the oven (NÜVE EN500, Ankara, Turkey) and rapidly cooled by plunging into an ice bath to stop further degradation. The anthocyanin contents and colour values of the samples were measured immediately.

Previous studies showed that thermal degradation of anthocyanins followed a first-order reaction (Peron, Fraga, and Antelo, 2017:837; Costa, Silva, Vieira, 2018:110; Jiang et al. 2019:464). This kinetic type was expressed by the following equation:

$$C = C_o * \exp\ (\pm k_1 * t) \qquad (1)$$

where C_o is the initial anthocyanin contents and C is the anthocyanin contents after time t (min) of heating at the given temperature while k_1 is the first order rate constant. The parameters of first order kinetic model (Eq. (1)) were estimated by non-linear regression iterative procedure of the SigmaPlot (SigmaPlot 10.0 Windows version, SPSS Inc.).

Half-lifes ($t_{1/2}$) which is the time needed for 50% degradation was calculated by the following equation:

$$t_{1/2} = -Ln0.5/k_1 \qquad (2)$$

where $t_{1/2}$ is the half-lifes and, k_1 is the first order degradation rate constant (h^{-1}).

The effect of temperature on the degradation rate constants was expressed by the linearized Arrhenius equation by plotting ln k against 1/T in which the temperature dependence of k was quantified by the activation energy E_a according to Eq. (3).

$$Ln\ k = LnA_o - \frac{E_a}{RT} \tag{3}$$

where the k is the rate constant (min^{-1}), A_o is the frequency factor (min^{-1}), E_a is the activation energy (kJ/mol), R is the universal gas constant (8.314 J/mol/ K) and T is the absolute temperature (Kelvin, K). The E_a value was calculated from the slope of the straight lines given by Eq. (3), using a linear regression procedure of the SigmaPlot (SigmaPlot 10.0 Windows version, SPSS Inc.).

Degradation Kinetics of Visual Colour

The complexity of fruit juices and derivatives implies a wide range of enzymatic and non-enzymatic browning reactions caused by thermal treatments. Consequently it is difficult to establish a reaction mechanism and to obtain a kinetic model describing the global process adequately (Ibarz, Pagán, and Garza, 1999:416). There are numerous references on the kinetics of colour of food materials in the literature. The majority of these works report zero-order (Eq. (4)) or first-order (Eq. (1)) degradation reaction kinetics.

$$C = C_0 \pm k_o * t \tag{4}$$

Sometimes the relatively simple models described do not adequately represent colour change mechanism. That is why a combined kinetics has been developed, in which the non-enzymatic colour change reactions are considered to consist of two stages. A first stage of coloured polymeric compound formation following zero order kinetics, the second stage supposes decomposition of the coloured polymers into non-coloured compounds following a first order kinetics. According to this combined kinetics, the colour change mechanism can be expressed by (Garza, Ibarz, Pagán, and Giner 1999:336; Ibarz et al. 1999:416):

$$C = \frac{k_0}{k_1} - \left[\frac{k_o}{k_1} - C_0\right] exp(\pm k_1 * t)$$

(5)

The terms C and C_0 are the concentrations of colour parameters at any time t and initial concentration, respectively; k_0 is the zero-order kinetics constant and k_1 is the first-order kinetics constant in Eqs. (1), (4),(5).

Total colour difference (TCD*) was calculated by using L^*, a^*, b^* values (Eq. (6)) (Loughrey 2002:11).

$$TCD^* = \sqrt{(L_0^* - L^*)^2 + (a_0^* - a^*)^2 + (b_0^* - b^*)^2} \quad (6)$$

where, L_0^* (0.73), a_0^* (0.12) and b_0^* (0.10) refer to initial values, and L^*, a^* and b^* refer to colour values at various times during heat treatment.

Statistical Analysis

All measurements were performed in triplicate and are reported as means and standard deviations. The parameters of kinetic models and Arrhenius equation were estimated by either linear regression procedure or non-linear regression iterative procedure of the SigmaPlot (SigmaPlot 10.0 Windows version, SPSS Inc.).

	Blackberry
pH	3.04
Total soluble solids (°Brix)	45.28
Titratable acidity (as percent citric acid) (%)	1.63
Color	
$L*$	0.73
$a*$	0.12
$b*$	0.10
Total Monomeric Anthocyanins (mg/L)	2423
Total phenolics (mg GAE /L)	3600
Total antioxidant activity (% reduction)	84

Values represent means calculated from three replicates.

Table 1. Physicochemical Properties of Concentrate.

RESULTS AND DISCUSSION

Physicochemical Properties

Blackberry juice was concentrated from 12.0 to 45.28 °Brix. Titratable acidity, pH, total monomeric anthocyanin, total phenolic matter and total antioxidant activity of blackberry concentrates were determined as 1.63 %, 3.04, 2423 mg/L, 3600 mg GAE/L and 84 % reduction, respectively (Table 1). Cemeroğlu et al. (2009) have been reported that total acidity of blackberries changes between 0.4 and 2.5 %, which is consistent with our results. In the studies of Wang and Xu (2007:273) on degradation kinetics of anthocyanins in blackberry juice and concentrate, total monomeric anthocyanin content of blackberry juice (8.9 °Brix) and concentrate (65.0 °Brix) was found 400.77 and 417.85 mg/L, respectively, which were lower than our results. They also concluded that anthocyanins in blackberries are relatively higher than strawberry, pomegranate and blueberry. In addition, total phenolic content of these blackberry juice (8.9 °Brix) and concentrate (65.0 °Brix) was found 1540.93 mg GAE/L and 1547.84 mg GAE/L, respectively. These variations were probably due to differences among in cultivars, growing seasons, agricultural practices and variations in applied experimental assays. In the studies of Pantelidis, Vasilakakis, Manganaris, and Diamantidis (2007:780) on antioxidant capacity, phenol, anthocyanin and ascorbic acid contents in raspberries, blackberries, red currants, gooseberry and Cornelian cherries, Cornelian cherries were found to have highest anthocyanin content (223 mg/ 100 g fresh weight) expressed as cyanidin-3-glucoside, followed by blackberry and raspberry x blackberry cultivars (104–198 mg/100 g fresh weight), whereas raspberry and red gooseberry cultivars (35–49 mg/100 g fresh weight) were found to have lowest amounts of anthocyanins. Moreover, blackberry and raspberry x blackberry cultivars had highest phenolic content and highest antioxidant activity as compared to other species of their study. In addition, Koca and Karadeniz (2009:448) have been reported that anthocyanin contents, phenolic contents and antioxidant activity of wild blackberries were higher than those of cultivated blackberries.

Degradation Kinetics of Total Monomeric Anthocyanins

Degradation of blackberry anthocyanins during heating was plotted as a function of time (Figure 1) and fitted to first order reaction kinetics (Eq. (1)). It has 2423 mg/L TMA content initially. Reduction in anthocyanin content was 85.9 %, 91.1 % and 97.1 % for heating at 60, 70, 80 °C, respectively. As the nature of first order reaction kinetics, degradation rate decreases with decreasing pigment concentration, duration of heat explosion and temperature, which is clearly observed in Figure 1. Our findings were in accordance with literature that reporting first order reaction kinetics for blackberry anthocyanins (Wang and

Xu 2007:273; Dai, Gupte, Gates, and Mumper, 2009:845; Fernandes et al., 2018: 428; Fan, Wang, Xie, Zhang, Li, and Zhou, 2019:303).

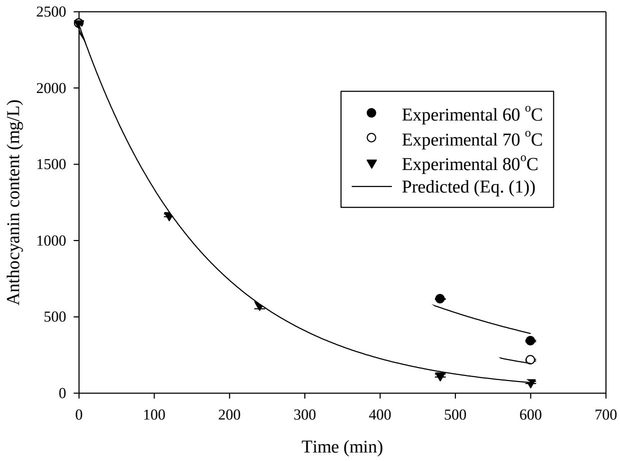

Figure 1. Degradation of Anthocyanins in Blackberry Concentrates During Heating at 60, 70 and 80 ºC.

The first order reaction rate constants (*k_1*) and half-life of anthocyanins (*$t_{1/2}$*) (calculated by Eq. (2)) were shown in Table 2. *k_1* values for anthocyanin degradation were 0.003, 0.0042 and 0.0059 min^{-1} in blackberry concentrate at 60, 70 and 80 °C, respectively. In accordance, *$t_{1/2}$* values for anthocyanin degradation were 3.9, 2.8 and 2.0 h in blackberry concentrate at 60, 70 and 80 °C, respectively (Table 2). As temperature increased *$t_{1/2}$* values decreased in consistent with faster reaction rates accompanied by higher *k_1* values. Wang and Xu (2007:273) reported that the *k_1* values for anthocyanin degradation were 0.00069, 0.00132 and 0.000247 min^{-1} in blackberry juice (8.90 °Brix) at 60, 70 and 80 °C, respectively, and, *$t_{1/2}$* values for anthocyanin degradation were 16.7, 8.8 and 4.7 h in blackberry juice (8.90 °Brix) at 60, 70 and 80 °C, respectively. That is, it can be concluded that anthocyanin degradation was greatly dependent on temperature as indicated by higher *k_1* values at higher temperatures (Kırca et al., 2003:365).

Concentrate type	Temperature (ºC)	$\boldsymbol{k_1^a}$ x 10^3 (min^{-1})	$t_{1/2}$ (h)^b	E_a (kJ/mol)^c
Blackberry	60	3.0 (0.9893)	3.9	33.07 (0.9996)
	70	4.2 (0.9933)	2.8	
	80	5.9 (0.9989)	2.0	

[a] Rate constant.

[b] Half-life.

[c] Activation energy.

[d] Numbers in parentheses are the correlation coefficients.

Table 2. Effect of Temperature on k_1, $t_{1/2}$ *and* E_a Values of Anthocyanin Degradation in Blackberry Concentrate.

To determine the effect of temperature on degradation rate constants, the constants (k) obtained from Eq. (1) were fitted to Arrhenius equation Eq. (3) at 60, 70 and 80 °C and shown in Figure 2. The calculated activation energy E_a for blackberry concentrate was 33.07 kJ/mol (Table 2). Wang and Xu (2007:273) reported that at 60- 90 °C, the activation energy for degradation of anthocyanins for blackberry juice (8.9 °Brix) was 58.95 kJ/mol. The difference in activation energy values could be due to different soluble solid contents (Cemeroğlu, Velioğlu, and Işık, 1994:1218) and compositional change in samples being treated (Kırca et al., 2007:217).

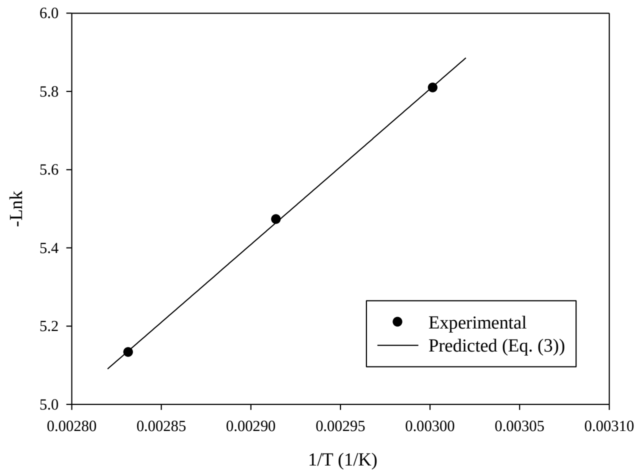

Figure 2. The Arrhenius Plots for Degradation of Anthocyanins in Blackberry Concentrate During Heating.

Degradation kinetics of visual Color

Variation of TCD* (calculated with (Eq. (6)) of concentrates fitted to zero order (Eq. (4)), first order (Eq. (1)) and combined model (Eq. (5)) during heating at 60, 70 and 80 °C for 600 minutes were shown in Figure 3. Figure 3 clearly indicates that the TCD* increased with increase in time and treatment temperature. Kinetic parameters of zero, first and combined model were given in Table 3. In the light of regression analysis, correlation coefficients of

TCD* fitted to first order (0.9672-0.9814) and combined model (0.9833-0.9868) were not considerably different from each other for blackberry concentrates, which showed better fit compared to zero order (0.8516-0.8884) (Table 3). So, both first order and combined model was found to be appropriate for these concentrates. Studies on color degradation kinetics in the literature report zero-order kinetics (Eq. (4)) (Chutintrasri and Noomhorm; 2007:303; Tiwari, O'Donnell, Patras, Brunton, and Cullen 2009:2827), first-order kinetics (Eq. (1)) (Ahmed, Shivhare, and Raghavan, 2000:242; Shao-qian Liang, and Si-yi, 2011:1994) and combined kinetic model (Eq. (6)) (Garza et al., 1999:336; Ibarz et al., 1999:416).

CONCLUSION

Blackberries are delicious attractive fruits which serves many antioksidants, anthocyanins and phenolics. Monomeric anthocyanin degradation fits to first-order reaction kinetics. *TCD** was fitted to zero-order, first-order and combined kinetics model and, generally, all of them gave good fits (R^2>0.8516) but, rather better fits with both first-order and combined kinetics models.

	Zero-order			First-order			Combined model			
Temperature (°C)	$C_o \pm SE$	$ko \pm SE$	R^2	$C_o \pm SE$	$k_1 \pm SE$	R^2	$C_o \pm SE$	$ko \pm SE$	$k_1 \pm SE$	R^2
60	0.1415±0.0550	0.0014±0.0002	0.8884	1.0436±0.0401	-0.0028±0.0004	0.9672	0.019±0.0314	0.0039±0.0005	0.0048±0.0010	0.9833
70	0.1878±0.0670	0.0016±0.0003	0.8736	1.0341±0.0413	-0.0041±0.0006	0.9769	0.0274±0.0352	0.0050±0.0006	0.0056±0.0009	0.9868
80	0.2620±0.0917	0.0020±0.0003	0.8516	1.0544±0.0413	-0.0070±0.0011	0.9814	0.0317±0.0492	0.0071±0.0009	0.0065±0.0011	0.9842

SE: Standard error, R^2: correlation coefficients.

Table 3. Kinetics Parameters of Zero-order Model (Eq. (4)), First-order Model (Eq. (1)) and, Combined Model (Eq. (5)) for TCD* Values

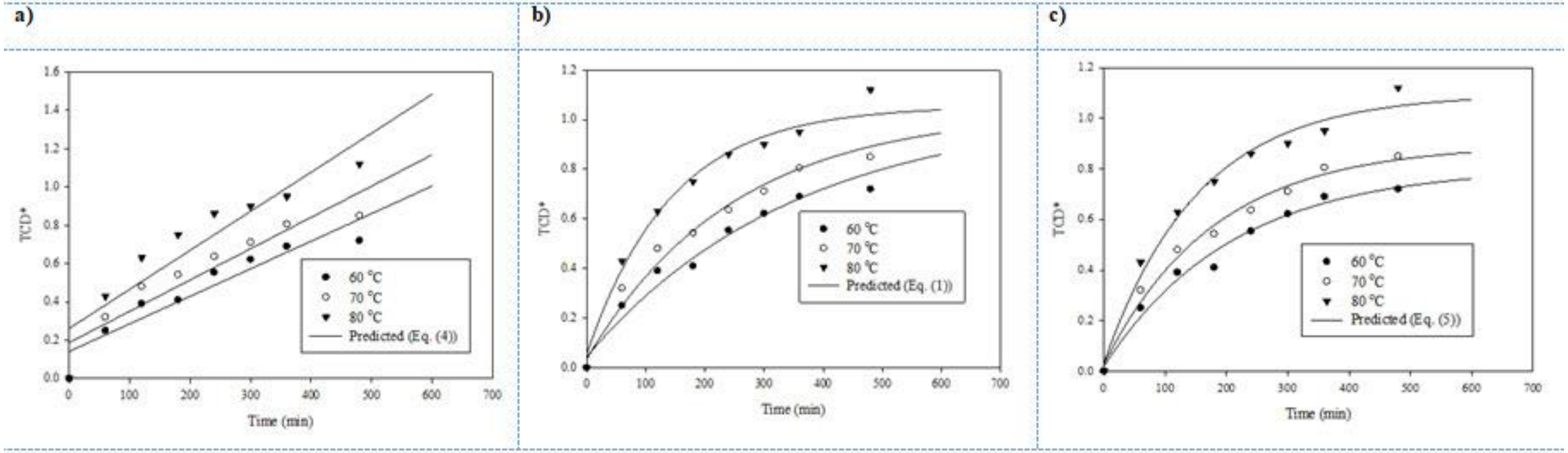

Figure 3. Change in Total Color Difference (TCD*) of Blackberry Concentrate Fitted to a) Zero-order Kinetics, b) First-order Kinetics and c) Combined Kinetics during Heating at 60, 70 and 80 °C.

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Antimicrobial Effects of Lactic Acid Bacteria Isolated from Fermented Plant Based Products

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ABSTRACT

Fermented plant based products are very rich sources in microbiological point of view and naturally contain probiotics. Various metabolites (organic acids, hydrogen peroxide, reuterine, bacteriocin etc.) produced by probiotics show bactericidal or bacteriostatic effects on some microorganisms. The aim of the present study was to examine the antimicrobial activities of lactic acid bacteria (LAB) isolated from fermented vegetable products. Total eleven different samples [pickled turnips (A), mixed pickles (B, D, E), salt pickled red peppers (C), pickled tomatoes (F), sauerkraut (G, H), pickled beans (I), pickled okras (J) and pickled gappari (K)] produced at homes by traditional methods were collected around İzmir city for the isolation of probiotic LAB strains. Among the samples, 114 LAB strains were isolated. Antimicrobial activity of these isolates was screened by disc diffusion method against *Listeria monocytogenes, Staphylococcus aureus, Escherichia coli, Escherichia coli* O157:H7*, Bacillus cereus* and *Salmonella* Typhimurium and the results were evaluated by zone measurement. According to the results; 86 of 114 isolates showed antimicrobial activity with changing zone diameters, depending on the isolates and the test culture used. No isolates have shown antimicrobial activity against *L. monocytogenes*. Thus, further tests should be applied for selecting these isolates as probiotic bacteria.

Key words: *fermented vegetables, antimicrobial activity, probiotic, lactic acid bacteria*

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ÖZET

Bitki bazlı fermente ürünler, mikrobiyolojik açıdan oldukça zengin bir kaynaklar olup ve doğal olarak probiyotikleri içermektedirler. Probiyotikler tarafından üretilen metabolitler (organik asitler, hidrojen peroksit, reuterin, bakteriyosin vb.), bazı mikroorganizmalar üzerinde bakterisidal veya bakteriyostatik etki göstermektedir. Bu çalışmada, fermente sebze ürünlerinden izole edilen laktik asit bakterilerinin (LAB) antimikrobiyal aktivitelerinin belirlenmesi amaçlanmıştır. Probiyotik LAB suşlarının izolasyonu için İzmir ili çevresinde evlerde geleneksel yöntemlerle üretilen toplam on bir örnek [şalgam turşusu (A), karışık turşu (B, D, E), kırmızı biber turşusu (C), domates turşusu (F), lahana turşusu (G, H), fasulye turşusu (I), bamya turşusu (J) ve gappari turşusu (K)] toplanmıştır. Numunelerden 114 adet LAB izole edilmiştir. Bu izolatların antimikrobiyal aktivitesi *Listeria monocytogenes, Staphylococcus aureus, Escherichia coli, Escherichia coli* O157:H7, *Bacillus cereus* ve *Salmonella* Typhimurium'a karşı disk difüzyon yöntemiyle incelenmiş olup, sonuçlar zon ölçümü ile değerlendirilmiştir. Elde edilen sonuçlara göre 114 izolattan 86'sı, kullanılan test kültürüne bağlı olarak farklı seviyelerde antimikrobiyal aktivite göstermiştir. Bununla birlikte izolatlardan hiçbiri *L. monocytogenes* üzerinde antimikrobiyal etki göstermemiştir. Bu nedenle, izolatların probiyotik bakteri olarak değerlendirilmesi için ilave testlerin uygulanması gerekmektedir.

INTRODUCTION

Vegetables are rich in antioxidants, vitamins, dietary fibers and minerals. Although refrigeration, freezing and canning techniques have improved in the 20th century, fermentation, which is one of the most practical methods to protect products in underdeveloped and developing societies, is still widely used. It is a simple and valuable biotechnological process applied to protect and / or improve the shelf life, nutrition and sensory properties of vegetables. Most of the plant based fermented products are produced by lactic acid fermentation and have acidic properties (Tamang, 2010: 9; Karaçıl and Tek, 2013: 165). Hence, plant based fermented products are important sources of lactic acid bacteria (LAB).

Lactic acid bakteria is Gram-positive, nonsporing, nonrespiring cocci or rods, which produce lactic acid as the major end product during fermentation of carbohydrates. LAB importance is associated mainly with their safe metabolic activity while growing in foods utilising available sugar for the production of organic acids and other metabolites (Bintsis, 2018: 1). Their common occurrence in foods along with their long-lived uses contributes to their natural acceptance as GRAS (Generally Recognised as Safe) for human consumption. LAB exert health benefits through the antimicrobial effect produced from different metabolic processes (lactose metabolism, proteolytic enzymes, bacteriophage resistance, bacteriocin production, polysaccharide biosynthesis and antibiotic resistance). The spectrum of antibacterial activity of LAB strains has the potential to cover a very broad field of application in the food industry. The antimicrobial properties of LAB were arised from competition for nutrients and the production of one or more antimicrobial active metabolites such as organic acids (mainly lactic and acetic acid), hydrogen peroxide and also other compounds, such as bacteriocins and antifungal peptides.

Plant based products may be preserved by fermentation, direct acidification, or a combination of these along with other processing conditions and additives to yield products that are referred as pickles. The most commonly pickled plants include cucumbers, cabbages, olives and peppers (Tamang, 2010: 9). During vegetable fermentations many physical, chemical and microbiological changes occur that influence the quality and safety of the products. It has been described that *Leuconostoc* and *Lactobacillus* genera predominated during the early hours of fermentation; subsequently, *Lactobacillus* and *Pediococcus* emerged as the dominant genera, and finally, *Pediococcus* appeared as a dominant genera during the late stages of fermentation (Singh and Ramesh, 2008: 279; Rodríguez et al, 2009: 83). A great number of potential LAB were isolated from various traditional naturally fermented plant based products. Previous studies showed that various LAB take a role during fermentation of vegetables such as *Leuconostoc mesenteroides, Leu. citreum, Lactobacillus brevis*, *Pediococcus pentosaceus* and *Lactobacillus plantarum, L. paraplantarum, L. pentosus* (Tamminen et al., 2004:442; Plengvidhya et al., 2007: 7700; Rodríguez et al, 2009: 81). Asian traditional fermented foods are generally fermented by LAB such as *L. plantarum, L. pentosus, L. brevis, L. fermentum, L. casei, Leuconostoc mesenteroides, L. kimchi, L. fallax, Weissella confusa, W. koreenis, W. cibaria,* and *Pediococcus pentosaceus* (Swain et al, 2014: 6). It is also possible to use starter culture such as *L. plantarum, L. rhamnosus, L. gasseri*, and *L. acidophilus* for providing consistency and reliability of fermentation performance.

LAB are considered as a major group of probiotic bacteria probiotic. Commercial probiotic cultures used in food applications include mainly strains of *Lactobacillus* spp., *Bifidobacterium* spp. and *Propionibacterium* spp. *L. acidophilus, L. casei, Lb. reuteri, L. rhamnosus* and *L. plantarum* are the mostly used LAB species in developing functional foods. Recently, numerous studies have been performed on the identification of probiotic microorganisms and to detect their various properties. These studies mostly related with the probiotic dairy products. Hence, in this study, it was aimed to investigate the antimicrobial properties of LAB isolates obtained from plant based fermented products.

MATERIAL AND METHODS

Sample collection

Pickle samples produced traditionally at homes were collected around Izmir city. At each sampling point, samples were collected in sterile jars and transported at 5 °C to the laboratory for analysis within 24 h. Total eleven pickle samples were analyzed for LAB isolation (Table 1).

Table 1. Pickle samples and number of LAB isolates

Code	Pickle Samples	Number of Isolates
A	Pickled turnips	22
B	Mixed pickles	15
C	Salt pickled red peppers	15
D	Mixed pickles	17
E	Mixed pickles	6
F	Pickled tomatoes	0
G	Sauerkraut	9
H	Sauerkraut	30
I	Pickled beans	0
J	Pickled okras	0
K	Pickled gappari (K)	0

Isolation of lactic acid bacteria

To isolate LAB, 10 g sample was transferred to 90 ml 0.1% peptone water (PW, pH 6.3±0.2, Oxoid-L37, Basignstoke, Hampshire, England) and homogenised with a Stomacher Lab-Blender 400 (Seward Medical, London, UK). Appropriate ten-fold dilutions of the samples were prepared in PW and plated by using the double layer technique on de Man-Rogosa and Sharpe Agar (MRS, pH 6.2±0.2, Oxoid-CM361). Then all plates were incubated at 30 °C for 3–5 days (Sharpe et al., 1966:66). For each colony type a number of colonies corresponding to the square root of the number of colonieswere randomly selected fromallmedia, leading to a total of 114 isolates. All isolates were checked for purity by streak plating on MRS Agar. For long term storage, isolates were kept at −20 °C in MRS (Oxoid) or M17 (Oxoid) broths containing 15% (v/v) glycerol.

The isolates showing Gram positive and catalase negative reaction were considered as LAB. These LAB isolates (114) were further characterized by phenotypic and genotypic methods.

Antimicrobial activity of the isolates

Antimicrobial activity of the isolates against test pathogens was determined by disc diffusion method (Wootton, 2013: 10). *Listeria monocytogenes* Scott A, *Staphylococcus aureus* 6538P, *Escherichia coli* ATCC 1103, *E. coli* O157: H7 ATCC 43895, *Salmonella* Typhimurium NRRLB 4420, *B. cereus* No 8 were used as test pathogens, which were obtained from Ege University, Engineering Faculty, Food Enginering Department, Food Microbiology Research Laboratory.

LAB isolates obtained from pickle samples were grown in de-Man, Rogosa and Sharp Broth (MRS, pH 6.2±0.2, Oxoid, Basingstoke, Hampshire, England) at 30°C for 24 h and test pathogens were grown in Tryptone Soya Broth (TSB, pH 7.3±0.2,Oxoid) at 37°C for 24 h. In the first step, fresh LAB cultures were distributed on MRS agar. Then test discs treated with test pathogens were placed on LAB inoculated MRS plates. After incubation period at 30°C for 48 h, zone measurement was applied. The experiment was performed in triplicate.

RESULT AND DISCUSSION

According to the results; 86 of 114 isolates showed antimicrobial activity with changing zone diameters, depending on the isolates and the test cultures used (Table 2).

Table 2. Results of antimicrobial activity

Code	*L. monocytogenes*	*S. aureus*	*E. coli*	*E. coli O157:H7*	*S.* Typhmurium	*B. cereus*	Code	*L. monocytogenes*	*S. aureus*	*E. coli*	*E. coli O157:H7*	*S.* Typhmurium	*B. cereus*
AL1	-	-	-	-	-	-	DL6	-	9	10	10	7	-
AL2	-	8	8	-	-	-	DL7	-	-	-	-	-	-
AL3	-	8	12	-	-	-	DL8	-	-	-	-	-	-
AL4	-	11	11	8	8	-	DL9	-	7	9	-	7	-
AL5	-	12	-	8	8	-	DL10	-	7	8	-	-	-

AL6	-	-	-	-	-	-	DL11	-	7	8	-	7	-
AL7	-	14	-	9	7	-	DL12	-	-	8	-	-	-
AL8	-	-	-	-	-	-	DL13	-	-	-	-	-	-
AL9	-	8	10	7	-	-	DL14	-	7	-	-	-	-
AL10	-	-	11	8	-	-	DL15	-	8	-	-	-	-
AL11	-	7	-	8	7	-	DL16	-	-	-	-	-	-
AL12	-	8	-	8	-	-	DL17	-	8	-	-	-	-
AL13	-	8	10	8	8	-	EL1	-	-	-	-	-	-
AL14	-	8	10	9	9	-	EL2	-	9	13	9	8	-
AL15	-	9	10	9	7	-	EL3	-	10	8	10	-	-
AL16	-	10	12	10	7	-	EL4	-	11	-	11	7	-
AL17	-	12	10	13	7	-	EL5	-	9	10	8	7	-
AL18	-	14	-	-	-	-	EL8	-	9	9	8	8	-
AL19	-	9	-	8	7	-	GL1	-	8	13	-	8	-
AL20	-	10	-	9	7	-	GL3	-	-	8	-	-	-
AL22	-	8	8	8	9	-	GL4	-	8	10	-	-	-
AL25	-	9	-	7	-	-	GL6	-	-	8	-	-	8
BL1	-	9	8	-	7	7	GL7	-	-	-	-	-	-
BL3	-	-	8	8	7	-	GL9	-	-	-	-	-	-
BL4	-	-	9	8	7	-	GL11	-	7	-	-	-	-
BL5	-	7	-	-	-	-	GL12	-	7	-	-	-	-
BL6	-	8	-	-	-	-	GL13	-	8	10	8	-	-
BL8	-	8	8	9	-	-	HL1	-	-	-	8	-	-
BL9B	-	-	-	-	-	-	HL2	-	-	-	-	-	-
BL9	-	8	-	-	7	-	HL3	-	-	-	7	-	-
BL10	-	10	8	8	7	-	HL4	-	8	10	8	-	-
BL11	-	8	8	8	7	-	HL6	-	-	7	-	-	-
BL12	-	-	8	8	-	-	HL7	-	-	7	-	-	-

BL13	-	10	8	8	8	-	HL8	-	9	10	8	8	-
BL14	-	-	-	-	-	-	HL9	-	9	10	8	8	-
BL16	-	8	-	-	-	-	HL10	-	8	10	8	-	-
BL17	-	9	8	9	-	-	HL11	-	9	8	7	-	-
CL1	-	-	8	-	-	-	HL12	-	8	10	-	-	-
CL2	-	9	7	8	-	-	HL13	-	-	-	-	-	-
CL5S	-	8	7	7	-	-	HL14	-	-	-	-	-	-
CL6	-	9	7	8	-	-	HL15	-	-	-	-	-	-
CL7	-	8	8	-	-	-	HL16	-	-	-	-	-	-
CL8	-	10	10	8	8	-	HL17	-	-	-	-	-	-
CL10	-	-	-	-	-	-	HL18	-	8	-	-	-	-
CL12	-	-	-	-	-	14	HL21	-	8	7	-	-	-
CL13	-	-	-	-	-	-	HL22	-	-	9	-	-	-
CL14	-	-	-	-	7	20	HL23	-	-	8	-	-	-
CL15	-	-	-	-	-	-	HL24	-	-	-	-	-	-
CL16	-	8	9	9	-	-	HL25	-	-	15	-	-	-
CL17	-	11	10	9	-	8	HL26	-	-	8	-	-	-
CL18	-	8	8	8	-	-	HL27	-	9	8	-	-	-
CL19	-	-	-	-	-	-	HL28	-	-	-	-	-	-
DL1	-	8	-	-	-	-	HL29	-	-	8	7	-	-
DL2	-	8	10	-	7	-	HL30	-	-	-	7	-	-
DL3	-	-	8	-	-	-	HL31	-	-	-	-	-	-
DL4	-	7	10	8	7	-	HL32	-	-	-	-	-	-
DL5	-	-	-	-	-	-	HL33	-	-	-	-	-	-

Zone diameters were ranged between 7 and 14 mm for *Stf. aureus*, 7 and 15 mm for *E. coli*, 7 and 13 mm for *E. coli* O157: H7, 7 and 9 mm for *S.* Typhimurium, 8 and 20 mmfor *B. cereus.* No isolates have shown antimicrobial activity against *L. monocytogenes*. Only four isolates (CL12, CL14, CL17 and GL6) were shown antimicrobial effects on *B. cereus*. Besides CL14 was the most effective isolate showing 20 mm diameter zone against *B.*

cereus. Antimicrobial effects of isolates were also week on S. Typhimurum and only 33 isolate showed zone in the range of 7 and 9 mm diameters. the highest number of isolates (65 isolate) were shown antimicrobial effect against *S. aureus*. 20 (AL4, AL13, AL14, AL15, AL16, AL17, AL22, BL1, BL10, BL11, BL13, CL8, CL17, DL4, DL6, EL2, EL5, EL8, HL8, HL9) isolate showed wide range antimicrobial effect by effecting four test cultures.

Çon and Karasu (2009: 191) isolated lactic acid bacteria from turmeric and fermented green olives. Antimicrobial effect of *L. plantarum* and *L. sake* was good against *L. monocytogenes*. However *Enterococcus faecium* showed medium antimicrobial effect against *E. coli*, weak effect against *Proteus vulgaris* and *Aeromonas hydrophila* and negative effect against *Yarrowia lipolytica*.

Mezaini et al. (2009: 3) show that in their study six isolates were active against one or more tested strains. *Streptococcus thermophilus* T2 strain showed a wide inhibitory spectrum against all the Gram positive target bacteria used in their study except *Staphylococcus aureus*.

Cizeikiene et al. (2013: 544) have reported the lactic acid bacteria strains were shown antimicrobial activities in ranging degrees. All five LAB strain's supernatants effectively inhibited the growth of test strains in various degree. *P. pentosaceus* KTU05-10 showed the highest antimicrobial activity against *Pseudomonas pseudoalcaligenes* and *Pseudomonas cepacia*. *Pediococcus acidilactici* KTU05-7 inhibited the *L. monocytogenes* and *B. cereus* growth. *P. acidilactici* KTU05-7 and *L. sakei* KTU05-6 showed antimicrobial activities against *E. coli* 1.10 whereas *E. coli* ATCC 25922 was inhibited by *P. acidilactici* KTU05-7, *L. sakei* KTU05-6 and *P. pentosaceus* KTU05-10.

Monika et al. (2017: 1947) observed a wide spectrum of antimicrobial activity for LAB isolates against *E. coli, S. aureus, B. cereus* and *Shigella dysenteriae* by agar well diffusion assay method. Most of the isolates inhibited the growth of *E. coli, S. aureus, B. cereus* and *S. dysenteriae*. *L. plantarum* (PKL-21) showed wide inhibitory spectrum against all Gram positive and Gram negative bacteria, which observed with ranging inhibition zones against *B. cereus* (16.36 mm), *E. coli* (13.1 mm), *Shigella dysenteriae* (12.86 mm), *S. aureus* (8.3 mm). However, *E. faecalis* (PKL-34) did not show antimicrobial activity against *S.*

dysenteriae while *L. plantarum* (PKL-20), *E. faecalis* (PKL-25) and *Enterococcus* sp. (PKL-28) did not show any activity against *S. aureus.*

CONCLUSION

The use of LAB as producers of antimicrobial substances is a promising advance for the food industry for improving the safety of food products, extending the shelf life and ensuring the health of consumers. The spectrum of antibacterial activity of LAB strains has the potential to cover a very broad field of application in the food industry. Therefore, further tests should be applied for selecting these isolates as probiotic bacteria.

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A Study on Determination of the Correlation Between the Variety of Vegetable and Fiber Quality Characteristics of Candia Cotton (G. Hirsutum L.) Variety Produced in Organic and Conventional Conditions

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ABSTRACT

This study was carried out according to Organic and Conventional methods by using Candia cotton varieties in Harran Plain conditions. As a result of the study, various correlations between plant height, sympodial branch, number of bolls, boll weight and bulk yield and fiber quality characteristics were determined. The negative and significant (r = -0.9165 *) between adaptability index (SCI) and humidity ratio negative and significant (r = -0.8727 *) between fiber fineness (mic) and curvature index (SCI), positive and significant (r = 0.9966 **), short fiber index between SF (r = 0.9966) and ripeness (mic) (r = -0.8264 *), positive and significant (r = 0.8254 *) between fiber strength and short fiber index (SFI), positive and significant between elasticity (Elg) and fiber strength. (r = 0.0864 *), positive and significant (r = 0.8750 *) between brightness (Rd) and curvature index (SCI), positive and significant (r = 0.9208 **), sympodial branch between sympodial branch and curvature index (SCI) negative and significant between fiber fineness (mic) and maturity (mat) (r = -0.9677 **, r = -0.9610 **), a negative correlation between Sympodial branch and plant height (r = -0.9773 **) was found.In addition, between the number of bolls and fiber fineness (mic) and maturity (mat) between the negative and significant (r = -0.9776 **, r = -0.9644 **), the number of bolls and sympodial branch between the positive and important (r = 0.9348 **) , positive and significant (r = 0.8668 *) between boll weight and curvature index (SCI) a correlation was found.

***Key words*:** *Organic, conventional, fiber, quality.*

ÖZET

Bu çalışma 2018 yılında Harran Ovası koşullarında Candia pamuk çeşidi kullanılarak Organik ve Konvansiyonel yöntemlere göre uygulanmıştır. Çalışma sonucunda bitki boyu, meyve dalı, koza sayısı, koza ağırlığı ve kütlü verimi ile lif kalite özellikleri arasında önemlilik derecelerine göre çeşitli korelasyonlar belirlenmiştir. Eğrilebilirlik indeksi(SCI) ile rutubet oranı(%) arasında olumsuz ve önemli (r=-0.9165*), lif inceliği(mic) ile

eğrilebilirlik indeksi(SCI) arasında olumsuz ve önemli (r=-0.8727*), olgunlaşma(Mat) ile lif inceliği(mic) arasında olumlu ve önemli (r=0.9966**), kısa lif indeksi(SFI) ile üniformite indeksi(UI) arasında olumsuz ve önemli (r=-0.8264*), lif mukavemeti ile kısa lif indeksi(SFI) arasında olumlu ve önemli (r=0.8254*), elastikiyet(Elg) ile lif mukavemeti arasında olumlu ve önemli (r=0.0864*), parlaklık(Rd) ile eğrilebilirlik indeksi(SCI) arasında olumlu ve önemli (r=0.8750*), meyve dalı ile eğrilebilirlik indeksi(SCI) arasında olumlu ve önemli (r=0.9208**), meyve dalı ile lif inceliği(mic) ve olgunluk(mat) arasında olumsuz ve önemli (r=-0.9677**, r=-0.9610**), meyve dalı ile bitki boyu arasında olumsuz ve önemli (r=-0.9773**) bir korelasyon bulunmuştur. Ayrıca koza sayısı ile lif inceliği(mic) ve olgunluk(mat) arasında olumsuz ve önemli (r=-0.9776**, r=-0.9644**), koza sayısı ile meyve dalı arasında olumlu ve önemli (r=0.9348**), koza ağırlığı ile eğrilebilirlik indeksi (SCI) arasında olumlu ve önemli (r=0.8668*) bir korelasyon bulunmuştur.

INTRODUCTION

Organic Agriculture is a form of agricultural production which is controlled and certified with the use of the inputs allowed in the regulations without the use of chemical synthetic inputs and drugs in production.

Basic Principles of Organic Agriculture can be sorted as: To produce a high quality sufficient amount of production by establishing a sustainable system in the whole production chain, To work in harmony with the natural cycles and living systems in the production system, To recognize the importance of past knowledge and traditional agricultural systems, To protect and to use this information to increase productivity and biological activity in the long term by using cultural, biological and mechanical methods such as rotation, proper soil treatment, green fertilization, animal fertilizer and compost. and to minimize all kinds of pollution that may affect animal health, and not to use synthetic chemical fertilizers, drugs, hormones and additives.

Studies on organic cotton cultivation have begun to attract attention as a result of environmental consciousness which started to develop in the world since the 70s. Agricultural pollution, which is one of the important factors that constitute the concept of environmental pollution, arises as a result of the application of the synthetic substances used in modern agricultural methods applied without considering the natural life balance. Organic Cotton is produced by completely natural methods according to conventional cotton and supports the conservation of nature and enables sustainable agriculture. Various chemicals used in agricultural areas, as well as the main uses of soil, plants, animals and indirectly constitute a significant threat to human life. As a result of environmental movements, these damages have been determined in such a way that they will not cause any illusions and the factors that cause agricultural pollution have been eliminated, and an agricultural method using completely natural methods has been defined and studies have been started to implement this method. This method, which has been successfully applied for thousands of years in the absence of chemical auxiliaries, is called as organic agriculture (Anonymous, 2019a).

Cotton plant has great economic importance as it creates value added and employment opportunities in textile sector in the world countries with its widespread usage area. The harvested cotton gin and fiber is an important raw material of the paper industry with its liner, oil and feed industry and the liner industry. The oil extracted from the seed obtained after ginning is used as a raw material in biodiesel production. Increasing the standard of living, increasing the income level and increasing the awareness of people's life cause the demand for cotton fiber and the final product textile. It constitutes approximately 90% of cotton cultivation areas in fiber crops grown in the world.

Upland cottons (*G.hirsutum* L.) offer the world's best fibers. There are various parameters in fiber quality. It is also important in the relationships between these parameters.

As a result of the production of cotton plants, the material that we call fiber and which is used extensively in the textile sector is obtained. In order to have a high level of effect of the obtained fiber material on textile quality, various quality criteria must be at the top level. Especially for high textile indexability, some of the parameters that we call fiber quality criteria should be at the highest level. Furthermore, it is a fact that there are positive or negative correlations between the fiber quality criteria and supporting each other. One of the basic parameters that determine the quality of the textile final product is that the correlations between the fiber quality criteria support each other in a positive and important way.

Cruz et al. (2004), in their study, although the phenotypic correlation coefficient is important, the relationship between the properties examined does not need to be a true cause-effect measure, the correlation coefficient between the two properties, the third feature and did not have a full effect on the group of features.

Desaleng et al. (2009), Ethiopia Werer Agricultural Research Institute, diallel hybridization obtained by cultivating 15 F1 cotton varieties in their study; reported that the heritability rate is high in the correlation of bulk and fiber quality characteristics. The authors were found to be positive and significant between the weight of the boll mass and the weight of the boll (r = 0.99 *), fiber yield (r = 0.88 **) and fiber index (r = 0.96 **). fiber breakage strength and fiber quality criteria; between the fiber breaking strength and the fiber length (r = 0.64 **); reported positive and significant correlations between fiber fineness and uniformity (r = 0.61 **). Also, between the fiber length and the fiber fineness (r = -0.86 **); reported negative and significant correlations between fiber length and short fiber index (r = -0.85 **) and between fiber length and uniformity (r = -0.99 **).

Bilalis et al. (2010), in Greece, Combo and Athena cotton varieties in their study; While there is no significant difference in terms of yield and fiber quality between the organic and conventional cultivation methods, Combo has the lowest fiber fineness, durability, length and brightness values, it has the highest elasticity and jaundice values. reported that there was no positive correlation between fiber length and fiber durability and negative correlation between fiber yield and fiber length.

Araujo et al. (2012), in the studies on the correlation between fiber yield and fiber technological properties of the cotton plant (relationship), the positive and important between fiber yield and boll weight; reported that there was a negative and significant correlation between fiber yield and fiber breaking strength, fiber uniformity index and fiber length values.

Salahuddin et al. (2010), American upland cotton (*Gossypium hirsutum* L.) in their study by sowing; sympodial branch, number of bolls per plant, boll weight and fiber index have found positive and significant correlations between properties.

Farıas, F. J. C. et al. (2016), in their study during the 2008 and 2009 period, 16 cotton varieties were taken to the trial, in the study, plant height, average boll weight and mass yield (kg ha^{-1}) as well as efficiency components were examined. Fiber fiber properties (mm), fiber uniformity index (UI), short fiber index (SFI,%), fiber strength (g tex^{-1}), fiber elasticity (EL,%), fiber fineness (mic), reflection, yellowing degree (+ b) and fiber maturity (mat,%) parameters are examined and reported that there are several correlations between the parameters examined. Positive and significant (r = 0.6261 *) between gin length (cm) and gin yield (%) and fiber maturity (Mat) with positive and significant (r = 0.7673 *), ginning yield (%) positive and significant (r = 0.4950 *) between the fiber fineness (mic) and the yield of the cotton (kg ha^{-1}) and the yield of the fiber (r = 0.9304 *), the yield of cotton (kg ha^{-1}) There is a positive correlation between (r = 0.5284*). Positive and significant (r = 0.5718*) between fiber yield and fiber maturity (r = 0.5718*), negative and significant (r = -0.5091*) between short fiber index (SFI) and elasticity (r = -0.5091*); important (r = -0.5461 *), positive and significant (r = 0.5947*) between fiber strength (FS), negative and significant (r = -0.6956 *) between reflection and fiber maturity (r = -0.6956 *), with reflection (Ref) reported a positive and significant (r = 0.4730*) correlation between the negative and significant (r = -0.8942 *) and reflection and fiber maturity (Mat) between yellowness (+ b). Fiber maturity (Mat) to a low degree, is effective on the yield of cotton fiber, fiber maturation (Mat) and cotton gin output (%) and the yield of a positive and indirect correlation between the cotton yield, and also between fiber maturity and fiber maturity reported a positive and significant correlation. There is a direct positive and significant correlation between plant height and cotton fiber yield (r = 0.7869 *), which means that large fiber genotypes are indirectly selected, affect productivity and industrial quality, but are non-directional between plant height and fiber yield. (r= -0.0708) reported a correlation. Mode and Robinson (1959) reported that the main reasons for the phenotypic correlation between features were pleiotropism (a gene can affect multiple properties at the same time, and the linkage imbalance is the non-random relationship between alleles of different loci).

MATERIALS AND METHODS:

This study was carried out in 2016 in the village of Sultantepe in the organic and conventional conditions of Harran Plain. CANDIA cotton cultivated in Harran plain was used as material. Work; Divided Parcels were established as 3 replications according to the experimental design. In the experiment, each parcel was established with a length of 12 m, 6 rows, 70 cm in row and 20 cm in rows. Sowing was carried out in 2018 with the pneumatic seeder on May 10 (normal sowing). The experiment was carried out under organic and conventional conditions. In the experiment, half of the nitrogen and all of the phosphorus were fed in pure form with 7 kg N and 7 kg of P_2O_5 from 20.20.0 compound fertilizer, and half of nitrogen with pure 10 kg before the first water. Various cultural measures were applied during the trial. Spraying against diseases and pests. Weighing against weeds was done with tractor anchor and hand hoe.

In 2018, the experiment was carried out in the field where organic production was carried out. In order to combat weeds and creme layer, 2 times tractor and 8 times hand hoe were applied. After sowing, the plants were diluted with 3-4 leaves and one week later they were squeezed. Since the test was carried out in accordance with organic agriculture legislation, no chemicals were used against weeds, and tractors or hand weaving were applied every ten days. During the growing period of cotton; aphids (*Aphis gossypii*), Trips (*Trips tabaci*), leaf flea (*Empoasca spp.*), red spider (Tetranychus spp.), white fly (Bemicia tabaci) and green worm (Heliothis armigera) pests, organic agriculture legislation used. For this purpose, a mixture of arab soap (3 kg / 100 lt water) and spirits (600 g / 100 lt water) was applied. In addition, Neemazal (*Azadirachta indica*) obtained from Neem tree according to its harmful density against aphid, triple, whitefly and red spider were sprayed in 300 cc / 100 lt water dose three times in the cool hours of the day to cover the whole plant surface. The drip irrigation system has been furnished since October and the land has been watered. In the experiment, the first irrigation was started 30 days after sowing and a total of 8 irrigation was done during the season. At the time the experiment was carried out, one-meter part of the head and end of the 2nd and 3rd rows of the 4-row plots were separated as edge effects and harvested on the remaining 14 m² area. The parcel yields were obtained by weighing the cottoned cottons and the parcel yield was converted to decare and the cotton yields were determined as kg ha^{-1}. The first hand was started in the period when approximately 60% of the bolls were opened. The first hand harvest was completed on 20.09.2018 and the second hand harvest was completed on 15.10.2018. Some physical and chemical properties of the soil investigated are given in table 1.

Soil Properties	**2018**
Habit of body	Clay
Clay, %	54.20
Plate-Tın, %	21.60
Sand, %	20.90
Reaction (pH)	7.72
Lime ($CaCO_3$), %	26.4
Total Salt, %	0.068

Organic Matter, %	1.44

Table 1. Some physical and chemical properties of test ground soil (Anonymous, 2018)

Monthly temperature (ºC), precipitation, average humidity and average temperature (ºC) values of long years are given in Table 2.

Table 2. Some Climate Data of the Regional Directorate of Meteorology, Şanlıurfa

	2018			**1929-2018**
Aylar	Monthly Average Temperature°C	Precipitation kg/m²	Average Relative Humidity%	Long Years Average °C
April	19.9	35.8	38.4	16.2
May	23.0	64.5	50.1	22.1
June	28.6	10.1	36.6	28.0
July	31.9	0.0	34.2	31.9
August	32.2	0.0	33.6	31.5
September	28.8	2.2	31.3	27.1
October	21.6	39.4	45.6	20.5
November	13.0	106.6	72.5	13.1

Anonymous, 2019b.

FINDINGS AND DISCUSSION

Table 3. Herbal Properties and Fiber Quality Properties Between Bilateral Correlation.

Pairwise Correlations

Variable	**by Variable**	ı	**Signif Prob**
1.MST(%)	15.SCI	-0,9165	0,0102*
2.MiC	15.SCI	-0,8727	0,0233*
3.Mat	2.MiC	0,9966	<,0001*

Variable	by Variable	ι	Signif Prob
4.UHML	1.MST(%)	-0,8563	0,0295*
5.SFI	16.UI	-0,8264	0,0426*
6.STR(gr/tex)	5.SFI	0,8254	0,0430*
6.STR(gr/tex)	7.Elg(%)	0,8391	0,0367*
8.Rd	15.SCI	0,8750	0,0225*
9.+b	15.SCI	-0,9070	0,0126*
9.+b	2.MiC	0,9402	0,0053*
9.+b	3.Mat	0,9509	0,0036*
9.+b	7.Elg(%)	-0,8219	0,0448*
9.+b	8.Rd	-0,8325	0,0397*
11. Sb	15.SCI	0,9208	0,0092*
11. Sb	2.MiC	-0,9677	0,0016*
11. Sb	3.Mat	-0,9610	0,0023*
11. Sb	4.UHML	0,8745	0,0226*
11. Sb	10.Ph	-0,9773	0,0008*
12. Nob	2.MiC	-0,9776	0,0007*
12. Nob	3.Mat	-0,9644	0,0019*
12. Nob	10.Ph	-0,8862	0,0187*
12. Nob	11.Sb	0,9348	0,0062*
13. Bw	15.SCI	0,8668	0,0254*
13. Bw	2.MiC	-0,8922	0,0168*
13. Bw	3.Mat	-0,8799	0,0208*
13. Bw	4.UHML	0,8661	0,0257*
13. Bw	8.Rd	0,8783	0,0213*
13. Bw	10. Ph	-0,9353	0,0061*

Variable	by Variable	ι	Signif Prob
13. Bw	11. Sb	0,9446	0,0045*
13. Bw	12. Nob	0,8941	0,0162*
14. Cy	15.SCI	0,8457	0,0339*
14. Cy	2.MiC	-0,8220	0,0447*
14. Cy	4.UHML	0,8811	0,0204*
14. Cy	8.Rd	0,9024	0,0138*
14. Cy	10. Ph	-0,9153	0,0105*
14. Cy	11. Sb	0,9036	0,0135*
14. Cy	12. Nob	0,8254	0,0431*
14. Cy	13. Bw	0,9891	0,0002*

1. Moisture (MST), 2. Micronaire (MIC), 3. Maturity (Mat), 4. Upper Half Mean Lenght (UHML), 5. Short Fiber Index (SFI), 6. Strength (STR), 7. Elongation (Elg), 8. Reflectance (Rd), 9. Yellowness (+b), 10. Plant height (Ph), 11. Sympodial branch (Sb), 12. Number of boll (Nob), 13. Boll weight (Bw), 14. Cotton yield (Cy).

According to Table 3, the paired correlations between plant characteristics and fiber quality characteristics were found as follows.

1. Negative and significant (r =-0.9165*) correlation between fiber moisture content (%) and Yarn curvature index (SCI) was found. An increase in fiber moisture reduces the fiber conversion rate. A positive and significant correlation was found between fiber fineness (mic) and yarn curvature index (SCI) (r =-0.8727*), maturation (Mat) and fiber fineness (mic) (r = 0.9966 **). This is undesirable and unexpected in terms of fiber quality. Under normal conditions, the fiber should have a thinner appearance as the fiber maturity increases.
2. Negative and significant (r =-0.8264*) between short fiber index (SFI) and uniformity index (UI), positive and significant between fiber strength and short fiber index (SFI) (r= 0.8254*), elasticity (Elg) positive and significant (r =0.8391*) correlations were found between the fiber strength. This situation is expected and desirable. Textile fiber quality and textile product quality is a desired development.

3. A positive and significant (r = 0.8750*) correlation was found between the Brightness (Rd) and the yarn curvature index (SCI). A negative and significant (r = -0.9070*) correlation was found between the yellowness (+b) value of the fibers and the yarn curvature index (SCI). As the yarn curvature index (SCI) increases, the yellowness (+b) of the fibers decreases. Textile fiber is desirable in terms of quality and efficiency.
4. A positive and significant correlation was found between jaundice (+b) and fiber fineness (mic) (r = 0.9402**). In this case, as the value of jaundice (+b) increases, the fibers become thicker. In other words, this is an expected situation. A positive and significant correlation was found between the jaundice (+b) value of the fibers and the fiber maturity (Mat) (r = 0.9509**). A negative and significant (r =-0.8219*) correlation was found between yellowness (+ b) value of fibers and elasticity (Elg). As the elasticity of the fibers increases, the rate of jaundice is expected to decrease. Textile is a desirable condition in terms of product quality. Again, a negative and significant (r =-0.8325*) correlation was found between jaundice (+b) and brightness (Rd). The decrease in the value of yellowness (+ b) as the fiber brightness increases is desirable in terms of textile quality and visibility of the woven fabric.
5. Positive and significant (r = 0.9208 **) between sympodial branch and yarn curvature index (SCI), negative and significant between sympodial branch and fiber fineness (mic) and maturity (r =-0.9610**), sympodial A negative and significant (r=-0.9773**) correlation was found between the branch and plant height. In addition, a positive and significant (r = 0.8745*) correlation was found between sympodial branch and fiber length (UHML).
6. Negative and significant (r =-0.9776**, r =-0.9644**) between boll count and fiber fineness (mat) and maturation, positive and significant between the number of bolls and sympodial branch (r = 0.9348** a correlation was found. Again, negative and significant (r = -0.8862*) correlation was found between the number of bolls and plant height. The increase of the sympodial branch in the physiological development of the plant naturally means the increase in the number of bolls. This is expected and means more cotton yield than the unit area.
7. Positive and significant (r = 0.8668*) between boll weight and yarn curvature index (SCI), negative and significant between fiber weight and fiber fineness (mic) and fiber maturity (mat) (r = -0.8922*, r =-0.8799*) a correlation was found. Positive and significant

between boll weight and plant height (r = -0.9353**), boll weight, fiber length, sympodial branch and number of bolls positive and significant (r =0.8661*, r =0.9446**, r =0.8941*) a correlation was found. Again, between boll weight and fiber brightness (Rd), positive and significant (r =0.8783 *), a negative and significant (r =-0.9353 **) correlation between plant height was found.

8. Positive and significant (r =0.8457*) between fiber cotton yield (kg ha^{-1}) and yarn curvature index (SCI), negative and significant (r =-0.8220*) between fiber fineness (mic), fiber length (UHML positive and significant (r = 0.8811*) and fiber luster (Rd) between positive and significant (r =0.9024*) correlations were found. Positive and significant between the yield of cotton (kg ha^{-1}) and plant height (r = -0.9153*) and the yield of cotton (kg ha^{-1}) and sympodial branch, boll number and boll weight (r = 0.9036*), r = 0.8254*, r = 0.9891**).

Our findings are partially or completely in accordance with the findings of Cruz et al. (2004), Desaleng et al. (2009), Bilalis et al. (2010), Araujo et al. (2012), Salahuddin et al. (2010), Farıas, F. J. C. et al. (2016), Mode and Robinson (1959).

RESULT

Various correlations were found between the plant and fiber quality characteristics examined in the cotton plant. Correlations between plant characteristics are related to direct seed cotton yield, while the correlations between fiber quality characteristics concern textile product quality. A negative correlation was found between fiber moisture and the yarn curvature index. When fiber moisture increases, the yarn spinning speed decreases. It causes the quality of the produced yarns to deteriorate. There was a negative and significant correlation between the short fiber index (SFI) and uniformity index (UI). As the short fiber index decreases, uniformity increases. This is a desirable improvement in terms of yarn and fabric quality. Positive and significant correlations were found between elasticity (Elg) and fiber strength. In terms of yarn and weaving quality, it is desirable to increase the elasticity and fiber strength in direct proportion. A positive and significant correlation between the number of bolls and sympodial branch is a desirable condition in terms of mass yield. Cotton plants in the wood branch and sympodial branches are the so-called. While wood branch plays a role in the vegetative development of the plant, the sympodial branch plays an important role in the formation of flowers and bolls of the plant. A positive and significant correlation between the yield of cotton (kg ha^{-1}) and sympodial branch, boll number and boll weight is expected. In addition to quality fiber production in cotton farming, one of the important issues is to obtain higher yield from unit area. The most important factor in the increase of mass yield is the number of bolls, boll weight and number of sympodial branches.

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Agriculture Systems And Sustainability Applied In Turkey

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ABSTRACT

In order to increase the production of nutrients in parallel with population growth, who deal with agriculture have taken various steps. The expansion of agricultural land came up on the agenda previously and with the agricultural tractors have begun to be used in agricultural activities, almost all agricultural lands have begun to be cultivated. However, the enlargement of agricultural areas has not been enough to meet the food necessities of the growing population, and consequently, the conventional agricultural system came up on the agenda as the yield from the unit area has been increased. In this system, early, high quality and high yield varieties were obtained and taken into production areas without paying attention to the risk of agricultural fields being fertilized with artificial fertilizers, excessive irrigation, pesticides use in combating against diseases and pests, and even the risk of disappearance of local varieties, resulted in biodiversity degradation. Human beings who do not consider nature's balance for increase the production, even used of Genetically Modified Organisms (GMOs) in agriculture. As a result, the soil gets tired and declined from day to day, the environment and ground waters are contaminated with artificial fertilizers and pesticides in agriculture, the most valuable upper part of agricultural soil where the most effective microorganisms live is eroded by erosion and agriculture becomes increasingly unsustainable. In this study were indicated alot of manucript and examined the conventional and sustainable agricultural systems and compared the advantages and disadvantages of these systems.

***Key words*:** *agricultural production systems, sustainability, organik agriculture, Conventional agriculture.*

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ÖZET

Tarımla uğraşanlar nüfus artışına paralel olarak besin maddeleri üretimini artırmak için, değişik yöntemler geliştirmektedirler. Önceleri tarım alanlarının genişletilmesi gündeme gelmiş ve traktörün de tarımsal faaliyetlerde kullanılmaya başlamasıyla birlikte, yeryüzünde tarıma elverişli olan arazilerin nerdeyse tamamı işlenmeye başlanmıştır. Ancak tarım alanlarının genişletilmesi, artan nüfusun gıda gereksinimini karşılamaya yeterli olmamış, bunula birlikte birim alandan sağlanan verimin de artırılması yani konvensiyonel tarım sistemi gündeme gelmiştir. Bu sistemde tarım alanlarının suni gübrelerle gübrelenmesi, aşırı sulama, hastalık ve zararlılarla mücadelede pestisit kullanımı, yerel çeşitlerin ortadan kaybolması riskine bile aldırış etmeden, erkenci, kaliteli ve yüksek verimli çeşitler ıslah edilerek üretim alanlarına alınmış, bunun sonucunda da biyoçeşitlilik azalmaya başlamıştır. Üretim artışı için doğanın dengesini göz önünde bulundurmayan insanoğlu, Genetiği Değiştirilmiş Organizmaların (GDO) tarımda kullanılmasını bile hayatiyete geçirmiştir. Bunun sonucunda da gün geçtikçe toprak yorulmakta ve verimden düşmekte, tarımda kullanılan suni gübre ve ilaçlarla çevre ve yeraltı suları kirlenmekte, topraklarımızın en verimli olan mikro organizmaların yaşadığı, tarım açısından en değerli üst kısmı erozyonla aşınmakta ve tarım gün geçtikçe sürdürülemez bir hal almaktadır. Bu araştırmada; konvensiyonel ve sürdürülebilir tarım sistemleri ele alınmış, çok sayıda ulusal ve uluslararası yayınlar incelenmiş ve karşılaştırılarak, bu sistemlerin avantaj ve dezavantajları irdelenmeye çalışılmıştır.

Introduction

The world population has increased the most over the last 200 years. Today, 2-3 people are added to the world population. This means approximately 150 per minute, 200,000 per day, 6 million per month. In 2050, the population increase is expected to increase by 70% to 100% (Anonymous, 2017). In order to meet the food needs of the increasing population, excessive fertilization, chemical fertilizers and pesticides are used. Chemical fertilizers and medicines, which are increasingly used in agriculture, make the soil inefficient and even destroy living things in rivers, lakes and seas. Increasing chemical use leads to cancer, infertility and developmental damage, hormonal disorder, and neurological problems in humans. These negativities tried to explain, while jeopardizing our health and the sustainability of agriculture, also negates the environment we live in. However, these lands and the environment we live in were not left to us as inherited from our ancestors, but were temporarily left to be passed on to future generations. For the survival of humanity, protection of the environment should be ensured that agriculture is sustainable for generations. The change in climate and ecology in the world, especially the increase of CO_2 gas released into the air and the greenhouse effect of such gases in the atmosphere cause natural disasters. It should be kept in mind that natural disasters are another factor that limits sustainability in agriculture, which limits production as well as other factors. On the other hand, Turkey is not a country rich in agricultural land. In fact, what we call deep soil, our areas with 90 cm and more soil layers are around 10-12%. For this reason, it is inevitable to plan the facilities that are suitable for agriculture in areas not suitable for agriculture, to plan the facilities such as residential area, industry and factory on lands which are not suitable for agriculture, to take measures against erosion, to avoid excessive irrigation, to make drainage systems absolutely, to sustain sustainable agriculture and organic agriculture systems.

In this study, the results of a series of national and international research results and publications about agricultural systems and the situation of conventional and sustainable agriculture in our country will be determined.

2. Materials and Methods

National and international research results and publications related to the study formed the material of the study, more than 50 publications were reviewed and summarized and our own experience was the method of the subject.

3. Findings and Discussion

3.1. Conventional (Traditional) Agriculture

The purpose of conventional agriculture is to maximize the yield from the unit area in production. For this purpose, genetically modified organisms are cultivated by applying synthetic chemicals and some other industrial inputs are not avoided. In the preservation of a traditional agricultural system, biodiversity, soil fertility and ecosystem are compromised (Huntley et al, 2013). In recent years, both the use of agricultural drugs and fertilizers has increased the agricultural production, but has led to the emergence of products that do not have food safety and threaten human health. On the other hand, with the increasing industrialization and environmental pollution, the naturalness and reliability of the foods coming to our table are decreasing. The chemicals applied to increase yield in conventional agriculture, change natural balance, reduce soil quality and biodiversity. In the production areas where chemical fertilizers are used, we need to continuously increase the use of chemicals in order to maintain the existing yield. This situation economically forces the producer on the one hand, and on the other hand, reduces the liveliness of the land a little more each year and makes the soil unproductive. Nevertheless, the production of genetically modified organisms and the use of chemicals in production are relatively attractive for farmers. High levels of nitrite, nitrate, lead and pesticide can be found in the fruit and vegetable samples taken by chance in our contry. Babies and children; are more affected than adults from food chemicals and pesticide residues. When we look at of babies diagnosed with allergy, it is seen that food taken by one-to-one babies does not cause allergy, but pesticides (insecticides, fungicides, herbicides, nematocytes and rodenticides) and nitrite and nitrate residues caused by chemical fertilizers given as nutrients during plant growing cause allergy. In terms of quality of life, especially in infants and children, the importance of nutrition with organic products is great. Day by day the environment and nature are polluted, health related problems are increasing and natural balance deteriorates. This raises the concern that we can not leave a healthy nature to future generations. Bununla birlikte, çevre ve doğa atalarımızdan bize miras kalmamıştır, ancak gelecek nesillere emanet edilmeye bırakılmıştır. In order to meet the food need of the increased population, sustainable agricultural systems should be expanded although organic production does not exist.

At least, we should ensure that the better agricultural systems which allow the agriculture, without decreased the biodiversity, by preserving nature, soil and water within the sustainable agriculture rules of conventional agriculture. If we will make a broad definition of sustainable agriculture; replacing the use of synthetic chemical drugs and fertilizers to reestablish the natural balance lost as a result of erroneous practices in the ecological system, organic and green fertilization, alternation, soil conservation, increasing the resistance of the plant, taking advantage of parasites and predators, increase in the quality of the product instead of increasing the quantity of production (Rehber and Turhan, 2001). However, it is desirable that conventional agriculture should be carried out within the framework of sustainable agriculture rules. In a better agricultural system; Protection of soil against erosion, preservation of field leveling, when irrigation of soil not to raise the ground water and drainage system is inevitable. When considering the market prices of the products, it is necessary to produce the products suitable for the region in a certain rotation, to use the water resources economically, to protect the gene centers, not to degenerate the biodiversity, and to spread the production of forage crops. Animal production should be included in the farms, and animal waste should be application as a fertilizer to the field, barns for animal production should in a suitable planning, standardization and packaging of the products, producer and consumers preferences should be taken into account, these are of the better agricultural systems components. Major elements of agricultural production in a country or region; soil, rains or irrigation water, climate and biodiversity. The effects of these elements on the sustainability of production will be discussed separately.

Soil:

Soil is the essential element of field agriculture. The non-objective use of land together with the increase in population maintains its place in the agenda. As a matter of fact, in recent years our land has decreased significantly as a result of other than the purpose use, This decrease is unfortunately expressed by million hectares. The Netherlands, one of the leading countries in agriculture, has been trying to create agricultural land by carrying soil from England with ships to improve the sandy soil and while Israel for creat agricultural soil is carrying soil with trucks to the rocky area, it is very thought-provoking that we waste our agricultural soil off-purpose. Another issue that threatens our lands is erosion. Water and wind erosion carries the micro organism and organic matter, rich upper part of our soil and makes it inefficient. Therefore, necessary measures against erosion should be taken urgently. Our land, which is 90 cm and more soil on the main rock, which we also call deep soil, is approximately 12% of the country's land. So 88% of our land is shallow soil. if thought that on the earth's for the formation of one cm of soil a time of 1000 years is needed the importance of the subject is better understood. In order not to deteriorate the physical structure of the soil in the production areas, rotation should be applied, and base stone formation should be prevented. Fields with organic fertilizers (barnyard manure, green manure and compost manure) should be fertilized and minimum soil processing should be applied. The use of chemical fertilizers mixed with organic fertilizers in Better Agricultural systems accelerates the decomposition of nutrients in the soil to the forum where plants can benefit and the cycle of plant nutrients. On the other hand, soil water retention capacity increase. In short, our lands should be used as required by the class in which they are located, and should not be destroyed by concrete. In the lands where agriculture is made, care should be taken to ensure that agriculture is sustainable. Care should be taken to ensure the sustainability of agriculture. There must be a drainage system in the fields, ground water should not be higher, the soil absolutely protection against erosion should be taken. As a result, it should never be forgotten that the soil is not need to us but that we need it.

Irrigation water:

Approximately 1/3 of the agricultural production areas in our country can watering economically. Only half of the areas that can be irrigated in our country had opened for irrigation. To increase productivity in agriculture, Irrigation of all areas that can be irrigated and it is inevitable to ensure the economic and effective use of water. As it is known, a large part of the water is consumed for agricultural purposes. In the coming years, a good water management planning is needed to meet the increasing water demand of the industry and services sector. Development of physical infrastructure for the effective use of water protection and improvement of water quality, elimination of factors that cause water contamination, development of water transmission and distribution systems, prevention of excessive water losses may come to mind. For this purpose, the wastewaters should be treated in a healthy manner and shold be use again in agricultural production, directing and collecting surface water in areas where water is scarce, encouraging manufacturers to use water-saving modern irrigation systems and spreading policies should be given importance (Çakmak ve Aküzüm, 2006).

Chemical fertilizers used in agriculture:

The chemical fertilizers used in agriculture are also highly toxic like pesticides to humans and the other creatures. As a result of improper fertilizer applications, these chemicals reach to lakes and seas with streams and rivers, which are mixed with rivers or streams with rain or irrigation waters. Some of them penetrate into the ground and mix with groundwater. This situation pollutes the lakes, dams, seas and groundwater and in this ambiance also adversely affects the life of living things. As a matter of fact, in recent years we have seen the fish population and sea creatures decreasing in our lakes and seas. In organic farming, organic fertilizers are used instead of chemical fertilizers, as a result of which richer biodiversity is created, soil structure is developed and soil water holding capacity increases. Organik bitki besin kaynakları ve iyi yönetilen organik sistemler yeraltı sularının kirlenmesini büyük ölçüde azaltır. In some countries and regions where pollution is a real problem (eg in France and Germany), as a preventive measure, conversion to organic agriculture is encouraged. It is thought that such incentives will be beneficial in our country

Climate:

Agriculture is a sector that both caused climate changes and effected from climate changes. In order to prevent climate change, the European Union should reduce the greenhouse gas emissions from agriculture and harmonize the food production system. Greenhouse gases, have been increasing at the atmosphere day by day and that increasingly causing greenhouse effect, and are the most heat-retaining compounds. The Earth's atmosphere is composed of various gases. Rays from the sun (heat rays / short wavy rays) is pass from through atmosphere and heat the earth. The gases in the atmosphere keep some of the heat on the earth and prevent the heat loss of the earth. The atmosphere has the ability to pass the light and keep the heat. The temperature of the water remains stable thanks to the ability of the atmosphere to retain heat. This prevents rivers and oceans from freezing. The effect of heating and insulation of the atmosphere, formed in this way is called Greenhouse effect is called Greenhouse effect (Anonim, 2015). Gases causing greenhouse effect in the world are 36-70% Water vapor, 9-26% Carbon dioxide, 4-9% Methane and 3-7% Ozone. While some of the greenhouse gases are self-formed, others are released into the atmosphere by humans. Naturally generated greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide and ozone. As a result of human activities has been increased gas levels and also as a result the greenhouse effect increased. Organic farming reduces greenhouse effect and global warming. The management practices used in organic farming (eg minimum soil tillage, organic fertilizer applications, use of stubble as organic fertilizer, plant rotation practices and nitrogen fixing plants in the system) accelerate the return of carbon to soil and increase productivity. Scientific research has shown that at organic farm lands organic carbon content in soil is high. As the amount of organic carbon in the soil increases, the effect of agriculture against climate change is decreasing.

Biodiversity:

Farmers engaged in organic production are biodiversity users at all levels. Traditional seeds are more resistant to diseases and are preferred because they are more resistant to adverse climate conditions and they are more efficient. Various combinations of plants and animals optimize the nutrient and energy cycle for agricultural production. The absence of chemical inputs in and around the organic areas in the ecosystem provides the protection of natural areas and creates suitable environments for wild life. The fact that species that are not involved in organic production often take place in crop rotation systems to increase soil fertility, reduces the erosion of agricultural biodiversity and helps create a more healthy gene pool in the future. The use not of pesticides in the organic system, the formation of environments that provide food and shelter in the natural life, attracts the organisms useful in wild flora and fauna to the region as permanent or nomadic. This situation increases the number of beneficial insects and pollinators in agriculture and puts natural struggle against pests. at the present despite the controversy on genetically modified plants, the cultivation areas of these plants are continue to expand every year. One of the concerns of today's people Genetically Modified Organisms that creat by genetic processes can because increased in health problems. On the other hand, it is important to inform to the people about the potential risks and advantages of GMOs developed with scientific information. Positive and negative opinions about genetically modified organisms have been put forward. The positive ones are; This technology that to open more production path, to increase nutritious value of nutrients, to eliminate the allergic properties of some foods, to addition easyly of nutrients against diseases and production costs by reducing, is to provide easy access. Negative views are that the nutrients produced by gene technology will increase the allergic reactions seen in the community, the resistant to antibiotics microorganisms will develop in a short time, and the genetically modified organisms will reduce the biodiversity in the world in time, increase the dependence on the foreign countries as a result must renewal of seed every year, and especially the small farmers will suffer from this. Due to the fact that, gene technology that is quite new and very fast development, proof of opinion is not possible at this time. Observations and research over time will shed a better light on this area. On the other hand, at present production lands land is not enough to meet food needs of the growing world population. For these reasons, the use of new technologies in plant breeding activities has come to the agenda. The concept of Genetically Modified Organisms (GMOs) emerges in order to meet the growing food need in the world and to solve the problem of hungery (Akgönül ve ark., 2013).

3.2. Comparison of Conventional and Sustainable Agriculture:

In the comparison of traditional and sustainable agriculture, various focal points will discussed, including production, biodiversity, soil composition, erosion, water use, energy use and greenhouse gas emissions. Although comparisons between these two systems are based on scientific data, much more research is needed to make a definite judgment. An enormous amount of resources are needed to meet the food needs of the current population. Traditional agriculture, which does not take into account the environmental damage associated with intensive production, is a feasible method to serve more people. Resulting of population growth and rising living standards the demand for herbal products from has been expected to double roughly in 2050 (Mueller et all,, 2012). Due to the rapid increase in the world population and thus the demand for food, the traditional agricultural system has been triggered and, as a result, the deterioration of the environmental pollution and ecosystem balance negatively affect the sustainability of agriculture. It is reported that the yield in organic systems is 25% lower than the yield in traditional production (Gabriel et al., 2013). Sustainable agriculture provides many environmental benefits, but production capacity is limited. Organic products are actually the best traditional plants. For example, in dry climate conditions, organic crops generally yield higher yields as they tend to consume less water (Pimentel et al., 2015). Traditional production, in general, has been modified to perform better than the sustainable production system under certain conditions (Carpenter 2011). The higher the biodiversity in the ecosystem, the stronger the immune system against diseases and pests. Organic farming is often associated with a significantly higher level of biological activity represented by bacteria, fungi, poultry, mites and worms, due to multi-faceted product rotations, reduced application of nutrients and the prohibition of pesticides (Gomiero et al., 2002). Because organic farms contain rich biodiversity, it creates a stronger soil ecology. The higher levels of total organic C, total N and soluble organic C in organic soils are indicative of better soil quality (Wang et al., 2012). However, erosion poses a threat to the development of agriculture. Because intensive agriculture, especially drought and adverse climate events, aggravate this phenomenon that threatens the sustainability of crop production on a global scale. Organic systems increase the composition in the soil and also prevent soil erosion due to the size of the plant material and biomass in the soil. Soil loss in traditional agriculture, up to three times of maximum tolerance value was recorded. The soils of sustainable systems due to the richness of the flora and fauna, it holds more water than traditional soil. Increasing water retention in soils in arid conditions causes sustainable agricultural systems to gain an advantage over conventional systems. It has been reported that the water holding capacity of the heavily structure and organically managed soils with a moderate climate in Switzerland is 20 to 40% higher than that of conventional agricultural land [12]. High amounts of energy are required for chemical fertilizers, disease and pest control and intensive soil treatment in conventional agricultural systems. According to calculations and estimates; we are spending 10 calories energy for every calorie of food (Anonim, 2013). Energy consumption can be reduced by applying sustainable agricultural systems in crop production.

4. Results and Discussion:

Although there are many agricultural application disciplines in production, they can be basically generalized in a sustainable or conventional. Organic farming systems that chemical fertilizers and drugs are not used, enriches soil composition and increases biodiversity. However, 20-50% decrease in yield is not to be ignored. The absence of chemical inputs in and around organic areas provides protection for natural areas and creates suitable environments for natural life. The absence of pesticides in the organic system causes the formation of ambiences that provide food and shelter in natural life. This situation attracts the organisms useful in wild flora and fauna as permanent or nomadic. Even though the retention time and the retention time in the are long, immature fruits and vegetables contain low vitamins and nutrients. However, organic products are more rich in natural nutrient content. On the other hand, all of the production stages from raw material to production in organic agriculture are under control and certified and can be monitored. In contrast, traditional seeds; genetic structure is more resistant to diseases and more resistant to adverse climatic conditions and they are preferred because they are more efficient. Genetically modified seeds have been developed to maximize yield and use chemical drugs and fertilizers to the maximum. This method requires a high amount of chemical and energy and weakens the ecology of the area in which it is grown. In the sustainable agriculture system, nature and the environment are considered and the drugs and fertilizers are used in production. In this system, agriculture can be sustained without reducing the yield in terms of possibilities Understanding the potential of sustainable and organic farming to develop agricultural systems that will meet the food needs of the increasing population will be of fundamental importance. The solution is to look at the world ecologically not economically.

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Effect of Vermicompost, Mycorrhiza and NPK Fertilizer on Growth and Yield in Piment Mme Jeannette Pepper

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ABSTRACT

This study was designed to observe the effects of vermicompost, mycorrhiza and traditional inorganic fertilizer on growth, yield and quality of *Capsicum chinensis* L. var (Piment Madame Jeannette). The greenhouse experiment was conducted at Agricultural Faculty, Selcuk University, Konya-Turkey. Performance of plant was assessed by application of different organic and inorganic fertilizers. The treatments were fitted in a Completely Randomized Design layout. Data collected for growth, yield and quality performances included plant height, number of fruits per plant, plant weight, weight of fruit per plant, fruit height, diameter of fruit, and weight of root. Based on the results obtained from this experiment, application of vermicompost (7.5%) +1/2 inorganic fertilizer shows highest growth and yield performance. Control treatment showed the lowest growth parameters. The average plant height changed between 21.90-36.90 cm; fresh plant weight changed between 16.76-52.60 g/pot. Application of vermicompost had a positive and statistically significant effect on growing of pepper ($P<0.01$) but mycorrhiza didn't change growing parameters.

Key words: *Pepper, vermicompost, mycorrhiza, biological properties.*

ÖZET

Bu çalışma; vermikompost, mikoriza ve geleneksel inorganik gübre uygulamalarının Meksika biberi (*Capsicum chinensis* L.) (Piment Madame Jeannette) çeşidinin büyüme, verim ve kalitesine etkilerini gözlemlemek için yapılmıştır. Sera denemesi Konya Selçuk Üniversitesi Ziraat Fakültesi' nde yapılmıştır. Farklı organik ve inorganik gübrelerin uygulanmasının bitkinin tepkisine etkisi değerlendirilen çalışmada; tamamen rastgele deneme deseni kullanılmıştır. Büyüme, verim ve kalite tepkisi için toplanan veriler; bitki boyu, bitki başına meyve sayısı, bitki ağırlığı, bitki başına meyve ağırlığı, meyve boyu, meyve çapı ve kök ağırlığıdır. Bu çalışmadan elde edilen sonuçlara göre; vermikompost (% 7.5) +1/2 inorganik gübre uygulaması ile en yüksek büyüme ve verim elde edilmiştir. Kontrol muamelesinde ise en düşük büyüme parametreleri görülmüştür. Ortalama bitki boyu

21.90-36.90 cm, taze bitki ağırlığı 16.76-52.60 g / saksı arasında değişmiştir. Vermikompost uygulamasının biber gelişimi üzerinde pozitif ve istatistiksel olarak anlamlı bir etkisi olmuştur (P <0.01); ancak mikoriza aşılamasını büyüme parametrelerini değiştirmediği gözlenmiştir.

INTRODUCTION

The origin of hot pepper is South America, but cultivated mostly in Asian countries such as Cambodia, Philippines, India, Laos, Malaysia, Myanmar, Thailand and many other countries. Pepper, specially red pepper, is rich in vitamin C and vitamin A. Pepper with its high content of vitamin C significantly increases iron uptake compared to foods in a meal such as other beans and cereals (Khandaker et al.,2017:5). Pepper with a good antioxidant has a lowering effect on cholesterol and triglyceride levels. Nutritional value of pepper is very high. There is the content of % 88 water, 40 kcal energy, 2.22 g protein, 8.9 g carbohydrate, 1.56 g total fiber, 17.7 mg Ca, 1.11 mg Fe, 340 mg K, 6.7 mg Na 0.08 mg thiamine, 0.08 mg riboflavin, 0.9 mg niacin, 240 mg ascorbic acid in 100 g pepper (Gebhardt and Thomas,2002:4).

Pepper types commonly grown in our country; pointed peppers for table, green pepper, pepper for stuffed, kapya (oil chili) pepper, local chilies for drying, pickle peppers and ornamental peppers. In our country, the planting area is 815.632 and the total production is 2.457.822 tons according to 2018 data (TÜİK, 2018: 9). Continuously the use of fertilizers during the production at greenhouse condition causes a deterioration of the physical properties of the soil and the emergence of adverse conditions such as salinity and soil fatigue. The use of organic fertilizers is an important solution for preventing these problems and for increasing the organic matter in the soil. In our country, the level of organic matter in greenhouse soils is generally insufficient (Sönmez et al., 1999: 8, Özkan et al.,2008: 7). Use of vermicompost and mycorrhizal inoculation as separately and together, the wet and dry weight of the plant and the nutrient content of the pepper were affected positively; with the highest dose of vermicompost was better developed the pepper plant and the nutrient element content was higher other application (Küçükyumuk et al.,2014:6).

In a study made on pepper plant inoculated by different types of mycorrhizae (*Glomus caledonium and Glomus clarum*); It was determined that the addition of mycorrhiza to the environment positively affects the plant development and yield, and the yield increased by approximately 16-29% compared to the control (Altuntaş et al.,2015: 1). In our study; In order to determine the effectiveness of vermicompost application and mycorrhizal inoculation for reducing inorganic fertilizer use, development of Mexican pepper and nutrient intake were investigated.

MATERIALS AND METHODS

The experiment was arranged according to the random plot trial pattern in the greenhouse environment. The soil used in the pot experiment was taken from 0-30 cm depth from the land of Sarıcalar Application and Research Farm of Agricultural Faculty of Selcuk University. The soil, which was air dried, was passed through 4 mm sieve, weighed and filled in pots (2.4 kg dry soil / pot). The experiment was carried out with 5 replications and was conducted in 30 pots with vermicompost, mycorrhiza and traditional fertilizer applications. The trial plan is:

Control Group - 7.5% Vermicompost (V) - Vermicompost + ½ Fertilizer - Mycorrhiza (*Glomus mosseae* 500 pcs / pot) (M +) - Mycorrhiza + ½ Fertilizer as Traditional Fertilizer doses (NPK (60 mg / kg N, 50 mg / kg P_2O_5, 60 mg / kg K_2O, ie (15.12.15) kg / da))

In traditional fertilizer applications; as the sources of nitrogen, phosphorus and potassium were used urea, TSP and KNO_3, respectively. The vermicompost obtained from a private company was mixed with 0% (control) and7.5% to pot soil.

Some properties of the soil and vermicompost used in the experiment are presented in Tables 1 and 2. Mycorrhiza (*Glomus mosseae* 500 pieces / pot) was applied to the root area during the growth of the seedlings. The seeds of pepper were planted in vials on May 15, 2018 and the plants coming into the form of seedlings were released on July 30, 2018. The water requirement of the plants was met by taking into account the soil moisture condition and the need of the plant. Plants were harvested on 18 January 2019 at the end of the vegetation period after about 172 days.

Soil Properties	Value	Comment	Soil Properties	Value	Comment
pH (1/2,5)	8.16	Slightly alkaline	P (mg kg^{-1})	16.02	enough
EC (mS/cm)	443	Light salty	K (mg kg^{-1})	767	much
Org. Matter (%)	2.45	good	Mg (mg kg^{-1})	325	medium
$CaCO_3$ (%)	12.75	middle	Zn (mg kg^{-1})	0.52	little
Field Capacity (%)	27.01		Fe (mg kg^{-1})	4.56	much
Sand (%)	14	-	Cu (mg kg^{-1})	1.64	much
Silt (%)	52.50	-	Mn (mg kg^{-1})	27.21	enough
Clay(%)	33.50	-	Na(meq $100g^{-1}$)	118	-
Texture Class	Silty clay loam				

Table 1. Some Physical and Chemical Analysis Results of Experimental Soil

Mexican pepper (Mme Jeannette) used as a test plant was obtained from a commercial company. Plant height, plant weight, fruit weight, fruit number, fruit size, fruit diameter, root weight values were determined in the harvest period.

Observation the plant growth and harvesting:

Plant height (cm): Each plant was measured from the soil surface to top of the plant.

Plant, Fruit and root weight (g): All plants harvested, cleaned and cut from the roots were weighted. The average values were found by taking the arithmetic mean.

Fruit number, Fruit size, Fruit diameter: The maturing fruits were collected regularly. Counting was done in harvested fruits and then height measurements and fruit diameters were determined. At the end of the experiment, the arithmetic averages of all measurements were calculated.

In the harvested peppers, after the preliminary analysis preparation, were burned with H_2SO_4 and H_2O_2 (Bayraklı, 1986:2); N, P and K contents were determined. The results were compared with the help of Variance Analysis and Tukey tests by using MINITAB 16 package program.

Statistical analysis: The data obtained through the measurements were statistically analyzed using Minitab and Mstat-C software.

Content	**Vermicompost**
Total Organic Matter (%)	46.32
Total Humic Fulvic Acid (%)	33.10
Ca (mg/kg)	25.09
Mg (mg/kg)	6.56
P	7.26
Total N (%)	2.00
C/N	14.14
Moisture (%)	21.60
pH	7.80

Table 2. Some Properties of Vermicompost Used in the Trial

RESULTS AND DISCUSSION

In the study made to determine the effect of vermicompost and mycorrhizal application on the reduction of the use of inorganic fertilizers; the changes in the development parameters of Mexican pepper grown in pots are presented in Table 3.As can be seen from the table, significant differences were observed between the applications in all growth parameters and between the applications and control ($P < 0.01$).

Plant height, plant weight, fruit weight, number of fruits and root weight values showed a significant increase compared to the control and other applications ($P < 0.01$) with the application of 7.5% V + 1/2 NPK. At vermicompost + 1/2 NPK application, plant height increased by 15 cm compared to control and plant weight increased by 3 times. These values were statistically significant ($P < 0.01$). 7.5% V application was the second in these parameters. There was no difference between mycorrhizal inoculation, mycorrhiza +1/2

NPK and only NPK applications. Fruit size and fruit diameter are higher in control and mycorrhiza + 1/2 NPK applications compared to others (Table 3).

It was made a study to determine the effect of gidya and chemical fertilizer applications on pepper (*Capsicum annuum* L.) plant. The effect of applications was found statistically significant at shoot weight, shoot dry weight, shoot length, number of leaves, root dry weight, root age weight, root collar diameter, and nitrogen of the leaves, phosphorus of the leaves, magnesium of the leaves, iron of the leaves($p < 0.01$), calcium and manganese ($P < 0.05$) content of the leaves. It was determined that the applications did not cause a significant change in root length and at the potassium, zinc, copper content of leaf (Yılmaz et al., 2014:10). At red pepper grown in Kahramanmaraş in 2001 and 2002, suitable fertilizer doses for wet pepper yield was 4 kg of P_2O_5 / da (applied to soil) + approx. 5 kg of P_2O_5 / da (soil determined) phosphorus and 10 kg of N / da. Considering the mean values for two-year dry pepper yield (%), it was determined that the available phosphorus for the plant, is present about 5 kg P_2O_5 / da in the soil and with 10 kg N / da application, was sufficient for dry pepper yield (Demirkıran, ,2003: 3).

Applications	**Plant length (cm)**	**Plant weight (g/pot)**	**Fruit weight (g/pot)**	**Fruit number (number/pot)**	**Fruit lenght (cm)**	**Fruit diameter (mm)**	**Root weight (g/pot)**
Control	21.90 C	16.76 D	4.84 A	4.2 B	21.85 A	15.91 A	2.23 BC
% 7.5 V	29.90 B	32.14 B	6.01 AB	3.2 B	17.92 BC	11.70 C	3.12 AB
1/2NPK+V	36.90 A	52.60 A	6.37 A	8.6 A	17.26 BC	12.08 BC	2.58 ABC
M+	23.70 C	17.80 CD	2.89 C	3.4 B	14.80 C	13.92 AB	2.10 C
1/2 NPK+M+	25.60 BC	17.73 CD	4.59 ABC	3.8 B	22.44 A	15.72 A	2.64 ABC
NPK	26.40 BC	22.02 C	3.90 BC	4.2 B	18.56 B	15.00 A	3.25 A
LSD Value *P<0.05, **P<0.01	**	**	**	**	**	**	**

Table 3. Effect of Different Organic and Chemical Fertilizer Application on Some Biological Parameters of Pepper (* n = 5)

Applications	N (%)	P (mg/kg)	K (%)
Control	2.01 B	5264 B	1.85 C
% 7.5 V	2.14 AB	4165 C	2.14 BC
1/2NPK+V	2.22 AB	4146 C	2.39 AB
M+	2.25 AB	5820 B	2.29 AB
1/2 NPK+M+	2.18 AB	5565 B	2.29 AB
NPK	2.31 A	7540 A	2.59 A
LSD Value *P<0.05, **P<0.01	*	**	**

Table 4. Effect of Different Organic and Chemical Fertilizer Applications on Pepper N, P and K Content (* n = 5)

When the effect of vermicompost, mycorrhizal and NPK applications on plant N, P and K content were examined; significant differences were observed between the applications and between the applications and control (P <0.01) (Table 4).

The higher values at Nitrogen and potassium content of pepper were observed at only NPK application and 7.5% V + 1/2 NPK applications compared to control. Compared to other applications in the application of NPK, phosphorus content is higher. In the case of half-dose or full-dose use of inorganic fertilizer, fruit nutrient content is higher than in other applications. In this case, it is understood that even if plant growth is promoted by vermicompost, the plant cannot meet the need for nutrients alone.

As a result; pepper plant during the cultivation if it is economically available 7.5% vermicompost application of the pepper has a positive effect on stem and root development; only NPK with fertilizer application instead of the vermicompost with ½ percent traditional NPK application can be recommended.

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Determination of Producer Satisfaction: The Case of Maras Pepper

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ABSTRACT

The objective of this study is to determine the factors that are effective in the producer's production satisfaction in Maras pepper in Gaziantep, Kahramanmaras, and Kilis provinces. The main material of the study is the data obtained from surveys conducted with 156 producers in 2017. Descriptive statistics and ordered probit model were used to analyze the data. According to the research results, while 28,20% of the producers are satisfied and 48,72% of the producers are less satisfied with the production of Maras pepper, 23,08% of the producers are not satisfied with the production of Maras pepper. According to the results of the ordered probit model, in the province of Kahramanmaraş, producers who are 41 years old or are older than 41 years old, producers who have less than 9 years of education level, producers who have 20 years of agricultural production experience or have less than 20 years of agricultural production experience, producers who have less number of individuals working in the family and producers who don't have marketing problems and producers who have land 5 hectares or have land under 5 hectares are more likely to be satisfied with the production of Maras pepper. A large part of the production of red spice pepper is provided from the research area. Producers' interest in the production of Maraş pepper should be increased by providing incentives and agricultural supports.

Keywords: *Maraş pepper, production satisfaction, ordered probit model*

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INTRODUCTION

Being an independent country in agricultural production and increasing the share of agriculture in exports is only possible with the sustainability of agricultural production. In this context, preventing rural migration will contribute to sustainability.

Factors such as lack of livelihood, lack of land and equipment, difficulties in agricultural labour supply, and inefficiency of land are shown as driving economic factors in rural migration, while low living standards, lack of social life, and inadequate education of children are shown as driving social factors in rural migration. Besides, factors such as better living conditions, desire to work more comfortably, desire to earn more income, employment, benefit from urban life, and provide high education to their children can be among the attractive factors of migration (Aytop et al., 2017).

In addition to rural migration, producers have to be satisfied with their production to continue agricultural production. Factors affecting producer satisfaction can be considered as economic, social, environmental, physical and political factors.

When the literature on this subject is examined, it is seen that domestic and foreign studies on the production of pepper are mostly aimed at determining the production structure, marketing opportunities (Paksoy, 2003; Akbay et al., 2005a; Akbay et al., 2005b; Paksoy and Uslu, 2006; Schipman and Qaim, 2011; Akbay et al., 2012; Srikola et al., 2016) and problems encountered in production (Andaya, 1995; Vos and Duriat, 1995; Duman et al., 2002, Saenz-sequma et al., 2009).

It is determined that there is not any study on the satisfaction of pepper producers from production. Although many studies have been conducted on consumer satisfaction, the number of studies on production satisfaction is limited.

The income of pepper production must be satisfactory for the sustainability of agricultural production. In this study, it is aimed to determine the effect of socio-economic factors on the production satisfaction of the pepper producers.

MATERIALS AND METHODS

The main material of this study is the data obtained from the face-to-face surveys with farmers producing Maraş pepper production. Surveys were conducted in three provinces in order for this research represent to Turkey.

The districts where cultivation of Maraş pepper was the largest and the districts where the production of Maraş pepper was highest were selected in terms of representing the provinces.

Proportional sample volume was used to determine the sample size of the farmers to be interviewed (Newbold, 1995).

The number of farmers producing Maraş pepper in the provinces included in the study is 2529 (Anonim, 2016). Accordingly, the sample size for the 99% confidence interval and 10% error margin was calculated as 156.

$$n = \frac{Np(1-p)}{(N-1)\sigma^2_{\hat{p}_x} + p(1-p)}$$

$\sigma^2_{p_x}$: Variance

n : Sample volume

N : Population

p : The ratio of spicy red pepper producers (p = 0.5 were chosen for maximum sample volume)

Descriptive statistics and ordered probit model were used in data analysis.

In the study, producers involved in research chose one of the 3 alternatives for production satisfaction. The dependent variable is y = 0,1,2. The relationship between the dependent variable (y) and the dependent variable y * which cannot be observed is given below.

y=0 if $y^* \leq 0$

y=1 if $0 < y^* \leq \mu_1$

y=2 if $\mu_1 < y^* \leq \mu_2$

The sequential categories in the dependent variable used in the model are as follows;

y=0 not satisfied

y=1 less satisfied

y=2 very satisfied

In the Ordered Probit model, the probability of the different alternatives selected by the producers is shown in the following equations.

$P(y=0) = \Phi(-\beta' x)$

$P(y=1) = \Phi(\mu_1 - \beta' x) - (-\beta' x)$

$P(y=2) = \Phi(\mu_2 - \beta' x) - (\mu_1 - \beta' x)$

Φ in equation 6 is the cumulative probability function which is normally distributed. The probability to be positive should be 0 <μ1 <Ol2 <. Model is solved with the maximum likelihood method. The marginal effects of the variables in the function were also calculated (Yayar, 2016).

For cases when the variable is 0 and 1, the marginal effect of the shadow variable is calculated separately then the difference of these variables is considered. The sum of the marginal effects of an explanatory variable in different probabilities is equal to zero (Mutlu, 2007; Greene, 1997).

When the coefficient and sign of an explanatory variable is positive, It shows that there is an increase in the possibility of the consumer to choose an alternative while there is a decrease in the possibility of the consumer not to choose (Chen et al., 2002; Akbay et al., 2007; Gündüz and Emir, 2010).

FINDINGS OF RESEARCH

All of the farmers participated in the survey were male. 32.05 % of farmers were 40 years of age and below, whereas 43.59 % of farmers were between 41-55 years of age. Moreover, the average age of farmers was 46.72 years. When the education years taken by the producers are examined, it is determined that 63.46% of producers were taken 5 years and less than 5 years of education and 22.44% of producers were taken between 6-8 years of education. The average education years taken by the producers is 6.35 years. In addition, 50% of the producers have agricultural production experience between 21-40 years and the average of agricultural production experience is 28.19 years.

When the monthly household income of the producers is examined, it is determined that the monthly household income is an average of 2137.83 TL, the income of the producers (48.08%) is between 1500-2500 TL, and the percentage of farmers who earn 2500 TL and more than 2500 TL is 19.23%.

When it comes to information about the producer surveyed, it was determined that the percentage of producers living in households with 1 - 5 people is 44/87%, the percentage of producers living in households with 6 - 7 people is 37/18%. In addition to this, the average number of people living in a household is 5.97 people, while the average number of people working in agriculture in a household is 2.62 people.

The sequential logistic regression model was used to determine the variables that affect Maras pepper production satisfaction. In the model, the dependent variable was coded as the producers who are not satisfied '0', the producers who are the less satisfied '1' and the producers who are very satisfied '2'. Some of the independent variables used in the model were transformed into dummy variables, while others were included in the model as a continuous variable and Likert scale. Table 1 provides explanations, averages and standard deviations of all variables.

Dependent Variable	**Description**	**Mean**	**Std. Dev.**
Production Satisfaction	Not satisfied: 0 (%23.08) Less satisfied: 1 (%48.72) Very satisfied: 2 (%28.20)		0.717
D_ province_1*	Dummy variable for province variable (Gaziantep: 1; others: 0)		0.483
D_ province_2	Dummy variable for province variable (Kahramanmaras: 1; others: 0)		0.374
D_ province_3	Dummy variable for province variable (Kilis:1; others: 0)		0.501
SS	Producers who sell their products as wet: 1 Producers who sell their products as dry: 0		0.451
ATÇS	Number of people working in agriculture in the family Continuous variable		1.667
Yield	Maras Pepper yield (wet) Continuous variable		350.690
Dage1*	Dummy variable for age variable ((40 years: 1; others: 0)		0.468
Dage2	Dummy variable for age variable (41-55 years:1; others: 0)		0.497
Dage3	Dummy variable for age variable (≤56 yearsl:1; others:0)		0.431
Deducation1*	Dummy variable for education variable (≤ 5 years:1 others: 0)		0.483

Deducation2	Dummy variable for education variable (6-8 years:1; others:0)		0.419
Deducation3	Dummy variable for education variable (≤ 9 years:1; others:0)		0.349
Dae_1*	Dummy variable for agricultural experience variable (≤ 20 years: 1; others: 0)		0.483
Dae _2	Dummy variable for agricultural experience variable (21-40 years: 1; others: 0)		0.502
Dae _3	Dummy variable for agricultural experience variable (≥41 years: 1; others: 0)		0.342
Dland	Dummy variable for land variable (≥ 50 da: 1; ≤ 51 da: 0)		0.479
I don't have any problem in marketing	5-point Likert		0.887

* It is not included in the model as a reference.

Table 1. Dependent and independent variables included in the sequential logistic regression model

The model in Table 2 was found to be statistically significant ($\chi 2=71.614$, $p<0.01$). The -2 Log-likelihood value of the model was found to be 127.324, while the McFadden Pseudo R2 value was found to be 0.219. 10 out of 13 variable of the model were found to be statistically significant. These variables are D_province_2, ATCS, Yield, Dage2, Dage3, Deducation3, Dae _2, Dae _3, Dland and Marketing

	Coefficient	**Standard error**	**t value**	**P value**
Constant *	-2.765	0.8501	-3.25	0.001
D_province_2*	1.2101	0.3460	3.50	0.000
D_province_3	0.3005	0.2627	1.14	0.253
SS	-0.3836	0.3138	-1.22	0.222
ATÇS***	-0.1127	0.0638	-1.77	0.077
Yield*	0.0014	0.0004	3.67	0.000
Dage2**	0.6349	0.3122	2.03	0.042

Dage3***	0.6709	0.3941	1.70	0.089
Deducation2	-0.0605	0.2583	-0.23	0.814
Deducation3***	-0.5932	0.3146	-1.89	0.059
Dae _2**	-0.6594	0.2997	-2.20	0.028
Daw _3***	-0.8980	0.4645	-1.93	0.053
Dland***	-0.4138	0.2237	-1.85	0.064
I don't have any problem in marketing ***	0.4797	0.1260	3.81	0.000
Mu (01)*	1.7749	0.1752	10.13	0.000

*p<0.01, **p<0.05, ***p<0.10 is statistically significant.

Table 2. Sequential probit model result

The marginal effects of factors affecting production satisfaction are given in Table 5.54. According to the model results, non-statistically significant variables are D_province_3 (Kilis province), SS (Sales form), Deducation2 (between 6-9 years); It was determined that the other variables, except for the variable D_province_3, had a negative coefficient. Considering the marginal effects of statistically significant variables; producers who are in Kahramanmaras province are more satisfied with the production of Maraş pepper (42.9%) than producers who are in Gaziantep province, while the probability of not being satisfied is less (18.8%). This result is supported by research findings. Producers in the province of Kahramanmaraş have more income from the production of 1kg Maraş pepper compared to other provinces.

An increase in the number of people working in agriculture in the household will decrease the probability of being very satisfied with production by 3.4% and increase the probability of not being satisfied with production by 2.7%. This may be the result of producers' unwillingness to employ their children in the agricultural sector. One kilogram increase in the production amount of Maraş pepper in a decare increases the probability of being very satisfied with production by 0.04%; it reduces the likelihood of not being satisfied and the likelihood of not being less satisfied by 0.03%.

The relationship between age and satisfaction was found to be positive and statistically significant. If the age of the producers who are between the ages of 41-55 increases by one year, the probability of being very satisfied with the production increases by 19.3%, while the probability of not being satisfied with production decreases by 14.7%.

When there is one year increase in the age of the producers who are 56 years and above increases the probability of being very satisfied with the production of Maraş Biberi by 22.1%, it reduces the probability of not being satisfied with the production by 13.5% and it decreases the probability of being less satisfied by 8.70%.3.

When there is one year increase in education of farmer who took nine years or more education, the probability of being very satisfied with the production decreases by 14.6% and it increases the probability of not being satisfied with production by 17.2%. This result coincides with the fact that educated people do not want to work in the agricultural sector.

There is a negative and statistically significant relationship between agricultural production experience and satisfaction. As the agricultural experience of the producers increases, producers are less likely to be satisfied with the production. A one-year increase in the experiences of producers having agricultural production experience of 21-40 years reduces the probability of being very satisfied with the production of Maras pepper by 19.5% and it increases the probability of not being satisfied with production of Maras pepper by 15.8%. Moreover, a one-year increase in the experiences of producers having agricultural production experience of 41years and more reduces the probability of being very satisfied with the production of Maras pepper by 19.8% and it increases the probability of not being satisfied with the production of Maras pepper by 27.9%. As in every profession, in agriculture, the expectations of the people who have worked in the same business for many years and their satisfaction levels decrease.

A one decare increase in the land of producers who have 50 decare land or have less than 50 decare land will reduce the probability of being very satisfied with the production of Maras Pepper by 11.7%, while it will increase the probability of not being satisfied with the production of Maras Pepper by 10.5%.

When the level of participation in the proposal of marketing increases by one unit, the probability of the producers being very satisfied with production will increase by 14.25%, the probability of the producers not being satisfied with production will decrease by 11.52% and the probability of the producers being less satisfied with production will decrease by 2.7% (Table 3)

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Variables	Prob[a] (Y=0)	Prob[b] (Y=1)	Prob[c] (Y=2)
D_province_2*	-0.1883	-0.2406	0.4289
D_province_3	-0.0715	-0.0183	0.0898
SS	0.0998	0.0065	-0.1063
ATÇS***	0.0271	0.0064	-0.0335
Yield*	-0.0003	-0.0004	0.0004
Dage2**	-0.1465	-0.0465	0.1929
Dage3***	-0.1345	-0.0870	0.2214
Deducation2	0.0148	0.0030	-0.0177
Deducation3***	0.1717	-0.0255	-0.1462
Dae _2**	0.1584	0.0361	-0.1945
Dae _3***	0.2794	-0.0817	-0.1977
Dland***	0.1054	0.0114	-0.1168
I don't have any problem in marketing ***	-0.1152	-0.0273	0.1425

*p<0.01, **p<0.05, ***p<0.10 is statistically significant.

Table 3. Marginal effects of factors affecting satisfaction level

CONCLUSIONS AND RECOMMENDATIONS

This research was carried out to determine the factors affecting the satisfaction levels of the producers in Maraş pepper production.

According to the model, the producers who are in Kahramanmaras province, the producers who are 41 years old or more than 41 years old, the producers who took less than 9 years education, the number of people living in household is less, the producers who have 20 years or less than 20 years agricultural experience, the producers who don't have any problem in marketing and the producers who have more than 50 decare land are more likely to be satisfied with the production of Maras pepper production.

It is clear that the producers in Kahramanmaraş are more satisfied with the production of pepper than the producers in other provinces. Although production satisfaction is high in the province of Maraş, the plantation area of Maraş pepper is relatively low compared to other provinces. This is an important shortcoming for Kahramanmaraş.

In the research results, it is determined that the young producers, the producers who have low agricultural production experience and the producers who take a high level of education are less satisfied with the production of Maraş pepper than the others. This result is due to the fact that the more educated and young producers do not want to engage in agricultural activities and want to live in the village. Policies need to be developed to ensure that young people do not move away from villages and farming.

It is expected that the producers who have more land and the producers who do not have any problem in marketing are more likely to be satisfied with the production of Maras pepper.

The production of Maraş pepper, which is an important export product, should be increased and the studies to be carried out should be directed towards the young people and the producers who have a higher education level.

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Profile of Thyme Producers and Determination of Production-Marketing Opportunities in Altınözü District of Hatay Province

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ABSTRACT

Thyme is a medicinal and aromatic plant consumed mainly as a spice and benefited from its oil and water. The objective of this study is to reveal the current condition of thyme production and to investigate production-marketing opportunities. The primary material of the study is the data obtained from face-to-face surveys conducted with 100 producers in Altınözü district of Hatay Province in 2018. Descriptive statistics were used to analyse the data. According to the research findings, 60.9% of the agricultural income of the producers come from the production of thyme. While 64% of the producers prefer to produce Thyme as it has marketing and price advantage, 19% of the producer prefer producing thyme as they have a garden already established. 67% of the producers stated that thyme production provides enough contribution to the regional economy. Moreover, the percentage of the producers selling their products as fresh is about 96%, whereas the proportion the producers selling their products to the wholesaler is around 75%. In addition, they stated that the most crucial factor determining the way of marketing is the price (95%). The results of the research will provide a source for stakeholders and decision-makers regarding the current situation of thyme producers.

Keywords: *thyme, production and marketing, Hatay*

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INTRODUCTION

The thyme, which has an essential place in medicinal and aromatic plants, is also a significant product of export. The thyme itself is collected through nature but can also be cultivated as a plant of the culture. Thyme mainly consumed in the Mediterranean countries is generally used as a spice in meat products, traditional food and pizzas (Akgul, 1993).

The thyme can also be utilised in the industry of cosmetics and perfumery; this is also used to treat skin having problem. In Turkey, the types of thyme most commonly are seen as a herb that is used in meat dishes. In addition, thyme is also used as a decorative plant in environmental layout. A large amount of thyme production is exported abroad. Turkey produces 15895 tonnes of thyme in 139061 areas; Denizli encounters 88.13% of the production.

In Turkey 15 cities produce thyme, and the province of Hatay produces most of the manufacture by 116 tonnes in 1313 areas, which places itself as the fifth on production ranking. In the province of Hatay, the production takes place in two districts, Altinozu by 95.2% and 4.8% in Samandagi.

In recent years, the share of the thyme production has been increased and keeps attracting the attention of producers. In 2009, while the production of thyme in 550 (da) was observed, it was found that the planting area increased 2.39 times at the end of 10 years. Similarly, 55 tons of thyme were produced in 2009, while it reached 116 tons by increasing 2.11 times in 2018 (TUIK, 2018).

When the studies on this subject were examined, it was determined that the researches were mostly carried out to determine the types of thyme, cultivation techniques, and essential oil components (Arabacı, 1995; Bayram, 2003; Kan et al., 2005; Baydar and Arabacı 2013). The objective of this study is to reveal the current status of thyme production within a specific research area and also to question the production –marketing opportunities.

MATERIALS AND METHODS

The primary material of this research is the data obtained from the surveys conducted from 100 producers in the Altinozu district of Hatay province in 2018. In addition, secondary data obtained from relatable sources were also used. Descriptive statistics have been applied to analyse the data.

FINDINGS OF RESEARCH

Producers of thyme who were surveyed, out of hundred; 26% were women, and 74% were specified as men. The results show that all of the producers are married, on average the ages were 50.4 years, 57% is primary school graduate, 37% can only read and write an average period of education is 2.55 years. In addition, it is determined that the average number of individuals living in the family is 6.29 and production of thyme for an average is 3.98 year (Table 1).

	Min.	**Max**	**Mean**	**Std. Dev.**
Age (years)	35	0	50.40	8.27
The number of individuals living in the family	4	0	6.29	1.46
Thyme production experience (years)	2	0	3.98	1.13

Table 1. The socio-demographic features of the surveyed producers

It was determined that thyme is produced at an average of 8.7 da and the yield obtained from this production is 121 kg/ha, while the income is 27159.66 TL. Producers obtain 60.9% of their agricultural income from thyme production (Table 2). Especially in the last five years, the number of thyme producers in Altinozu district has been increased.

	Mean	**Std. Dev.**
Thyme production area (da)	8.7	3.895
Yield(kg/da)	121.0	2.58
Wet Thyme Sale price (kg)	8.6	1.20
Average harvest (times/year)	3.0	0.00
Income from thyme production (TL / year)	27159.7	
Total agricultural income (TL / year)	44598.5	
The share of income of thyme production in total agricultural income (%)	60.9	

Table 2. Production of thyme information

The majority of producers (64%) prefer to produce thyme as it has a price advantage and is accessible to the market, whereas 19% of producers prefer to produce thyme as they have an already had thyme garden established previously (Table 3).

	Number of farmers	**Rate (%)**
Production of thyme is easy.	8	8.0
I evaluate Empty or barren lands by producing thyme.	4	4.0
Thyme provides a price advantage.	64	64.0
Marketing of thyme is easy.	64	64.0
I have thyme garden established previously.	19	19.0
The production of other thyme farmers influences me.	5	5.0

Table 3. Reasons to produce thyme production

A large proportion of thyme produced in the region is sold as fresh. In other words, 96% of the producers stated that they sell their products as fresh. On the other hand, 4 % of producers sell their products as both dried and fresh (Table 4)

	Number of farmers	**Rate (%)**
Fresh	96	96.0
Both dried and fresh	4	4.0
Total	100	100.0

Table 4. Marketing

75% of the producers stated that they sold thyme to merchants, and 25% of producers said that they sold thyme themselves (Table 5).

	Number of farmers	**Rate (%)**
Wholesaler	75	75.0
Themselves	25	25.0
Total	100	100.0

Table 5. Marketing channels

The majority of producers (95%) stated that they pay attention to the price while determining the marketing channel. When the merchants provide the price they expect, they prefer to sell their products to the merchants; otherwise, thyme is marketed by themselves (Table 6).

	Number of farmers	**Rate (%)**
Price	95	95.0
Market demand	4	4.0
Storage facilities	1	1.0
Total	100	100.0

Table 6. Factors determining the marketing channel

64% of the producers stated that they were slightly satisfied with the sale price of thyme, while 32% of them were moderately satisfied with the sale the price of thyme. In addition, there is not any producer who is very satisfied with the sale price of thyme (Table 7).

	Number of farmers	**Rate (%)**
I am not satisfied with the sale price.	4	4.0
I am slightly satisfied with the sale price.	64	64.0
I am moderately satisfied with the sale price.	32	32.0
Total	100	100.0

Table 7. Satisfaction status of the producer about the sale price

When the question of whether the production of thyme in the region contributes to the country's economy sufficiently was asked to producers, 68% of the producers stated that thyme production contributed considerably to the regional economy (Table 8).

	Number of farmers	Rate (%)
Moderately adequate	10	10.0
Considerably adequate	68	68.0
Adequate	22	22.0
Total	100	100.0

Table 8. Whether thyme production contribution to the economy of the region

When the level of knowledge of the producers about thyme cultivation was questioned, 54% of the producers stated that they have excellent knowledge, whereas 38% of the producers have good knowledge (Table 9).

	Number of farmers	Rate (%)
Moderate	8	8.0
Good	38	38.0
Excellent	54	54.0
Total	100	100.0

Table 9. The level of knowledge about thyme production

CONCLUSIONS AND RECOMMENDATIONS

This study was carried out to reveal the current status of thyme producers in the Altinozu district of Hatay province and to question production-marketing opportunities. In the province of Hatay, Altinozu district, the production of thyme, which has become widespread in recent years, has been increasing the interest of producers.

The average age of thyme producers is quite high. Recently, the decrease in the number of young people in rural areas due to the migration has caused significant losses in agricultural production. Increasing the interest of young people in the production of thyme with the incentives and supports will make significant contributions to agriculture sustainability. If the thyme plant, which has substantial export potential, is produced consciously, it will contribute significantly to the economy of the region.

In addition, producers will be able to increase their productivity by using modern techniques in the production of thyme. If producers of thyme were organized in the region, this would ease the process of marketing, and this would enable them to have a say about the sale price of thyme.

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Genotoxic Interventions in Agriculture

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ABSTRACT

As in the rest of the world, agriculture is one of the most affected by technology and scientific developments. Sowing, maintenance and harvesting works are facilitated with agricultural machinery. This has allowed more products to be purchased with less human labor, which is a good development. Today's agriculture is also one of the fields of application of chemical industry. Chemical fertilizers, hormones, pesticides, herbicides are used more and more in agriculture every day. All of these chemicals used to increase the product pollute the ecosystem and contaminate the products and threaten human and animal health. This situation is even more alarming in greenhouses where the product is obtained out of season. In recent years, there has been a connection between many diseases in human and agricultural chemicals. It is now known that these chemicals are genotoxic substances that affect DNA in the living cell.

The aim of this study is to provide information about the potential genotoxic effects of chemicals used in agriculture and to discuss current legal regulations in Turkey.

***Key words*:** Agricultural chemicals, human health, ecological impact.

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In order to meet the nutritional needs of the growing population in the world and increase the product, there is intensive use of chemicals in agriculture. Various chemicals that are used unconsciously, unnecessarily and uncontrollably in the field of agriculture threaten the health of the whole people, especially the farmers. Artificial fertilizers, pesticides, herbicides and hormones are frequently used in agriculture. Pesticides are the leading agricultural chemicals that negatively affect the ecosystem, especially human health.

Pesticides

A pesticide is a substance or mixture of substance intended for preventing, destroying, repelling or lessening the damage caused by the pest. For example, a pesticide can be a insect, plant pathogen, weed, bacteria, bird etc. A pesticide is any compound or mixture of compounds that prevents, removes or protects the spread of any unwanted organism called pests. Many chemical pesticides are poisonous to human, animals and harmful for environment (Gaikwad, A. S., Karunamoorthy, P., Kondhalkar, S. J., Ambikapathy, M., & Beerappa, R. 2015:2; Nicolopoulou-Stamati, P., Maipas, S., Kotampasi, C., Stamatis, P., & Hens, L. 2016:2)

Classification of pesticides

1. Herbicide: These are the chemicals used to kill weeds, unwanted plants.

2. Insecticide: These are used to kill insects.

3. Nematicide: These are used to kill namatodes.

4. Molluscicide: These ar used to kill molluscs.

5.Fungicides: These are used to kill fungus.

6.Algaecides: These are used to kill algae.

7.Bactericide: These are used to kill bacteria

8. Acaricides: Acaricides (Ticks, carpet beetles, dust beetles, etc.)

9.Rodenticides: Mouse killers, rodent killers.

10. Avicides: Bird Killers

Hazards of pesticides

1. The pesticide industries cause pollution of soil, water and air.

2. They enter the food chain and cause problem of bioaccumulation or biomagnification.

3. They are not target specific hence also kills non-pest insects.

4.Continuous and indiscriminate use of pesticides may develop resistance in insect pest like superpest and superbugs.

5. They are non-biodegradable and affect the balance of ecosystem.

6.They are highly toxic in nature and if not handled carefully, they can cause serious health problems like cancer, deformities in babies and disease. Accidents in pesticides manufacturing units cause great loss in environment and human life.

7. Alternative to pesticides war such as Integrated Pest Management (IPM) maybe an effective and environmentally sensitive approach to pest management. IPM uses a combination of common-sense practices. • IPM programs use current, comprehensive information on the life cycles of pests and their interaction with the environment. •

Herbicides

Herbicides are chemicals commonly used in weed control in agricultural areas. They can cause genotoxic effects on healthy cells by causing soil and product contamination (Sarıgöl, Z. 2015: 1; Van Bruggen, A. H. C., He, M. M., Shin, K., Mai, V., Jeong, K. C., Finckh, M. R., & Morris Jr, J. G. 2018: 1).

Classification of Herbicides

Herbicides are classified according to their various properties. Classification of herbicides according to the mechanism of action,

Herbicides that inhibit photosynthesis (uracils, urea compounds, triazine)

Respiratory inhibiting herbicides (dinitrophenol, pentachlorophenol, benzonitrile, aniline)

Growth hormones (phenoxy compounds)

Herbicides that inhibit mitosis (carbamate, chloracyl, amide, aniline)

Germicidal herbicides (carbamate, aniline)

Other Agricultural Chemicals

In addition to pesticides and herbicides, some plant hormones and fertilizers are used extensively in agriculture. The use of all kinds of agricultural chemicals in greenhouses is increasing. There are many studies on the contamination of all these chemicals with food and their negative and genotoxic effects on human health (Sarıkaya, R., & Çakır Arıca, Ş. 2018:4; Oliver, M. A., & Gregory, P. J. 2015:1).

CONCLUSIONS AND RECOMMENDATIONS

Human and ecosystem health are interrelated with many chemicals used in agriculture. Some are known to directly affect DNA in the cell and are genotoxic (Sarıkaya, R., & Çakır Arıca, Ş. 2018: 1; Sarıgöl, Z. 2015:1). Sale and use of pesticides is related to the health of the public, so it requires great care. In Turkey, according to the regulations about storage and wholesale and retail sale of existing chemical plant protection products, in addition to being a university graduate, they are required to be agricultural engineers or technicians. However, rules about this issue is not followed in Turkey. These agricultural chemical dealers must be strictly controlled for human and environmental health. Agricultural chemicals should only be sold with prescription. In addition, continuous training programs about this issue should be organized for farmers and public awareness should be provided. Producers and user farmers should be informed about the disposal of pesticides and fertilizer wastes.

As the world population increases, food safety problems increase due to interventions in agriculture to increase production. The chemicals used in agriculture such as pesticides, herbicides, fertilizers and plant hormones all cause soil pollution. According to some scientists, there is relationship between soil and human health and this is an interdiciplinary topic (Oliver, M. A., & Gregory, P. J. 2015:1; Singh, N. S., Sharma, R., Parween, T., & Patanjali, P. K. 2018: 1).There are laws and regulations that protect public health related to chemicals used in agriculture. They need to be reviewed continuously, taking into account the current conditions. But the real problem is the application of these legal regulations. These failures are caused by unconsciousness or, unfortunately, by the desire to obtain more products. For public health, this matter should be followed up more carefully by the authorities and necessary sanctions should be applied.

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The Effects of Monocultural Agriculture on The Sustainability of Local Agricultural Biodiversity

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ABSTRACT

Rapid population growth and providing food in sufficient quality to this growing population is one of the most important problems of the 21st century. Rapid population increases are threatening the food supplies. Because, the effort to increase food for the increasing population has industrialized agriculture by removing naturality in agriculture which protects traditional local variety. Monocultural agriculture is a good example of this and can be defined as agricultural practice of producing or growing a single crop, plant, or livestock species, variety, or breed in a field or farming system at a time. However, monoculture agriculture has significant negative and irreversible impacts on ecological systems and local agrobiodiversity.

According to FAO Report, biodiversity is critical for safeguarding global food security, to able to prepare healthy and nutritious diets for human and also improving rural livelihoods, and enhancing the resilience of people and communities. That's why, human needs to use agrobiodiversity in a sustainable way, so that human can better respond to climate change challenges and produce food in a way that doesn't harm our environment. Turkey has an extremely rich genetic potential for many agricultural plant types due to its ecology and climate variations. Therefore, the negative impact of monoculture agriculture is much more important for Turkey.

The aim of this study is to highlight the negative impacts of monoculture cultivation also increased in Turkey and to discuss solutions to protect local agricultural biodiversity.

***Key words*:** Monocultural agriculture, agricultural biodiversity, local gene sources

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The Advantages of Monocultural Agriculture

Specialised crop production

These all varieties in monocultural agricultural activities have the same growing requirements and habits because planting, maintenance including pest control and harvesting can be standardized. At the same time, this standardization results in less waste and loss than inefficient harvest and planting. It is also useful because a crop can be planted in an area with special problems such as soil salt or drought or a short growing season.

High efficiency

Crops that are best suited for the land can be planted so that soil and climate specificities such as winds, droughts or a short growing season, don’t impact the yield as much. Monoculture may maximise the efficiency of farming processes. This reduces costs and makes the requirements a single variety. This facilitates agriculture.

Simplicity

In monocultural agriculture, one kind of grain or other crops are grown in the field in the same period. It is much easier to cultivate one kind of crop or breed one type of farm animals, in terms of the knowledge and experience needed to do it successfully.

The Disadvantages of Monocultural Agriculture

It is critical to increase food for increasing population in the 21st centry but, monoculture farming has some distinct disadvantages which put our planet’s long-term food production potential at risk (Özer, H., Dönmez, İ., & Gülser, C. 2016:1).

High use of fertilisers

Growing the same crops year in year decreases valuable soil nutrients that plants rely on, so this deficiency is compensated for by using increasing amounts of artificial fertilisers. These artificial fertilizers used disrupt the natural structure of the soil and cause environmental pollution.

Susceptibility to pests

Monocultural plants are more susceptible to certain weeds and insect pests that's why pesticides are used to protect against them. Weeds and insect pests may spread faster in a monoculture because of the lack of biological diversity. As the cultivated species is susceptible to the same pest, there is a danger of losing the whole crop at once.

Environmental pollution

In monocultural agriculture, the chemicals used to combat the pest and fertilizers used to increase the product cause soil pollution. The negative effects of this soil pollution on human health and ecosystem are well known. For example, these agro-based chemicals, finding their way into groundwater sources, spread into the ecosystem so affecting all living things. In addition, they may contaminate into our food and increase risk of some diseases such as cancer in human.

Loss of biodiversity

An important negative impact of monocultural agriculture, which is not emphasized sufficiently, is its erosional impact on local biodiversity in particular. Local agricultural biodiversity is the outcome of the interactions among local genetic resources, the environment and the management systems and practices used by local farmers. These local genetic resources and sustainability is an important potential for every country.

CONCLUSION AND SUGGESTIONS

Biodiversity is the mainstay of sustainability. Therefore, when we allow biodiversity loss, we accept losing sustainability of all biodiversity's potential benefits. Nowadays particularly as the population is increasing, able to increase yields are vital for having affordable food. An important monocultural advantage is that it allows abundant production of low-cost products. Monoculture farming, however, has some disadvantages we can't ignore (Çetiner, S. 2017: 1). If monocultural agriculture in the world and in Turkey continue to spread dominantly, long term food production comes at risk from high use of fertilizers, pests, loss of biodiversity, soil fertility and environmental pollution. In this regard, solutions such as application with permaculture, crop rotation application, attention to biological struggle, breeding of indigenous species are proposed.

Sustainable Agriculture has become increasingly important due to increased demand for food, negative impact of climate changes and limited resources. This can only be achieved by preserving the genetic diversity of field crops that have adapted to the conditions of each country. This diversity of genes provides an alternative to adapting to future environmental conditions. We cannot achieve this with an agricultural policy based on seeds that are not domestic and originated from abroad.

In the 21st century, there has been a rapid transition from polycultural agriculture to monocultural agriculture. This change has brought many problems, especially erosion of local agricultural biological genetic diversity. This local agricultural genetic diversity, as old as human history, is a legacy to be passed on to future generations.

Turkey has a richness of natural and agricultural genetic resources due to its climatic, geological and historical structure (Karagöz, A., Özbek, K., & Nurgül, S. A. R. I. 2016:96). This wealth is a strategic potential for the future, and the sustainability of this potential is threatened recently by the widespread monocultural agriculture. Necessary legislation on sustainability of agricultural biodiversity should be completed and its implementation should be monitored.

The effects of monoculture agriculture on the sustainability of local agricultural biodiversity are much more important for Turkey. Therefore, in this study, it was aimed to draw attention to this important issue.

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Design and Analysis of Date Picking Elevator Scissor Type

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ABSTRACT

The local market needs machines to facilitate the date picking for farmers, because this operation is hard for the farmer and will take a lot of muscular effort so gets him tired and waste of time. So, it is possible to design appropriate elevator scissor type for picking date to get rid of unwanted parameters. We designed the base plate, upper plate and the other parts that used in this system by solidworks software program and then also by using this program the necessary analysis had been done and the complexities in the design are reduced. This research is useful for manufacturer to save the time and finance.

Key words: *Picking Elevator, Base plate, Upper plate, Scissor Type, Solidworks.*

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Hurma Toplama Makas Tipi Asansörün Tasarımı ve Analizi

ÖZET

Çiftçilerin işlerini kolaylaştırmak için yerel pazarın makinalara ihtiyacı vardır, çünkü hurma toplama zor bir iştir, çifçi hem çok emek sarf eder hemde çok zamanını alır. Dolayısı ile istenmeyen parametreleri ortadan kaldırarak hurma toplamak için uygun asansör makas tipi tasarlamak mümkündür. Bu sistemde kulanılan ana palet, üst palet ve diğer parçaları solidworks programını kullanarak tasarladık ve aynı bu programda gereken analizleri yaparak karmaşıklıkları azalttık. Bu araştırma üreticiler için hem zaman hemde para tasarrufu sağlar.

I. INTRODUCTION

The scissor elevator type is used for picking the dates consists of platform moves up and down vertically and the mechanism known as pantograph which is arms linked and folded together like X cross shape. To elongate the crossing pattern the hydraulic jack used to press the first link down from outside and so the platform will be lifted. Also an extending bridge made on the platform to protect the worker from falling down or during movement of platform vertically, i.e. to fulfill the safety requirements. The lever scissor designed to bear a maximum weight of 180 kg. And we used a hydraulic jack for lifting and a maximum height for elevator is 10 m.

II. DESIGN OF DIFFERENT COMPONENTS OF PICKING ELEVATOR SCISSOR TYPE

Picking elevator scissor type consists of seven elements. The main elements of the system are hydraulic jack, base plate, links, upper plate, nut, pin and bolt screw. Depending on certain assumptions, the designing procedure for each of the elements has been described as follows:

1. Designing the Base Plate

To provide an appropriate balance to the apparatus, this element is used only for this purpose. The dimensions of base plate are supposed as the length of the plate (L) is 2050 mm and width (B) is 2040 mm while the thickness of the plate is 20 mm, and according to our studies it found that there are no stresses supplied to this plate. Type of the metal that used is cast iron.

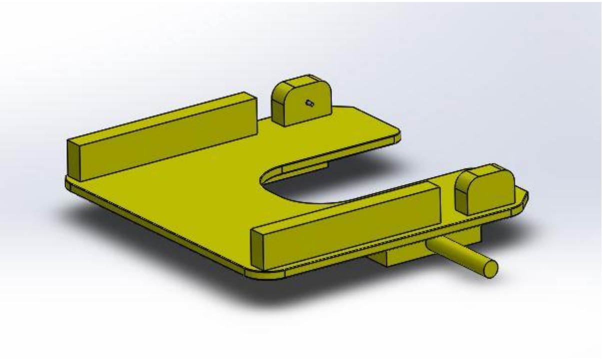

Figure 1. Design of the Base Plate

2. Designing the Upper Plate

This part is used for placing the load and transferring it to the links. Design of this part is the same as the base plate because the requirements for upper plate are the same as for the base plate. Another thing, also there are not much stresses developed to this element. The dimensions of this part are supposed as the length of the plate (L) is 2050 mm and width (B) is 2040 mm while the thickness of the plate is 20 mm. The height of railing = 1000 mm. Type of the metal that used is cast iron.

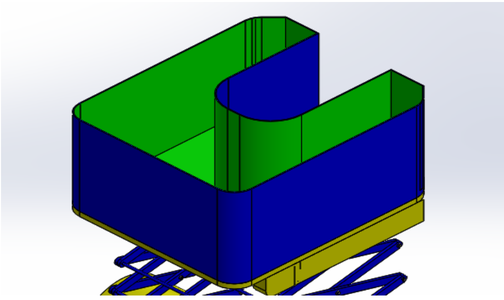

Figure 2. Design of the upper Plate

3. Designing the Nut

The mild steel is assumed to be the material of the nut. So the distributions of bearing pressure of W load over the cross sectional area of nut for mild steel assumed to be uniformly. The boundary conditions like bearing pressure between the threads, stability and preventing undesirable movement forces the thickness of nut (t) to be 16 mm, outer and inner diameters to be 32 mm and 20 mm respectively.

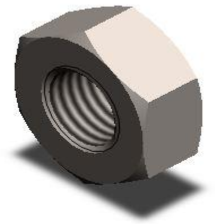

Figure 3. Design of the Nut

4. Designing the Link

The supplied load to one link equals F/2 = 883 N, this part is used for buckling the load. The safety factor (FOS) assumed to be 2, so the critical buckling load equals to 883x2 = 1766 N, width = 80 mm, thickness = 30 mm and length = 1600 mm. Since the apparatus is moved vertically the links are buckled, so the ends of the link considered to be hinged and therefore the equivalent length (L) equals 1600 mm. Type of the metal that used is galvanized steel.

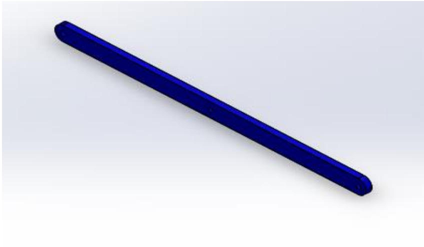

Figure 4. Design of the Link

5. Designing the Hydraulic Jack

The best way to produce linear motion and force for transferring power applications is a fluid mechanism. To achieve this goal we preferred pressurized hydraulic fluid device known a hydraulic pump. The stored energy of the fluid in the cylinder converted to a force used to lift the platform linearly. This Jack is designed to lift a rated 180 Kg load**.**

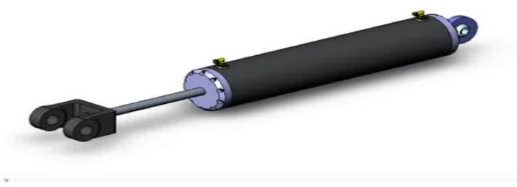

Figure 5. Design of the Hydraulic Jack

6. Designing the Pin

The small diameter, big diameter and length of the pin are calculated to 24 mm, 28 mm and 1928 mm respectively because of double shearing conditions.

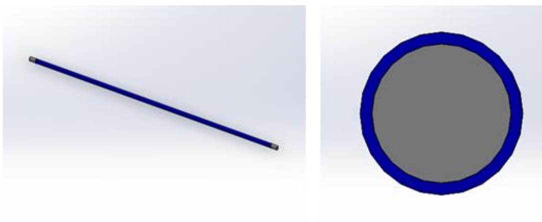

Figure 6. Design of the Pin

7. Designing the Bolt Screw

Bolt screw are used for connecting Links with each other, we used Stainless Steel to withstand shear stress because the screw was subjected to high shear stress and in order to avoid failure. Dimensions of the bolt screw diameter = 24 mm, length = 80 mm.

Figure 7. Design of the Bolt Screw

III. DESIGN AND DEVELOPMENT OF DATE PICKING ELEVATOR SCISSOR TYPE

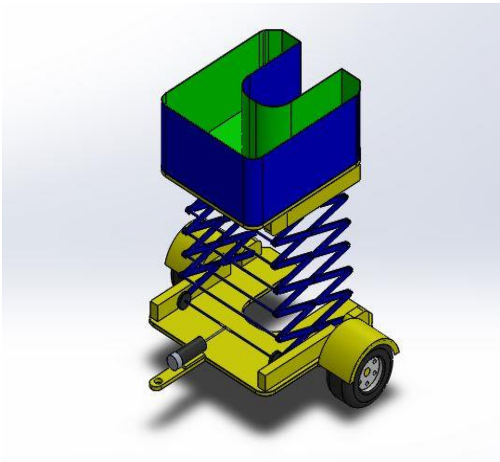

Figure 8. Modified date picking elevator scissor type

IV. ANALYSIS OF DATE PICKING ELEVATOR SCISSOR TYPE

The SOLIDWORK software program are used after carring the designed system and different analysis carried out on the parts under load of 180 kg.

- **Link**

a) mesh

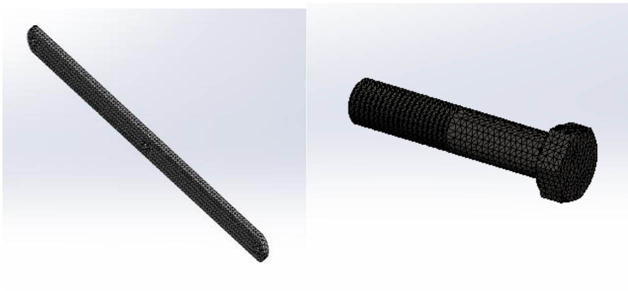

Figure 9. Meshing of Links and Bolts Screw

b) Von Mises

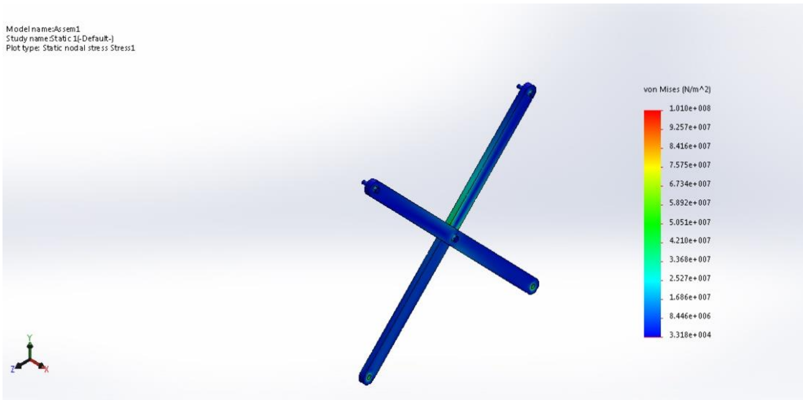

Figure 10. Von Mises analysis of link

c) Deformation (URES mm)

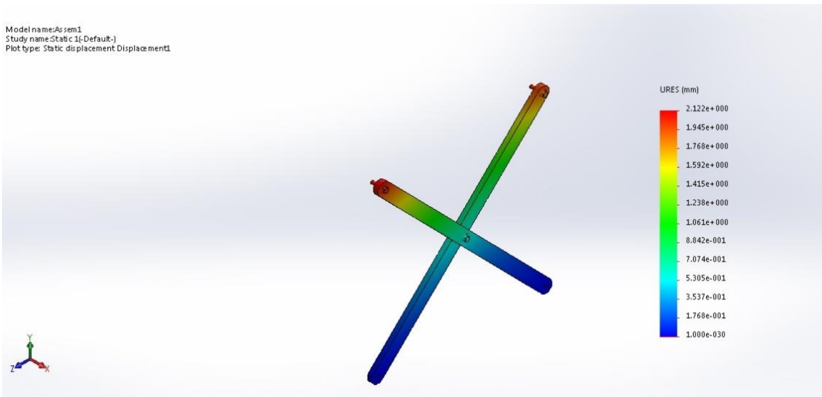

Figure 11. Deformation analysis of link

d) Shear Stress: Towards the axis YZ

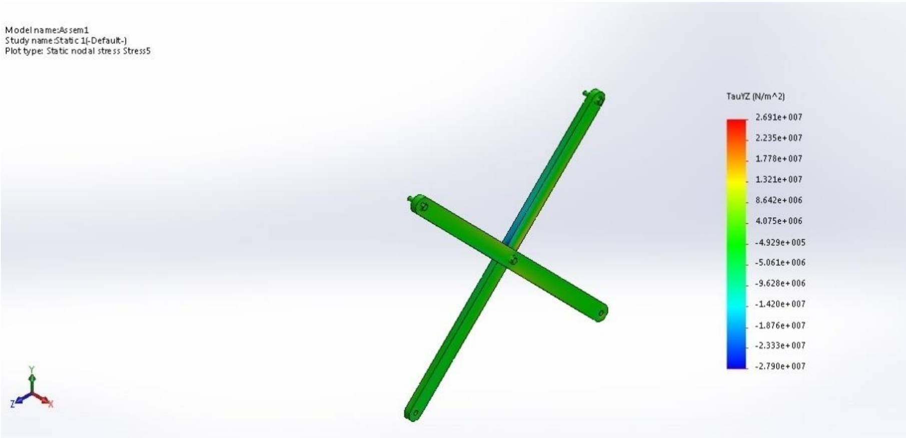

Figure 12. Shear Stress analysis of link

e) Strain

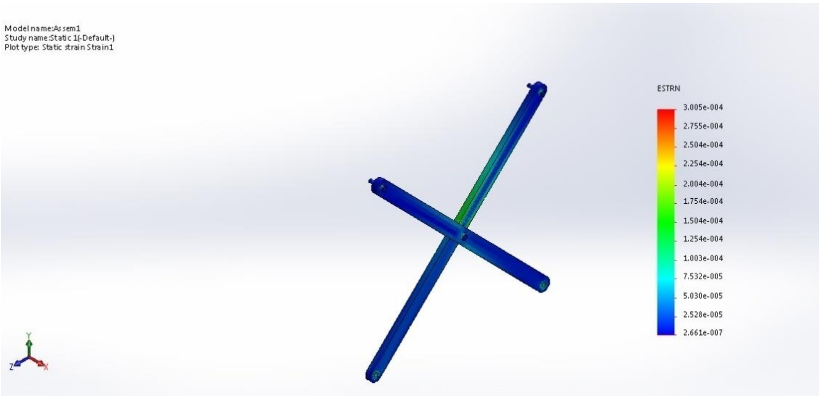

Figure 13. Strain analysis of link

f) Factor of Safety FOS = 2

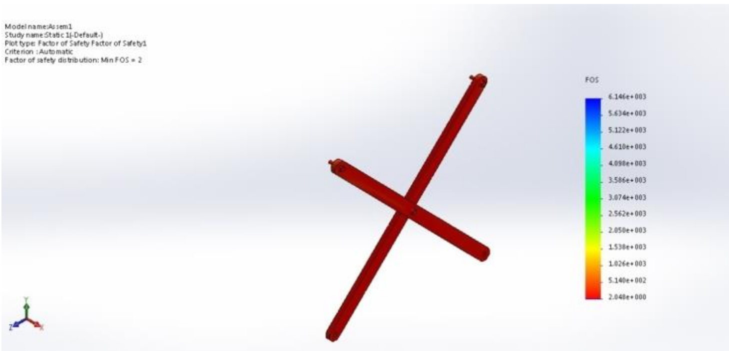

Figure 14. Factor of Safety analysis of link

- **Bolt Screw**

a) Von Mises

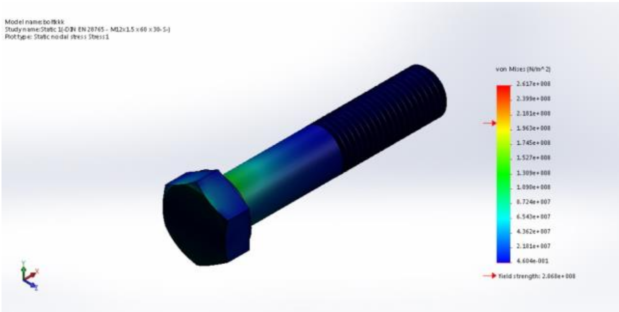

Figure 15. Von Mises analysis of bolt screw

b) Deformation (URES mm)

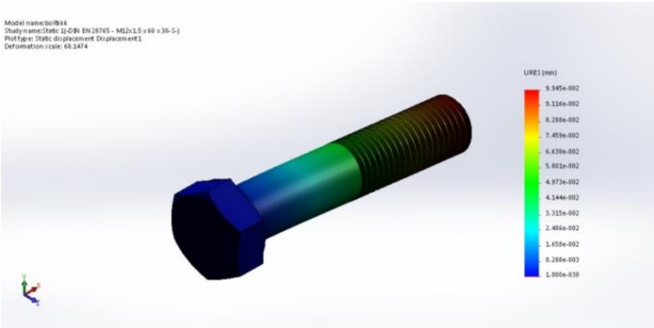

Figure 16. Deformation analysis of bolt screw

c) Shear Stress: Towards the axis YZ

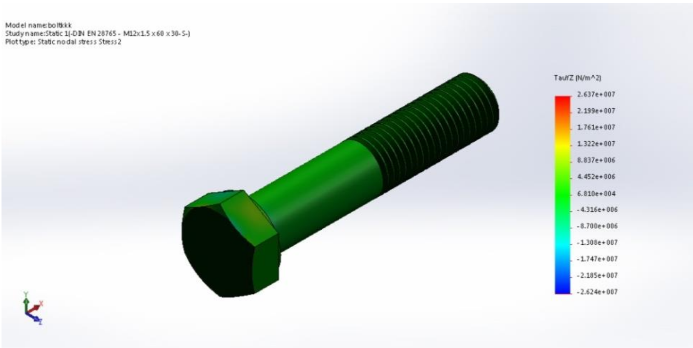

Figure 17. Shear Stress analysis of bolt screw

d) Strain

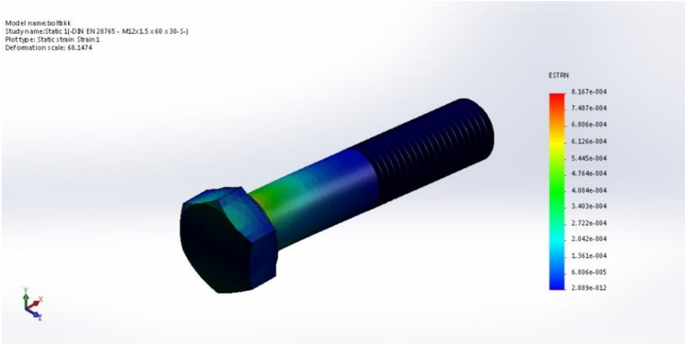

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Figure 18. Strain analysis of bolt screw

e) Factor of Safety FOS = 0.79

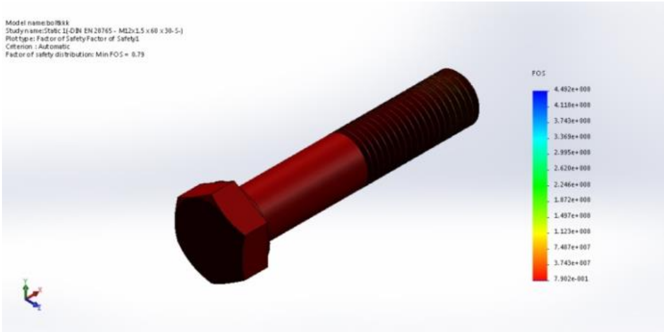

Figure 19. Factor of Safety analysis of bolt screw

Ⅴ. CONCLUSION

The device is assembled and analyzed in Solidworks software program as shown before, and the important parts that are under the load are the links and screw bolts. So we will concentrate to these two parts analysis. If we will check the figures 10 & 15 we will see the values of Von Mises Stess for these two parts and it will be as follows:

for the Link:

Name	Type	Min	Max
Stress	Von Mises stress	3.318e+004	1.010e+008

And for bolt screw is:

Name	Type	Min	Max
Stress	Von Mises stress	4.604e+001	2.617e+008

Though, the values all are in the safe under certain accepted parameters.

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Situation of Organic Fruit Growing in Turkey and the World

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Abstract

This study was conducted to identify the current status of organic fruit cultivation in the world and Turkey and to make assessment on the future of organic fruit cultivation in our country. In the study, data on organic fruit growing and production taken from statistical institutions were examined. According to this, organic farming has been carried out in 179 countries and Australia (47.13%), Europe (23.39%), South America (12.30%) and Asia (8.59%) continents have been seen that the highest organic production area. The most important fruit species used in organic fruit production in the world were olive (672.033 ha), grape (332.913 ha), apple (82.983 ha), banana (62.586 ha), mango (30.307 ha), apricot (18.201) and fig (15.551). In our country, olive (219.075 tons), fig (92.929 tons), grape (90.385 tons), apple (78.905 tons) and apricot (47.654 tons) were to be important fruit species used in organic fruit production. As a result, we believe that organic fruit cultivation, which is one of the important application areas of sustainable agriculture, will continue to be increased for in the future both in our country and in the world. In this regard, sustainability of agriculture will contribute to not only raise awareness among consumers but also support organic fruit producers.

Key Words: *Organic fruit, Sustainable agriculture, Current situation and future*

Özet

Bu çalışma, Dünya ve Türkiye'de organik meyve yetiştiriciliğinin mevcut durumunu tespit etmek ve ülkemizde organik meyve yetiştiriciliğinin geleceği üzerinde değerlendirmelerde bulunmak üzere gerçekleştirilmiştir. Çalışma kapsamında istatistik kurumlarından organik meyve yetiştiriciliği ve üretimi konusunda elde edilen veriler incelenmiştir. Buna göre, günümüzde 179 ülkede sertifkalı olarak organik tarım yapıldığı ve Avusturalya (% 47.13), Avrupa (% 23.39), Güney Amerika (% 12,30) ve Asya (% 8.59) kıtalarının organik üretim alanı en yüksek olduğu görülmüştür. Dünya'da organik meyve üretiminde kullanılan en önemli meyve türleri zeytin (672.036 ha), üzüm (332.913 ha), elma (82.983 ha), muz (62.586

ha), mango (30.307 ha), kayısı (18.201) ve incir (15.551) olduğu saptanmıştır. Ülkemizde ise organik meyve üretiminde zeytin (219.075 ton), incir (92.929 ton), üzüm (90.385 ton), elma (78.905 ton) ve kayısı (47.654 ton) önemli meyve türleri olduğu anlaşılmaktadır. Sonuç olarak, sürdürülebilir tarımın önemli uygulama alanlarından biri olan organik meyve yetiştiriciliğine gelecekte hem ülkemizde hemde dünyada ilginin aratarak devam edeciği kanısındayız. Bu konuda, organik meyve üreticilerinin desteklenmesi yanında tüketicilerinde bilinçlendirilmesi tarımın sürdürülebilirliğine önemli katkı sağlayacaktır.

Introduction

Organic agriculture, which is a sustainable agriculture system, is seen as an agricultural system that provides a habitable world for the future generations of the world. The industrial revolution and the use of synthetic chemicals started in 1970 increased rapidly the pollution of the nature (Özaslan, 2006). In order to prevent this, organic agriculture appears to be an alternative agricultural system.

In order to produce healthy products without disturbing the natural balance, growing in the appropriate ecologies of plant and animal production, preferring natural methods in plant protection and pest control by adopting cultural measures as a priority, and are a farming system documented by a certification process and (Kaplankıran, 2001; Çalışkan, 2018).

Organic farming is embarked on the principles of health, ecology, honesty and care. Thus, social, economic and environmental sustainability of agriculture will be guaranteed (Anonymous, 2018).

Why Organic Agriculture?

The world's agricultural land is 4.9 billion hectares and China (519 million ha) is the country with an important continental part with 10.6%. USA (411 million ha) 8.5%, Australia (409 million ha) 8.3%, Brazil (275 million ha) 5.6%, Russia (215 million ha) 4.4%, Kazakhstan (209 million ha) 4.3% and India (180 million ha) are the countries with a significant soil presence. Turkey has 38.2 million hectares of agricultural area (Anonymous, 2018) (Table 1).

Table 1. Total agricultural land existence of countries

Country	Agricultural Area (Million ha)	Share (%)
China	519.0	10,6
USD	411.0	8,4
Avustria	409.0	8,3
Brazil	275.0	5,6
Rusia	215.0	4,4
Kazakstan	209.0	4,3
Indian	180.0	3,7
Turkey	38.2	0.78

Organic agriculture has emerged as a promising approach to achieving sustainable agricultural systems, but its applicability remains controversial. Today, it is not possible to meet the nutritional needs of the world population with its organic form. However, there are important benefits such as preventing pesticide residues in fruits and vegetables, ensuring the protection of soil and water by not using chemical fertilizers, and reducing greenhouse gas emissions. Organic farming 1910 begins with the Albert Howard Agricultural Will. 1924 Rudolf Steiner Biodynamic Agriculture Management, 1972 International Federation of Organic Agriculture Movements, 1991 European Union EEC 2092/91 Organic Agriculture Directorate continued with the 1999 FAO by Codex Alimentarius has been finalized by the preparation and increasing the efficiency of each day (Usal, 2006)

1. Organic Agriculture in the World

Nowadays, organic farming is carried out in 178 countries around the world. While the world had 30.2 million hectares of organic production in 2006, it reached 57.8 million hectares of organic production in 2016 (Figure 1). Organic farm area constitutes 1.2% of the total agricultural land in the world (Anonymous, 2018a). In 2016, there is a 15% increase in organic agriculture, 5 million hectares increase is observed in Avusria. Organic farming areas are also increased in China (42%), Uruguay (27%), India (27%) and Italy (27%) (Anonymous, 2018a)

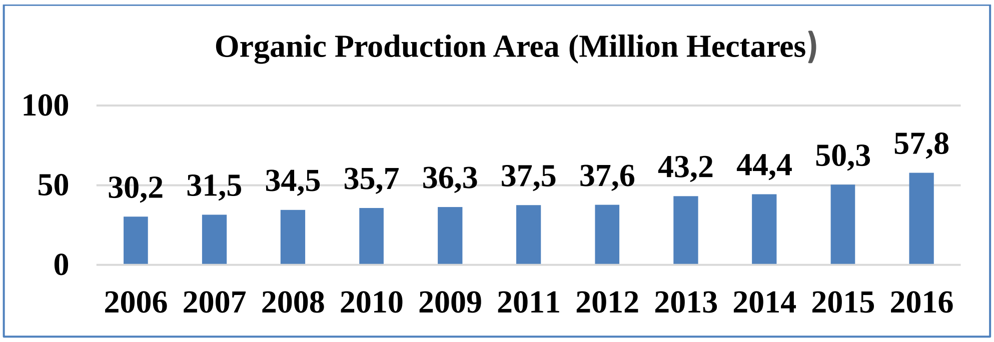

Figure 1. Growth of the organic production area in the world (years of 2006-2016)

Australia is the country with the highest area (27.150.000 ha) of organic production in the World. In addition, Argentina (3,010,000 tons), China (2,280,000 ha), USA (2.030.000 tons), Spain (2.020.000 ha), Italy (1.800.000 ha), France (1.540.000 ha), Uruguay (1.660.000 ha), India (1.490.000 ha) and Germany (1.250..000 ha) has a significant production area, respectively (Anonymous, 2018a) (Figure 2.).

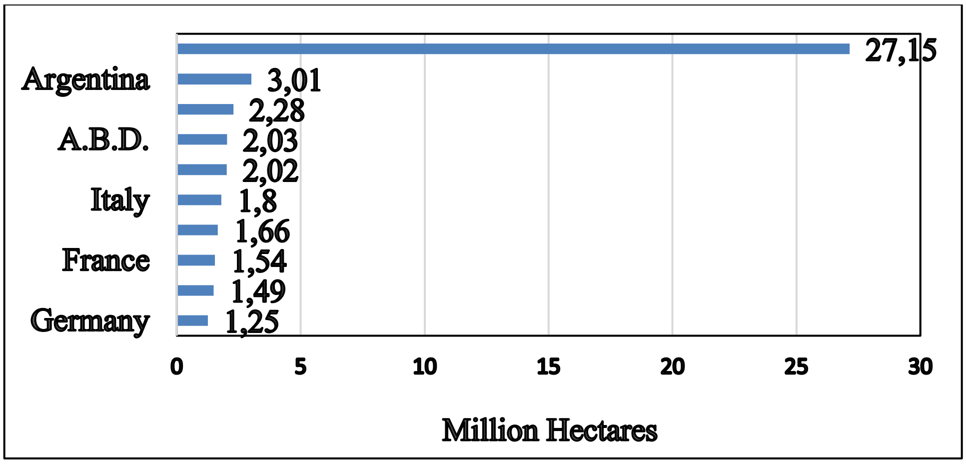

Figure 2. Ten important countries with organic production area in the world (2016 year)

In 2016, the number of organic producers are reached 2.7 million in the world. The number of producers in India (835.200), Uganda (210.352), Mexico (210.000), Ethiopia (203.602), Philippines (165.994), Tanzania (148.610), Peru (91.771), Turkey (67.879), Italy (64.210) and Paraguay (28.258) are important countries (Figure 3.). Turkey also is ranked 8 th in the number of organic producers (Anonymous, 2018a).

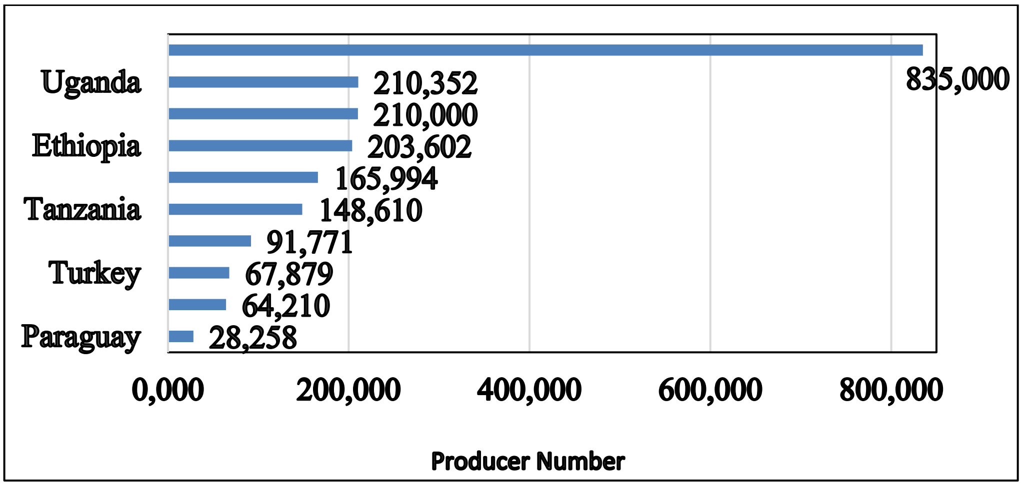

Figure 3. The ten countries with the largest numbers of organic producers 2016

Apple (10.232 ha), apricot (4.723 ha), plum (2.679 ha), cherry (3.671 ha), pear (5.264 ha) peach and nectarine (1.023 ha) which are the temperate climatic fruit species produced organically have significant increase is observed in the world (Anonymous 2018a) (Table 2.).

Table 2. Organic Grown Temperate Climate Fruit Species in the World (2015 and 2016)

Crops	**Production Area (ha)**	
	2015	**2016**
Temperate climate Fruits	105,633	-
Olive	672.032	672.036
Avocados		62.352
Bananas		58.407
Apple	72,751	82.983
Other Temperate climate Fruits	32,547	-
Apricot	18,201	22.940
Plum	12,984	15.871
Cherries	12,200	15.924
Nut Fuit (not Detail)	10.268	-
Pears	10.076	15.376

Peach and nectarines (no detail)	9,838	10.877
Pome Fruits (no detail)	3,941	1.190
Quince	61	81
Total	**288.502**	**254.600**

The organic temperate climate species of the world have a production area of 254.600 hectares. China with the area of 97.880 hectares has the most important organic temperate climate fruit production area. Germany (23.000 ha), Italy (22.378 ha) and Poland (18.616 ha) are followed by respectively. Turkey has 16260 hectares of organic farming in temperate fruit species (Anonymous 2018a) (Table 3).

Table 3. Important countries producing organic temperate climate fruits in the world (2016 year)

Country	**Production Area (ha)**
China	97.880
Germany	23.000
Italy	22.378
Polond	18.616
Turkey	16.260
USD	11.670
France	13.554
Total	**254.600**

In the world organic tropical and subtropical climate with avocado (62.352 ha), banana (58.407 ha), camu camu (62.586 ha), date palm (38.744 ha), mango (30.307), fig (17.092 ha) and guava (11.102 ha) are fruits with significant area (Table 4.).

Table 4. Organic tropical and subtropical climate fruit species production area in the world (2016 year)

Crops	**Production Area (ha)**
Avocados	62.352
Bananas	58.407
Camu camu	62,586

Date	38.744
Mangos	21.442
Fig	17.092
Guava	11.102
Pineapple	7.167
Kiwis	5.735
Pomegranate	3.145
Total	**356.119**

There are a total of 356.119 ha organic subtropical and tropical climate fruit production areas in the world. The important organic tropical and subtropical fruit production areas are Mexico (130,563 ha), China (28,403 ha), Dominican Republic (25,835 ha), Madagascar (19,012 ha) and Ecuador (18,650 ha) (Anonymous 2018a) (Table 5.).

Table 5. Tropical and subtropical fruit: Organic area by country (2016 year)

Country	Production Area (ha)
Mexico	130.563
China	28.403
Dominican Republic	25.835
Madagascar	19.012
Ecuador	18.650
Kenya	18.637
Turkey	18.415
Saudi Arabia	12.530
Peru	7.297
Burkina Faso	7.165
Italy	7.092
Vietnam	6.171
Philippines	6.150

Costa Rica	4.445
Total	**356.119**

The organic grape production area is approximately 380.000 hectares in the world. 3 important countries with organic grape production area are Italy (103,545 ha), Spain (106,720 ha) and France (70,732 ha) (Anonymous 2018a) (Table5).

Table 5. Grape: Organic area by country (2016 year)

Country	**Production Area (ha)**
İspanya	106.720
İtalya	103.545
France	70.732
China	20.025
Turkey	13.961
United States	11.071
Germany	8.000
Argentina	6.240
Bulgaria	5.390
Austria	5.088
Total	**379.555**

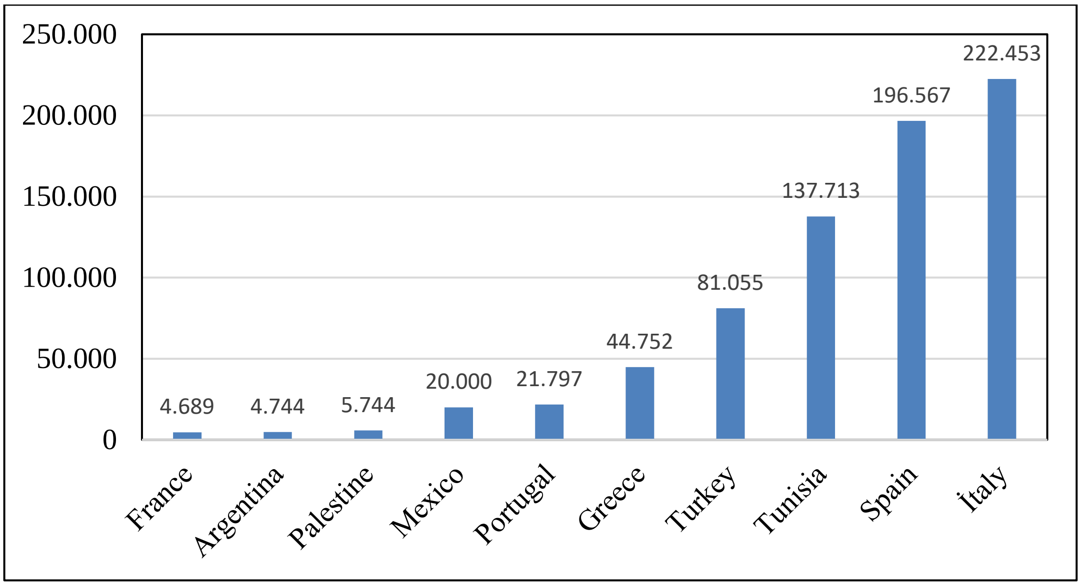

Figure 4. Countries producing organic olive in the world (2016 year)

There are 757.640 hectares of organic olive production in the world. Italy (22.453 ha), Spain (196.567 ha), Tunisia (137.713 ha) and Turkey (81.055 ha) are the countries with major production area (Anonymous, 2018a) (Figure 4).

According to 2016 FIBL data, there are 91.000 hectares of organic citrus production in the world. This constitutes only 1% of the 9.4 million citrus production of the world (Faostat, 2018). In organic agriculture, the largest producer is Italy with over 36.000 hectares, constituting 24.6 percent of Italy's harvested citrus fruit area, followed by China (14.400 hectares, 0.6 percent), Mexico (almost 13.000 hectares, 2.2 percent), and Spain (over 10.000 hectares, 2.8 percent). The area of organic citrus fruits shown in Table 6 includes oranges (%40), lemons and limes (%16), grapefruit and pomelos (%13), and tangerines (%4) (Figure 5). In organic agriculture, the largest producer is Italy with over 36.000 hectares, constituting 36.125 (ha) of Italy's harvested citrus fruit area, followed by China (14.403 ha), Mexico (12.570 ha), and Spain (10.183 ha) (Anonymous 2018a) (Table 5).

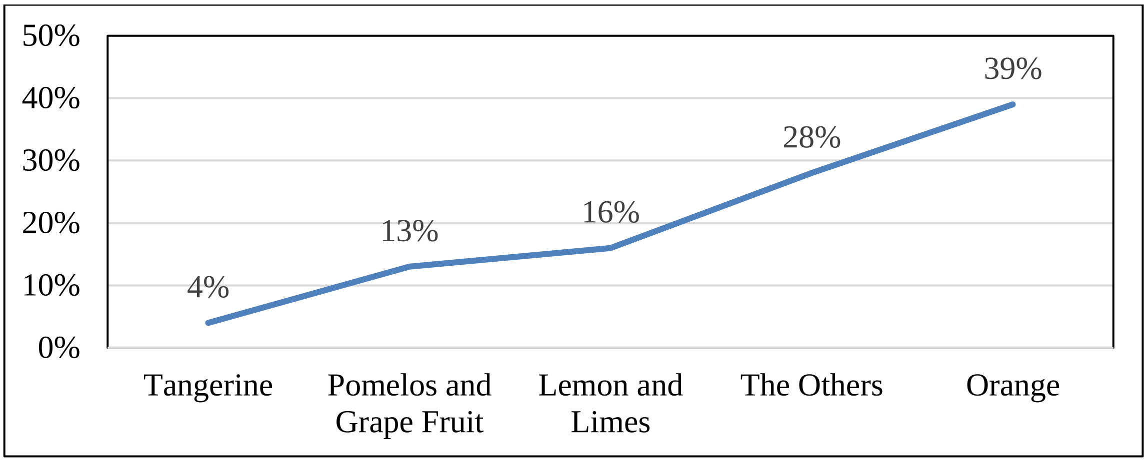

Figure 5. Distribution of the organic citrus area by citrus type

Table 6. Organic area by country in Cirtus Fruit (2016 year)

Country	Organic Citrus Production Area (ha)
Italy	36.125
China	14.403
Mexico	12.570
Spain	10.183
United States	4.919
Ghana	4.105
Morocco	1.526
Greece	1.476
Egypt	1.190
Argentina	1.011

North American continent that consumes the most organic products (117 Euros) per capita. Also the country that consumes the most organic products is Switzerland (274 Euro). This is followed by Denmark (227 Euro), Sweden (197 Euro), Luxembourg (188 Euro) and

Australia (177 Euro) (Anonymous, 2018a) (Figure 6).

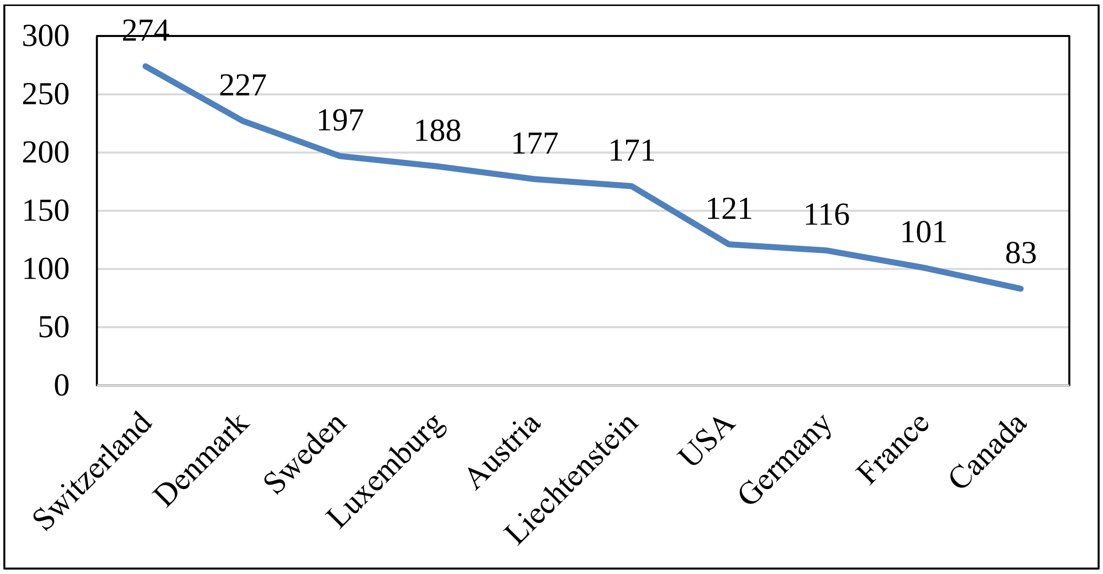

Figure 6. Important Countries Consuming Organic Products in the World (2016)

2. Organic Agriculture in Turkey

Turkey has the organic production area of 38.2 million hectares. Aydın (55.607 tons), Manisa (35.611 tons), Malatya (34.813 tons), Izmir (29.914 tons) and Nigde (21.371) are the most important provinces in Turkey (Table 6). Fig (17.963 tons) and apple (7.351 tons), in Aydın; grape (16.667 tons) and olive (5.362 tons) in Manisa; apricot (29.289 tons) and mulberry (0.738 tons) in Malatya;, olive (4.176 tons) , fig (3.489 tons) and grape (2.877 tons) in İzmir, and apple (19.068 tons) and apricot (0.789 tons) in Niğde are cultivated as organic (Anonymous, 2018b).

Table 6. Provinces of Turkey in the cultivation of organic fruits

Province	**Production (ton)**
Aydın	55.607
Manisa	35.611
Malatya	34.813
İzmir	29.914
Niğde	21.371

Turkey's organic fruit production is 658.661 tons. The highest organic fruits are produced in Olive (219.075 tons), fig (92. 929 tons), grape (90.,385 tons) and apple (78.905tons) (Anonymous, 2018b) (Table 7.).

Table 7. Fruit cultivation of organic production in Turkey (2016 year)

Fruits	**Production (ton)**	**Fruits**	**Production (ton)**
Olive	219.075.00	Mandarin	2.425.64
Fig	92.929.00	Pears	2.256.97
Grape	90.385.00	Plum	2.213.55
Apple	78.905.00	Orange	1.881.89
Apricot	47.654.00	Pistachio	1.767.80
Tea	20.552.00	Chestnut	887.81
Pomegranate	26.836.06	Lemon	758.11
Hazelnut	15.093.18	Quince	677.67
Sour Cherry	6.616.80	Grapefruit	671.93
Cherry	5.768.74	Kiwi	597.18
Walnut	5.735.03	Mulberries	520.66
Strawberies	3.851.30	Peachs	582.40

In 2016, Turkey's most exported products are fig and fig products (3,676 tons), nuts and nut products (2,466 tons) of dried fig (3.33 tons). It is followed by apricot and apricot products

(1.845 tons), other fruits (1.758 tons) and pistachios (0.022 tons) (Table 8).

Table 8. Most of exports organic fruits in Turkey's (2016)

Crops	**Amount (Ton)**	**Price ($)**	**% Ton**	**%$**
Fig and Fig Products	3.676	18.665.594.94	21.9	24.0
Hazelnut and Hazelnut Products	2.466	24.975.616.46	14.7	32.1
Dried Fig	3.393	12.456.025.53	20.2	16.0
Apricot and Apricot Products	1.845	10.996.054.17	11.0	14.1
Fruits and Fruits Products	1.758	6.222.986.33	10.5	8.00
Pistachio	22	492.932.44	0.1	0.6

According to 2016 data, Turkey obtained from 15.513 tons of organic products export to approximately 75 billion dollars. Especiallly, these products are expoted toUnited States (2.897 tons), Germany (2.414 tons), France (1.979 tons), Holland (1.495 tons) and Switzerland (1.281 tons) respectively (Anonymous, 2018b) (Table 9).

Table 9. Most organic products export countries Turkey's (2016 year)

Country	**Amount (Ton)**	**Price ($)**	**%$**
USD	2.897	14.357.313.26	18.4
Germany	2.414	13.402.071.14	17.2
France	1.979	11.463.475.50	14.7
Holland	1.495	10.593.721.25	13.6
Switzerland	1.281	6.353.764.37	8.2
Italy	568	4.807.593.23	6.2
Britain	799	4.144.944.06	5.3
Sweden	564	3.139.275.90	4.0
Canada	698	2.599.795.22	3.3

Japon	213	1.248.665.52	1.6
KKTC	2.318	887.299.79	1.1
Avustralia	175	776.312.81	1.0
Denmark	112	582.517.08	0.7
Total	**15.513**	**74.356.749.13**	**95.5**

Table 10. Countries that Turkey'simport organic products (2016 year))

Crops	Amount (Ton/Litre)	Import Country
Olive oil	1.000	Italy
Dired Fruit (Plum, Aplle, Date, Goji Berry)	334.88	Kirghizistan, France, Irania, Pakistan, Tunisia, Britain, China, Iraq
Juice (Apple and Cherry)	70.7	Germany
Grape (dired)	61	USD, Slovenia
Friut Puree (Banana)	20	Equator
Coconut oil	2.2	Philippines
Herbal Tea	0.14	Germany
Pistachio	0.04	Kirghizistan

Turkey imports olive oil from Italy (1,000 tons), dried fruits from Kyrgyzstan, France, Iran, Pakistan, Tunisia, Pakistan, Tunisia, Britain, China and Iraq (33.38 tons), fruit juice from Germany (70.7 l) in 2016 (Anonymous, 2018b) (Table 10).

Conclusion

In recent years, interest in organic fruit growing has been increasing both in the Turkey and in the world. This tendencey, it can be enabled organic agriculture practices to be widespread in fruit growing. However, selection of suitable ecology, cultivation with the perfect cultivars, using of tolerant rootstocks which are different soil conditions and disease-pests (such as drought, salinity, high pH and heavy metals), application of cultural (organic fertilizers, biotechnical combat with diseases and pests etc.) and technical (organic compounds for flower and fruit thinning, planting and pruning systems) should be considered.for increasing organic fruit growing.

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Biological Filtration By Using Mammalian DNA

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ABSTRACT

In paralel with the rapidly increasing industrialization in developed countries, the volatile organic carcinogenic substances such as formaldehyde, chloroform and benzene accumulate indoor more than other environments. Benzene, formaldehyde, 3-butadiene, chloroform carbon tetrachloride, 1,4-dichlorobenzene, acetaldehyde, naphthalene, perchlorethylene, and ethylene chloride are the volatile organic subtances having the highest risk.

The cytochrome P450 (2e1) gene in mammals and prokaryotes catalyzes the oxidation of various structurally different compounds. These enzymes are involved in the oxidation of many drugs and alcohol metabolism in human. It also oxidizes a wide range of important volatile organic carcinogenic substances such as benzene, trichlorethylene, chloroform, and carbon tetrachloride in many indoor areas. A study was conducted by The National Aeronautics and Space Administration to increase the air quality inside the space station and plant species that can be used to clean the air were discovered. Pothos ivy was one of those species. In 2018, scientists at the University of Washington transformed the rabbit cytochrome P450 2e1 gene to Pothos ivy via the *Agrobacterium infection* and allowed it togrow in culture.

Then, the researchers exposed genetically modified and wild type Pothos ivy plants to volatile organic gases in tubes and compared the results. The level of benzene and chloroform was found to be decreased by 82% in the tube containing genetically modified plants, while no change was detected in tube with wild type. This result suggested that genetically modified plants could be used as biological filter store move the toxic compounds in houses. The use of similar biological filtration techniques, could increase the quality of life by spending less energy.

Keywords: *Biological filter, mammalian DNA, Pothos ivy, volatile compounds*

INTRODUCTION

Air quality is a global problem which threat to human health and causes to lead economic loss (Seppänen and Fisk, 2006: 957). With a rapidly growing shift towards greater urbanisation globally (World Health Organisation, 2016: 14), the population exposed to indoor air pollutants is likely to continue to increase. The quality of the indoor environment has become a major health issue in the developed world; because, urban-resident began to spends approximately 90 % of their time in indoors (Krzyanowski 1999:230; Wang et al. 2007:104). In recent years, incentives to evolve energy efficiency have facilitated the development of thermally insulated buildings, which require less energy for ventilating, heating and airconditioning systems (Maisey et al., 2013:546). Common air pollutants in different indoor environments contain volatile organic compounds (VOCs; e.g., benzene and formaldehyde), carbon monoxide and dioxide (CO and CO_2), polycyclic aromatic hydrocarbons (PAHs) and nitrogen oxides and dioxide (NO and NO_2) (Geiss, O. et al., 2011:3676).

Worry about poor indoor pollution have steadily increased since the early 1950's when relationship between allergies, chronic illnesses and indoor air quality were first perceived. (Randolph and Ralph, 1980: 70; Weschler, 2009:156). Continuous exposure to poor indoor air quality, may case cardiovascular and respiratory diseases eventually lend to the well-known 'sick building syndrome' (SBS) and 'building-related illnesses' (BRI) (Brilli et al, 2018:507). Removing indoor pollution can help to decrease the risk of indoor health concerns, particulary Legionnaires' disease (Sundell, 2017:708), respiratory allergy (Guan et al., 2016: 1939; Lukcso et al., 2016:85) and children's asthma (Huang et al., 2016:154).

Indoor Air Pollution

Poor indoor air quality results from polluted air entry buildings from outdoors. For example CO2 from dwellers respiration, particulate matter released from occupant activities, such as cooking (Buonanno et al., 2009: 3235), and a range of VOCs off-gassed from a wide array of cleaning products and synthetic materials (Torpy et al., 2013:10). Air pollutants that are mainly create within the indoor environment, such as VOCs, often accumulates in indoor air owing to the reduced building air conditioning rates that accompany modern building drafts (Weschler, 2009: 157).

Table.1. Types and sources of pollutants in the indoor air (Lin et al, 2017:2544)

Origin	**Main Pollutants**
Outdoors atmospheric exchange	Particulate matter, Ozone, Carbon oxides, Nitrogen oxides, Pollen,
Structure materials such as glues, wallpapers, paint, upholstery	Alcohols, Formaldehyde, Benzene, Toluene, Insects
Furnishings and decorative materials, carpets, heater, televisions, refrigerators	Particulate matter, Formaldehyde, Acetone, Ethyl acetate, Insects, Benzene, Carbon oxides, Ammonia, Fungi
Office materials, photocopiers, printer, inks, computers, fax, paper, cosmetics	Particulate matter, Ethanol, Carbon oxides, Ozone, Formaldehyde, Ester, Acetone, Nitrogen oxides, Bio-aerosol, Ammonia,
Activities of households, smoking, cooking, foods, cleaning	Particulate matter, Ether, Acetate, Alcohols, Fungi, Benzene, Eater, Carbon dioxide, Bio-aerosol
Planting and Pets	Particulate matter, Sulphur compounds, Carbon dioxide, Insects, Methane, Ammonia, Ethyl acetate, Bio-aerosol,

In improved countries, the well-know and most important pollutants are CO2 (Ramalho et al., 2015:115), particulate matter (Morawska et al., 2013:462) and VOCs (Wolkoff, 2013:371) Although other pollutants have been identified in the indoor air, such as O3 (Wisthaler and Weschler, 2010:6568), and NO2 (Bozkurt et al., 2015:590), we focused on VOCs in this review.

Volatile Organic Compounds (VOCs)

Recently, interest n VOCs which is an important contributor to indoor air pollution has increased due to the adverse effects on human health (Jones 1999:4535; Kabir and Kim, 2012:137). VOCs are mainly sourced indoor pollutions from a broad array of building materials, synthetic materials, furnishings, paints, plastics, varnishes, rubber, waxes, electronic equipment, carpets, solvents, cleaning products, cosmetics, lubricants, adhesives, curtains, office equipment such as printers, copiers and papers, gas cooktops, smoking and with maximum spreading when the new material (Zhang et al., 1996:184; Akbar- Khanzadeh et al., 1997:657; Schlink et al., 2010:3840; Kim et al., 2010b:1489; Maisey et al., 2013:546; Torpy et al., 2013:10; de Gennaro et al., 2015:115). İndoor air contaminants is of particular concern, with over 200 VOCs defined as pollutants (Kostiainen, 1995:693). The highest risk VOCs are 1,3-butadiene, naphthalene, 1,4-dichlorobenzene (PDCB), acetaldehyde, perchloroethylene, carbon tetrachloride, ethylene dichloride, benzene, formaldehyde and chloroform (Zhang et al., 2019:325).

In paralel with the rapidly increasing industrialization in developed countries, the volatile organic carcinogenic substances such as benzene, chloroform and formaldehyde accumulate indoor more than other environments (Zhang et al., 2019:325). Several VOCs, such as formaldehyde (Khanchi et al., 2015:152) and benzene, are known to be carcinogens. Also, Logue et al. Showed that residential concentrations of 18 out of 59 VOCs exceeded guideline values (Logue et al., 2011:99).

One of the dangerous VOCs related with indoor air pollution is formaldehyde, a colorless and odorous gas, that can cause nasopharyngeal cancer and sensory irritation. (Xu et al., 2011:314; He and Zhou, 2014:44; Vazquez and Adams, 2014:399). In general, the amount of formaldehyde in newly built or restore residences are often higher than in old buildings and reach its minimum after ten years. (Park and Ikeda, 2006:129; Tang et al., 2009:1210; Kim et al., 2010a: 90; Xiong et al., 2016:734) so, it is too much time to breathing this carcinogenic chemical into lungs (Colls, 2002:455). Even if each compound VOCs' is probably to be present in very low density, the mixture can produce additive and possibly synergistic effects (Weschler and Shields 1997:156; World Health Organization 2000: 13). For example formaldehyde and benzene has only 30-min average concentration guideline value of 0,1 mg m-3 (100 μg m-3), and this can cause blood dyscrasias. (World Health Organization 2010:141). Studies showed that long-term exposure to indoor formaldehyde cause low birth weight, premature birth, leukemia in children, congenital anomalies, genotoxicity and cancer (ATSDR, 2011:221). Also, it can case short-term effects such as eye irritation, eye redness, irritation and frequent blinkingin the upper respiratory system (Europe, 2010:112). VOCs in the indoor pollutants as xylene and toluene has been lead to several health problems, such as caues building-related illness /or sick building syndrome (Brinke et al., 1998:140) and worse asthma symptoms (Fuentes-Leonarte et al., 2009:231;

McGwin Jr et al., 2010:313), while well known VOCs, such as acetyl aldehyde, have been identified as endocrine disruptors (Kawano et al., 2012:135), and others have been correlated to problems with the hepatic renal, nervous and respiratory systems (Sriprapat et al., 2014:2603). Pollutants in indoor environments change according to season and are maximum levels in the wintertime because of closed windows (Edwards et al. 2001:4531; Rehwagen et al. 2003:283; Schlink et al. 2004:3840)

Cleaning Indoor Pollution

NASA compared health issues correlated to pollutions indoor air in totally closed occupied systems in outer space, and more than 300 VOCs were identified in the space stations.

Primarily, NASA investigated use of plants to enhance air quality in indoor spaces such as space stations (Wolverton et al., 1989:1). Wolverton and teams demonstrated over 50 species of houseplants had increased air quality and decreased VOCs levels in the air (Wolverton et al., 1989:14; Wolverton, 1996:12). The use of plants to improved poor indoor air quality offers a cheaper method than other methods (Darlington et al., 2001:240; NASA, 2007:64) and it is to considered a feasible alternativeto the use of such as technology-based systems (Guieysse et al., 2008:398). The addition of indoor plants has been shown to greatly diminish the amount of VOCs in indoor air, in this way, decreasing the health risks to the people exposed to VOCs (Xu et al., 2011:314). As the “green liver” known houseplants are commonly touted as having the ability to cleaned pollutant indoor air (Sandermann, 1994:225).

Several studies have showed that common houseplants can clear benzene formaldehyde and other VOCs from indoor air, but these studies indicated fairly variable results:

Wolverton and `Wolverton (1996) demonstrated that houseplants absorb, translocate or metabolize, air polluting organic chemicals to microbes growing on and around plant roots where they are biodegraded. Kim et al. (2008) reported that plants can absorb and metabolize gaseous formaldehyde. Similarly, Xu et al., (2011) observed thatsome plants can the highest formaldehyde removal capacity compared with others. In addition, Irga et al., (2013) showed that hydroculture plants have the potential to remove VOCs. Moreover, Setsungnern et al., reported that (2017) LED light could help plants to increase their benzene disposal performance and reduce benzene into less toxic compounds.

There is much confirmation in these studies that plants will reduce the amount of VOCs through various processes within the plants, so, decreasing the harmful effects of these VOCs in the human body.

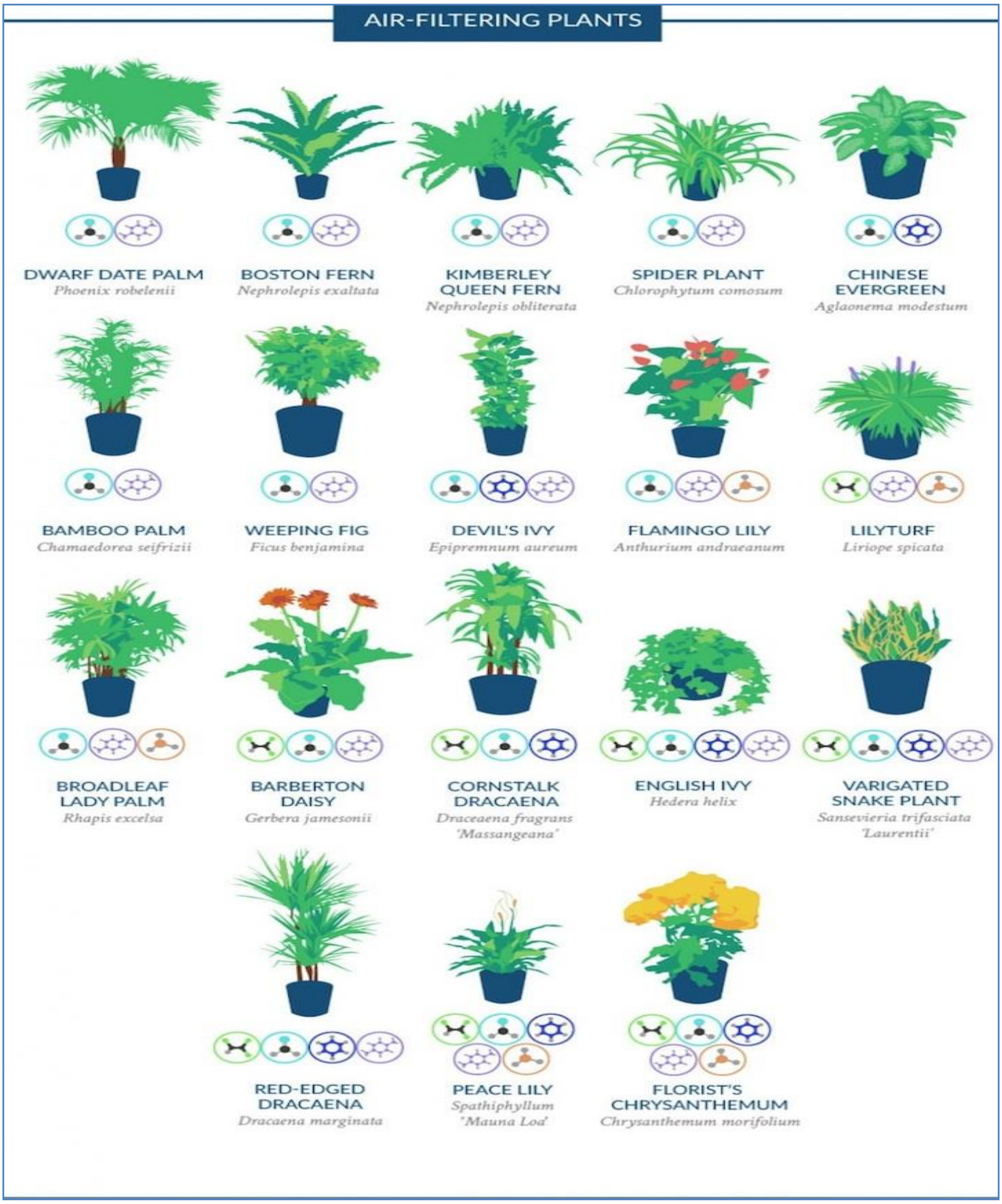

Fig 1. List of the Best Air-Cleaning Plants for Homes (NASA)


https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/19930073077.pdf

(20.05.2019)

Cytochrome CYP P450 2E1 (CYP2E1)

The mammalian (rabbit) cytochrome P450 2E1 oxidates a wide wide of important VOCs found in home air, such as carbon tetrachloride, benzene, vinyl chloride, chloroform, , bromodichloromethane and trichloroethylene which are all common environmental pollutants that pose risks to human health (Doty et al., 2007:16816; James et al, 2008 :289). CYP2E1 represent one of the oldest and largest gene superfamilies coding for enzymes present in the genomes of all biological kingdoms (Degtyarenko and Archakov, 1993:1). Generally, they action as terminal monooxygenases enzyme systems refers to a family of heme proteins present in all mammalian cell types, except mature red blood cells and skeletal muscle cells, which catalyze the oxidation of a wide variety of structurally diverse compounds (Özerol, 1996:3; Mansuy, 1998:5). In mammals reactions carried out by P450s are extremely diverse and contribute to the biotransformation of drugs, the bioconversion of xenobiotics, the bioactivation of chemical carcinogens, the biosynthesis of physiologically important compounds and it metabolizes both endogenous substrates, compounds, including fatty acids,prostaglandins, steroids, ethanol, acetal and acetone, as well as exogenous substrates including benzene, ethylene glycol, carbon tetrachloride, and nitrosamines which are premutagens found in cigarette smoke (Hasler et al,1999:2; Doty et al., 2007:16816).

Therefore, In 2018, scientists at the University of Washington (Zhang et al., 2019) wondered if introducing a mammalian gene called CYP2E1 to a common houseplant, pothos ivy (*Epipremnum aureum*), also known as “devil’s ivy”, would boost the plant's detoxifying potential. The following method was used research team.

The researchers, mammalian (rabbit) cytochrome P450 2e1 gene was transformed to Pothos ivy via the Agrobacterium infection. The plant was allowed to grow in culture (Zhang et al., 2019:326).

- Then, genetically modified and wild type ivy plants were exposed to volatile organic gases in glass tubes (Zhang et al., 2019:326).
- To test how well the modified plants work, they were placed in glass tubes with high concentrations of chloroform or benzene gas into each tube (Zhang et al., 2019:326).
- The levels of pollutants in each tube were measured (Zhang et al., 2019:326).
- Within three days, the concentration of chloroform reduced by 82% with the modified ivy and it was barely detectable after 6 days (Zhang et al., 2019:329).

- After eight days, the benzene concentration in the tubes with the modified plants had decreased by approximately 75% (Zhang et al., 2019:329).

CONCLUSION

Increased indoor air pollution is a critical problem which threat to human and public health. Also, this problem causesa serious economic burden for the governments considering health and environment costs. Genetically modified plants could be used as biological filters to remove the toxic compounds in houses. The use of biological filtration techniques could increase the quality of life by spending less energy. However, there is a need further research to prevent possible negative consequences as there are various debates on genetically modified plants.

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Evaluation of Efficiency Relationship of Fertilizer Use in Olive Growing in Plain and Mountain Villages in Kilis

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ABSTRACT

Olive which is considered take place in all religions, has a wide range of use with its rich historical background in our country as well as all over the world. Olive trees that can grow in all conditions in all kinds of terrain can provide products without requiring much maintenance and cost. As this abusive tree shows in periodicity, it gives one year full product and gives fewer products in the following year. If the conditions of nutrition and care are improved, it can be less affected by the period. In our country, olive oil is produced in most of our provinces and oil and table production is made in Southeastern Anatolia Region. Kilis oil type, which is one of the varieties specific to our region, has a high fat content and it grows on 28,130 hectares of land in Kilis province and produces 10.013 tons per year. 16.878ha area of cultivation is made in Red Brown Mediterranean soils while the remaining part is made in dry conditions on soil belonging to Basaltic soil group. Olives are grown in 150cm deep base ground; 75cm deep in stony and rocky mountain villages in dry conditions, rain water feeding successfully produced. Fertilization and maintenance processes vary according to culture. In this study, it was aimed to evaluate the relationship between fertilizer usage and fertility in olive production by comparing the plain and mountain villages of the 50 family enterprises determined from the villages in the central and Musabeyli districts of Kilis. The survey was conducted using simple random sampling method. As a result of the study, it was determined that fertilizer usage was more in the central villages than in the mountain villages and accordingly the yield was higher. Fertilization and maintenance operations are carried out in traditional mountain villages. While 27% of the producers in the central villages made chemical and organic fertilization, this value was determined as 12% in the mountain villages. The sensitivity to fertilization and maintenance processes is related to the education level and it has been observed that the educational activities carried out by the agricultural institutions in the region have been supported.

Key Words: *Olive, Fertilization, Yield, Drought.*

ÖZET

Tüm dinlerde kutsal sayılan zeytin, tüm dünyada olduğu gibi, Ülkemizde de zengin tarihsel geçmişi ile geniş kullanım alanına sahip olup, özellikle sağlık alanında şifa kaynağı olarak yaygın şekilde kullanılan zeytin ve zeytinyağı önemli bir yere sahiptir. Her türlü arazide, her koşulda yetişebilen zeytin ağacı fazla bakım ve masraf gerektirmeden ürün verebilmektedir. Bu kanaatkâr ağaç, periyodisite gösterdiğinden, bir yıl tam ürün verirken, sonraki yıl daha az ürün vermekte ya da hiç ürün vermemektedir. Beslenme ve bakım koşulları iyileştirilirse periyodisteden daha az etkilenebilmektedir. Ülkemizde çoğu ilimizde üretimi gerçekleştirilen zeytin, Güneydoğu Anadolu Bölgesinde yağlık ve sofralık olarak üretilmektedir. Kilis ilinde 28.130 ha alanda zeytin yetiştirilmekte ve yıllık 10.013 ton üretim gerçekleştirilmekte olup üretimin büyük çoğunluğunu yüksek yağ oranına sahip Kilis yağlık çeşidi oluşturmaktadır. Yetiştiriciliğin yaklaşık %60'ı Kırmızı Kahverengi Akdeniz toprakları, geri kalan kısmı ise Bazaltik toprak sınıfına giren ait topraklar üzerinde ve kuru koşullarda yapılmaktadır. Zeytin derin toprak yapısına sahip taban arazilerde yetiştiği gibi, dağ köylerindeki toprak derinliği az, tabanı taşlık ve kayalık olan arazilerde de kuru koşullarda, yağmur suyu ile beslenerek başarılı bir şekilde üretilmektedir. Yetiştiricilik yapılan yere göre gübreleme ve bakım işlemleri değişiklik göstermektedir. Bu çalışmada, Kilis ili Merkez ve Musabeyli ilçelerine bağlı köylerden belirlenen 50 aile işletmesinin, zeytin üretiminde gübre kullanımı, budama başta olmak üzere kültürel bakım işlemlerinin verimle olan ilişkisini ova ve dağ köylerini karşılaştırarak değerlendirmek amaçlanmıştır. Anket çalışmaları basit tesadüfi örnekleme yöntemi kullanılarak yürütülmüştür. Araştırma sonucunda, merkez köylerde gübre kullanımının dağ köylerine göre daha fazla olduğu buna bağlı olarak verimin de fazla olduğu belirlenmiştir. Gübreleme ve bakım işlemleri dağ köylerinde geleneksel ve yeniliklere kapalı olarak sürdürülmektedir. Merkez köylerde üreticilerin %27 si kimyasal ve organik gübreleme yaparken dağ köylerinde bu değer %12 olarak belirlenmiştir. Gübreleme ve bakım işlemlerine olan duyarlılık eğitim düzeyi ile ilişkili olup, tarım kurumlarının bölgede gerçekleştirdiği eğitim çalışmalarının desteklediği görülmüştür.

INTRODUCTION

Throughout history, olive has been the source of prosperity and peace for humanity in the countries around the Mediterranean. In addition, the importance of human health and nutrition is known from past to present. The history of cultivated olives goes back to 6,000 years, but the first culture on earth is one of the types of wood taken. If the conditions of nutrition and care are improved, it can be less affected by the period. he olive matures are long and slow.is a process. The length of this process is essentially the geographical location of the place where depends on activities and the type of olives (Boskou,1996). 95% of the world's olive production areas are located in the Mediterranean region is seen (Artık and Tokusoglu, 2010). Olive and olive oil are very important in terms of health. Olive oil should also be consumed every day for healthy life taking place in health shows its importance (Durlu-Özkaya and Sefa, 2014). The average life of an olive tree is 300-400 years, but 3 thousand years old olive trees were also found. Therefore, the name of the olive tree in mythology and botany "immortal tree" is (Karabulut, 2013). In our country, olive oil is produced in most of our provinces and oil and table production is made in Southeastern Anatolia Region. Kilis oil type, which is one of the varieties specific to our region, has a high fat content. In the province of Kilis, olives are cultivated on 28,130 hectares of land and the annual production is 10.013 tons. 16.878ha area of cultivation is made in Red Brown Mediterranean soils while the remaining part is made in dry conditions on soil belonging to basaltic soil group. Olives are grown in 150cm deep ground terrains, 75cm deep in the stony and rocky mountain villages in the dry conditions, rain water is fed with a successful breeding (Anonim, 2018).

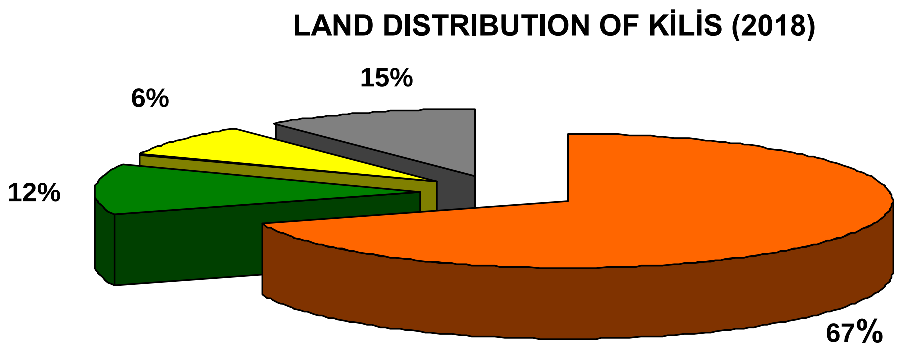

Figure.1 Kilis city land distribution 2018 year

Agriculture Area   *Forest Area*

Meadow Area   *Agriculture Unfavorable Areas*

As seen from Figure 1, agricultural production is carried out in a large part (67%) in the territory of Kilis province. At the same time, 10.013 tons of olives are produced in 280.432 decares of land in Kilis. This shows us that Kilis is a city with a potential of agricultural production. Particularly Kilis city has a significant potential especially in olive production and cultivation in Turkey (Fig.1, Table 1.).

Table 1. Plant production status in kilis province

Product Name	2017	
	Planted Area (decare)	Productıon (ton)
Pistachio	63.355	3.217
Almond	2.348	545
Walnut	2013	247
Apple	484	254
Fig	1.017	289
Red Pepper (Spice-Unprocessed)	16.500	29.500
Pomegranate	8.400	6.598
Grape	147.903	84.533
Olive	280.432	10.013
Other products	987	241
TOTAL	523.439	135.437
Source: TUİK 2017		

In this table, 50,695 hectares of agricultural land is 105,500 ha of total agricultural land. 49.019 hectares of this area is cultivated under dry conditions. In this group agricultural land; olive, vineyard, pistachio and other fruits (walnut, almond, mulberry, fig, pomegranate) are produced. Yield and production are mostly related to precipitation. Besides fertilization, fertilization and maintenance processes are the most important factors affecting efficiency. In this study, the approaches of the producers of olive cultivation in the plain and mountain villages of Kilis province to fertilization and maintenance processes were evaluated.

MATERIAL AND METHODS

This research was carried out in the central villages of Kilis Province. Fertilization and maintenance processes vary according to the location of aquaculture. In this study, it was aimed to evaluate the relationship between fertilizer usage and fertility in olive production by comparing the plain and mountain villages of the 50 family enterprises determined from the villages in the central and Musabeyli districts of Kilis. A total of 150 people were interviewed in each group. Kilis city has fertile soil land with agricultural potential in our country. Face to face interviews with these families study was conducted. % was used in the analysis of the data obtained. The data obtained as a result of the interviews were evaluated and interpreted.

RESULTS AND RECOMMENDATIONS

Fertilizer Usage Status

As seen from the table on the use of fertilizers, 62% of non-literate olive producers participating in the study do not apply fertilizers. When 33.33% of the university graduates use organic fertilizers and 15.33% use inorganic fertilizers.

Table 2. Level of education level fertilization practices of 150 people interviewed (% person)

Education Level	Inorganic Fertilizer Applying (% person)	Organic Fertilizer Applying (% person)	Green Fertilizer Applying (% person)	Leaf Fertilizer Applying (% person)	Non Fertilizer (% person)
Nonliterate	1.33	21.33	11.33	4	62
Primary school graduate	11.34	24	7.33	8	49.33
Secondary school graduate	8	28	6	17.34	40.66
High school graduate	11.34	32	5.34	16.66	34.66
University graduate	15.34	35.33	3.34	25.33	20.66

When Table 2 is examined, it is seen that fertilizer processes increase as the education level of the producers in the study increases. It is concluded that this general in fertilization practice is due to the fact that they are members of organic olives producers in Kilis province and they produce organic olives. The ministry of agriculture stems from organic agriculture support from Provincial Directorates. Leaf fertilization is recommended to increase the nutritional status of the olive trees during the fruit development period (Cimato 1990). It has been found that green eye application is one of the traditions of the ancestors and some of the illiterate owners continue to apply green leaves. The relationship with the educational background has resulted in the reverse here. Green fertilization and agricultural use in rural areas were found to be higher in plain (Fig 2). If we evaluate the variety of manure used, we can say that the old villages in the mountain villages continue and the interest in organic fertilizers is high. It can be said that updated information is published more quickly in lowland villages. In this way, lowland villages are more prone to use popular, current and inorganic fertilizers.

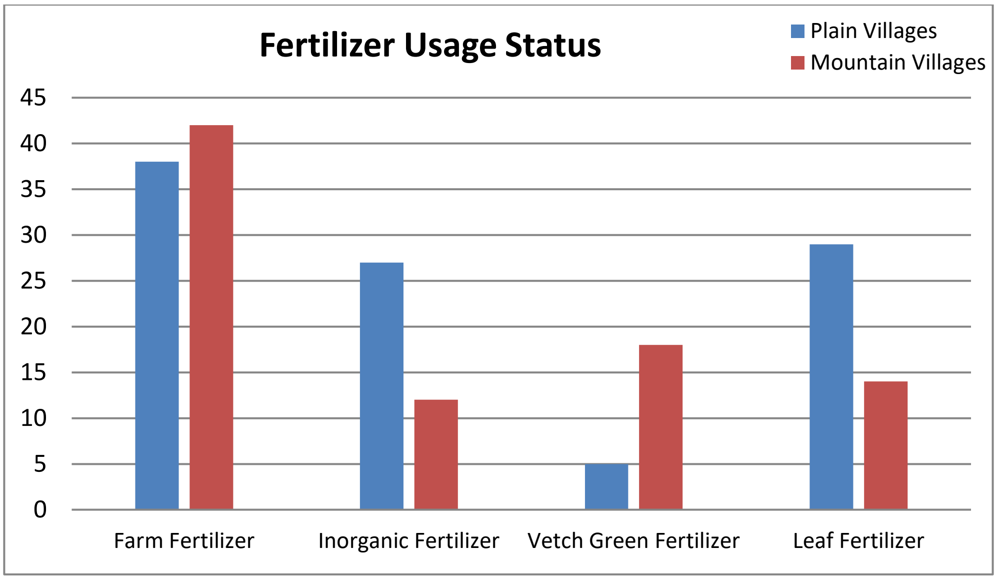

Figure 2. Use of fertilizers in plain and mountain villages

The use of foliar fertilizer has been more common in lowland villages. As the education level of lowland villages is higher than mountain villages, it is determined that the approach to modern practices is more widespread and acceptable in lowland enterprises. The relationship with the level of education results here in the opposite direction. In the mountain villages, it was determined that the use of green fertilization and farm manure was more than in the villages.

Figure 3. Traditional vetch green fertilization in Kilis province mountain village

In interviews with our farmers vetch green manure applications without the grandfather of the fathers in the city of Kilis, was reported to be a very old tradition. While this old application continues in the mountain villages, very few producers in the city know this application. Pruning operations that occur in the province have also been similar in the plains and mountain villages. Most olive producers perform deep pruning after harvesting (Fig.4), (Fig. 5). Olive yield has increased with using traditional vetch green fertilizer in Kilis province (Kuzucu,2018). While organic fertilizers increase yield also provide the soil's productivity (Kuzucu,2019). An important issue is to protect the organic olive cultivation soil and plant in our province. At the same time, yield increases (Gözel et al., 2013).

Figure 4. Performed in Kilis Province Pruning Process

Figure 5. The Wild in the Province of Kilis Pruning Process

Yield

Fertilization is one of the most important factors affecting yield. It is known that fertilization increases yield and quality. As a result of the interviews conducted with enterprises, as a result of the information received from the enterprises that produce Kilis oil types; Ova villages were found to be more prone to use of fertilizers than mountain villages. There was significant difference between fertilization and yield. Although the use of green manure and farm manure in the mountain villages was not successful, fertilizer and foliar fertilizers were not used. As a result of the interviews, the experiences of farmers in the production phase were evaluated from the information they shared.

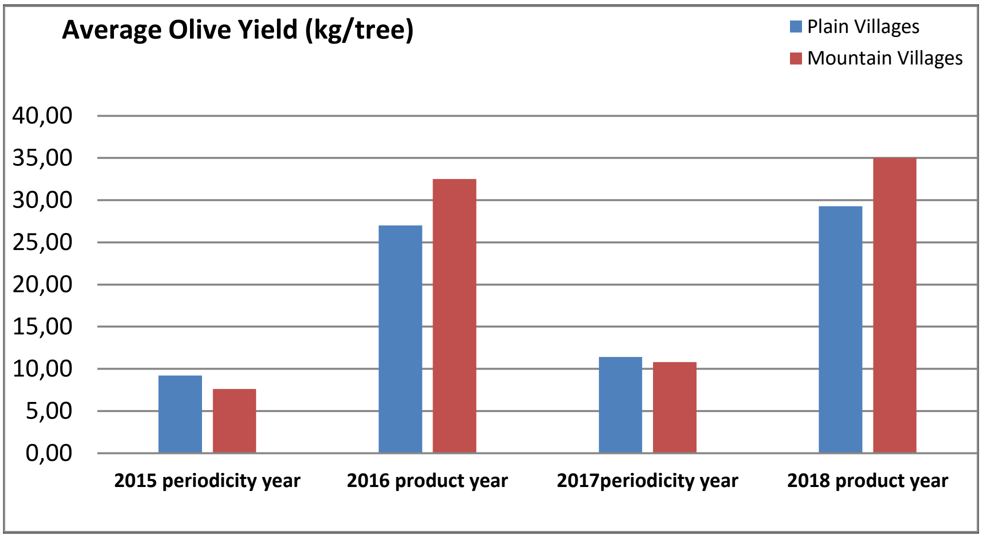

Figure 6. Average Olive Yield

Effıcıency in the olive of nitrogen fertilization the effect on quality study on it was determined that the yield increased 800 g N / tree dose compared to the control. Because the soil depth is low in the mountain villages and the main material is rocky, it is thought that the water need of the olive is less than in the plain villages, the summer months are cooler and that this situation affects the yield positively. It has also been reported that the periodicity affects the nutrient content and annual nutrient consumption of the olive tree. (Fernandez-Escobar et al., 1999 and 2004). In order to establish a physiological balance in the vegetative and generative development of the olive tree and to prolong its economic life, pruning is needed by taking into account the existing or non-existent years. Pruning increases fruit size and meat ratio and provides more yield (Fontanaza, 1988). The application of irrigation and fertilization, which is one of the factors increasing yield and quality in olive, is very important. Sloping terraced terraced terraced terraced terraced trees can be used more than the existing rainfall. Biological pests, environmental conditions and deficiencies in agronomical methods, olives and olives causes low quality.

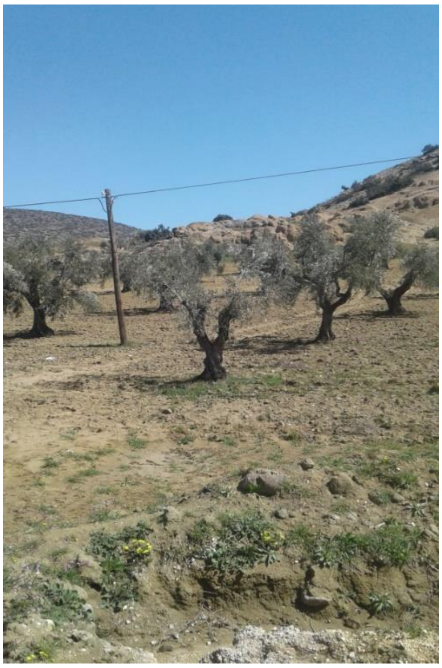

Figure 6. Kilis oil type garden production without fertilization

Decreases in yields are observed in the gardens where the production is done without fertilization and deep pruning is performed after the harvest. Due to the lack of maintenance operations, olive pest pests are seen as intense in these gardens and decreases the quality of olives. The sensitivity to fertilization and maintenance processes is related to the level of education, and it has been observed that the educational activities carried out by the agricultural institutions in the region support the use of modern nutrition and care practices in olive cultivation. For sustainable agriculture, soil fertility should be maintained and maintained. We can add it to the soil with organic matter containing fertilizers and nutrients. As a result of this study, it was determined that fertilizer use was insufficient in olive cultivation in Kilis province and producers in mountain villages were closed to innovations. In addition, it was seen that the training sessions of the agricultural engineers helped the farmers to change their maintenance.

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Incorrect Applications on Olive Cultivation in Southeastern Anatolian Region

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ABSTRACT

Olive trees, symbolled of Mediterranean, have spesific basis for the whole civilization established in that region. It is accepted that maincountry of olive is upper mesopotamia, bordered Mardin, Gaziantep, Hatay, Syria and Palaestine west shores. Olive is grown 800 million trees with nearly 10 million ha area on the world. There are 175.000.000 olive tree on 846.000 ha in Turkey, which is the fourth bigger producer country in the world. Olive Cultivation is one of the most important means of livelihoodin Southeast Anatolia Region. Olive is cultivated about 84,2 thousand hectares in this region (Gaziantep, Kilis, Mardin, Sanliurfa, Adiyaman, Diyarbakir, Batman and Sirnak) which meets Turkey's olive production of about 5%. Area, although the motherland of olive, production mostly concentrated in the provinces of Gaziantep and Kilis. Considering the overall average per tree yield in Turkey remains very low compared to other olive growers in the country. There is also a parallel situation in Southeastern Anatolia. Kilis Yaglik and Nizip Yaglik varieties constitute the majority of cultivars grown in the region. The efficiency decrease is added even when faulty maintenance practices are applied to the genetically seen absolute and partial periodicity in these varieties. Cultural care (pruning, fertilization etc.) practices in olive cultivation and wrong practices in the region were examined.

Key Words: *Olive, Pruning, Fertilization, Yield*

ÖZET

Akdeniz'in sembolü olan zeytin ağacı, tarih boyunca bu bölgede kurulan tüm uygarlıkların temelini oluşturmuştur. Zeytinin anavatanının Mardin, Gaziantep, Hatay, Suriye ve Filistin'in batı kıyılarını içerisine alan Yukarı Mezopotamya olarak adlandırılan bölge olduğu kabul edilmektedir. Dünyada yaklaşık 10 milyon ha alanda 800 milyon zeytin ağacı yetiştirilmektedir. 846.000 ha alan ve 175.000.000 ağaç varlığı ile dünyada 4. büyük üretici ülke konumundadır. Zeytin yetiştiriciliği Güneydoğu Anadolu Bölgesinde en önemli geçim

kaynaklarından biridir. Türkiye toplam üretiminin yaklaşık %5'ini karşılayan bölgede (Gaziantep, Kilis, Mardin, Şanlıurfa, Adıyaman, Şırnak ve Diyarbakır) 84,2 ha alanda zeytin tarımı yapılmaktadır. Bölge, zeytinin anavatanı olmasına rağmen, üretim çoğunlukla Gaziantep ve Kilis illerinde yoğunlaşmıştır. Türkiye'de geneli dikkate alındığında ortalama ağaç başı verim, diğer zeytin yetiştiricisi ülkelerle kıyaslandığında oldukça düşük kalmaktadır. Güneydoğu Anadolu bölgesinde de paralel bir durum söz konusudur. Bölge genelinde yetiştirilen çeşitlerin çoğunluğunu Kilis Yağlık ve Nizip Yağlık çeşitleri oluşturmaktadır. Bu çeşitlerde genetik olarak görülen mutlak ve kısmi periyodisiteye yetiştiricilikte yapılan hatalı bakım uygulamaları eklendiğinde verim düşüklüğü daha da artmaktadır. Zeytin yetiştiriciliğindeki kültürel bakım (budama, besleme vb.) uygulamaları ve bölgede yapılan hatalı uygulamalar irdelenmiştir.

INTRODUCTION

Olive grows in two geographical area between 30-45 latitude degrees in the northern and southern hemisphere in the World. Countries which have Mediterranean coast, such as Spain, Italy, Greece, Turkey, France, Portugal, Tunisia, Morocco, Algeria, Syria, etc. or which have Mediterranean climate, in some micro-climate regions (US-California, Australia, Iran, etc.) olives cultivation is carried out. But economic olive growing is made many European Union (EU) countries, located in Spain, Italy, Greece and Turkey outside the EU, Tunisia, Morocco and Syria, and so on. countries can be expressed (Tunalıoğlu,2008).

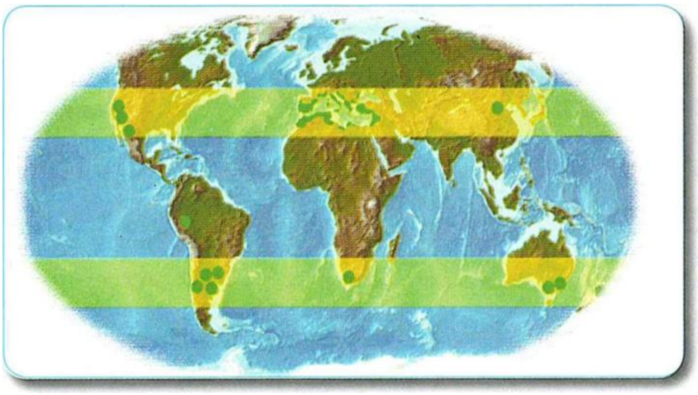

Figure 1. World Olive Cultivation Areas (Rallo et all., 2000)

In the world, 20.872.788 tons of grain olives are produced in approximately 10 million 800 thousand ha area. Total world production 61% of the EU countries, while 10% is produced by Turkey (FAO, 2017). Due to reasons such as periodicity, although the rates can be vary according to years, the ranking of the contries in the production does not change. Olive cultivation, in Turkey, is one of the most important agricultural activities on 846 062 hectares area with 2.1 million tons production (TUİK,2017). In Turkey, important olive grower provinces are Aydın, İzmir, Muğla, Balıkesir, Bursa, Manisa, Çanakkale, Hatay, Antalya, Gaziantep and Mersin. Olives can be grown in Turkey, except Central Anatolia and Eastern Anatolia regions. The most production is carried out in the Aegean region. This is followed by Marmara, Mediterranean, Southeastern Anatolia Regions and some microclimate areas of the Black Sea Region (Tunalıoğlu,2008). The total of olives, produced in the World and Turkey is evaluated, approximately 30-35% for table olives, as the 65-70% for oil (Gözel and Ilgın,2019). The periodicity that is one of the most important problems in the olive production in our country is increasing due to the inadequacy or misapplication of cultural transactions.

OLIVE GROWING IN SOUTHEASTERN ANATOLIA

Approximately 5% of olive production is carried out in Southeastern Anatolia Region of Turkey. In the region where the total agricultural area is 2.316.516 ha, olive cultivation is carried out in an area of 84.195 ha (Gözel and Ilgın,2019). Total production amount is 132,865 tons (Figure 2). 70% of the produced olive is consumed as oil and 30% as table olive.

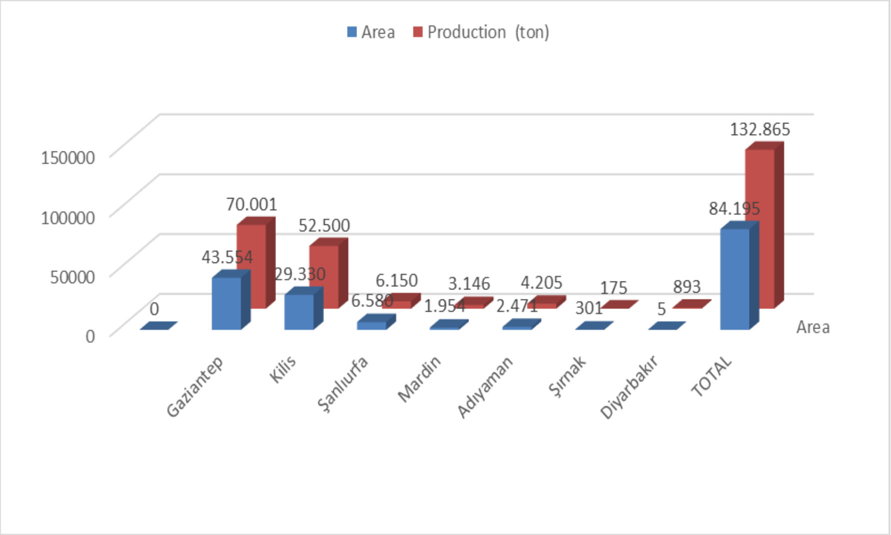

Figure 2. Olive Production Area and Production Quantities in Southeastern Anatolia Region (2018)

According to Figure 2, olive is cultivated in Mardin, Şanlıurfa, Adıyaman, Şırnak and Diyarbakır, mostly in Gaziantep (43.5 ha-70.000 tons) and Kilis (29.3 ha- 52,500 tons).

There are total 17.739.313 olive trees, 14.718.051 fruit bearing and 3.021.262 fruitless tree (Figure 3).

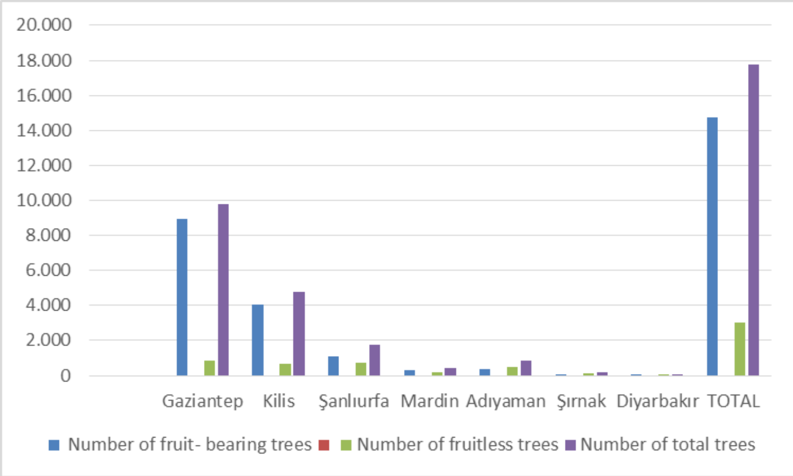

Figure 3. Olive Tree Numbers of Provinces of Southeastern Anatolia Region (2018)

Southeastern Anatolia Region is located in the region which is shown as the motherland of olive.

The amount of yield per tree in the region and Turkey, is low compared to other olive growers countries. Kilis Yağlık and Nizip Yağlık olive varieties constitute the majority of cultivars grown in the region. In addition to these varieties, Halhalı, Eğriburun olive varieties and Kan Çelebi, Yün Çelebi, Yağ Çelebi, Kalembezi, Derik Halhalı, Zoncuk, Belloti, Blue, Hurseki are grown in local varieties (Gözel and Ilgın,2019). When incorrect practices are added to the genetically seen absolute and partial periodicity in Kilis Yağlık and Nizip Yağlık olive varieties, the inefficiency increases.

CULTURAL APPLICATIONS REQUIRED IN OLIVE GROWING AND INCORRECT APPLICATIONS

Olive tree is a kind of fruit that can grow in different soil and climatic conditions and has high adaptability. It is also known as the “rich tree of poor soils" because of these features. Winter cold is the most important factor that restricts olive cultivation in general Olive trees can be grown in a large belt extending from Artvin in the north to Çanakkale in the west, to Hatay in the south and to Şırnak in the east (Ozkaya et all,2008). The main target in olive growing is to take more products than the unit area. The most important factors limiting olive cultivation in the region are; low winter temperatures, lack of precipitation and high summer temperatures.

Selection of Cultivar and Place

While olive cultivation is expanded in the region, areas with low temperature risk should be avoided. Because temperatures below -7^{0}C, depending on its degree and duration can cause damage to some of the organs or all the tree. In variety selection; The type of evaluation (table-oil), whether efficient, early to give the fruit and adapt to the region should be taken into account. In Gaziantep, where cultivation intensified, while more than one type of olives were cultivated and Kilis Yağlık cultivar was grown in Kilis as monoculture. From the beginning of the 2000s, the Ministry of Agriculture distributed state-sponsored olive saplings throughout the country. Almost all of the saplings distributed in our country and in our region have been consist of Gemlik and Ayvalık varieties because it is easier and shorter to produce the saplings and easy to supply. The new gardens were established mostly with Gemlik and Ayvalık varieties due to reasons such as the lack of sapling producers who regularly produce the production of standard olive varieties adapted to the region, inadequate numbers, the lack of breeding parcels to be used in the production of seedlings by seedlings producers. There are some problems in the orchards which are established with these varieties which are very valuable and high quality in their own ecologies, due to the low air humidity in the region and the lack of irrigation. The increase in fruit crust thickness, fruit blackening in the early period and fruit castings are among the problems. Gemlik variety, which is one of the varieties with high water demand, cannot catch the quality of its own ecology except the regions where irrigation is possible. For this reason, the orchard should be established with varieties adapted to the region where irrigation cannot be done. Should not be preferred the domestic and foreign varieties which unknown adaptation ability. Adaptation studies are carried out at research institutes and universities in the region. It should be preferred the saplings which produced by cutting at 1-2 years old, which produduced by grafting at 3-4 years old. Very tall or old saplings should not be buy.

Pollinator Type

Since fertilization plays an important role in productivity, the first condition of obtaining a high level of product is known that self-compatibility situation of olive cultivars. Olive varieties are classified as self fertile, partially self fertile and self infertile. If the variety is infertile or partially self fertile, the orchard should be establihed together with a suitable type of pollinator. In some studies, it has been reported that foreign polination will benefit even in self-infertile varieties in order to obtain sufficient and high quality products (Sibbett ve Osgood,1994). It was determined that having 10% of pollinators in the orchard would be sufficient for a good pollination (Lavee, 1998). Nizip Yağlık variety self-fertile, Kilis Yağlık and Yuvarlak Halhalı varieties self-infertile, Gemlik variety partially self-fertile was found (Korkmaz ve Ak, 2018; Mete ve Çetin, 2017). Importance should be given to the overlooked issue of pollinators. Edincik Su, Ayvalık and Memecik varieties determined as an acceptable pollinator especially for Kilis Yağlık variety, should be planted together with the Kilis Yağlık variety in the orchard.

Sapling Planting

Soil should be processed at a depth of 90-100 cm before planting in the orchard. If there is a ground water problem, the drainage channels must be opened. To determine the amount and type of fertilizer to be used in planting, soil analysis should be done before planting. Planting pits can be opened by hand or using a digger. It should be placed at the bottom of the planting pit which is opened 80x80 cm wide, mixed soil and fertilizer, then, some soil should be put on it, thus, the roots that start to grow must be prevented from direct contact with the fertilizer. The saplings removed from the tube should be placed in the planting pit and filled with soil then soil compressed thoroughly. Another application that must be done after planting is to plant a stick next to the saplings to form straight body, then attached it to the sapling (Figure 4). Due to the stick is not planted, saplings lies right and left, can not develop properly.

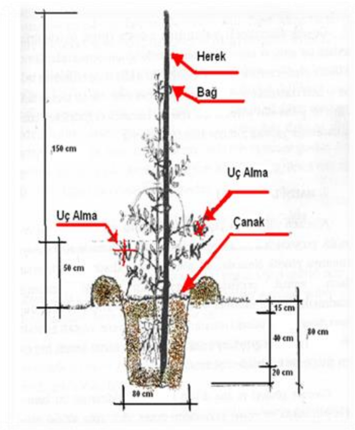

Figure 4. Saplings Planting

Technical information and support are not received in the region before the olive orchard is established. But, it is very important to get pre-facility tecnical support to prevent problems.

Incorrect applications are the planting pit is too small to allow the development of the saplings, very large opening of the planting pit, no analysis of soil for plant fertilization, not planted the stick next to the saplings, multi-thrunk saplings. After planting saplings, single-thrunk saplings should be formed for a straight and strong tree development.

Pruning

Pruning is necessary to shorten the unproductive period in the youth period of the tree, to prolong the productive period, to maintain the balance between vegetative and generative development. For proper pruning, it is necessary to know the physiological period of the tree and pruning accordingly. During juvenility period very little, during yield period mild and when aging begins heavy pruning should be done. While pruning, the natural structure of the tree, the climate of the region should be considered. In order to increase quality of the fruit and yield, the surface area should be increased. Shape pruning is important to give form to the tree. While shape pruning, the saplings should be single-trunk, trunk of the saplings to be overshadow (Figure 5,6).


Figure 5. Multi-trunk saplings / Figure 6. Single-trunk Saplings

The most problematic cultural practice in the region is pruning. Faults are done on pruning time and application. Generally pruning is carried out together with harvesting and intensive branch cuts are performed in region. As a result of the cuts made in this way, the periodicity intensity increases. Hard cuttings should be made every 4-5 years to rejuvenate the branch. Crop pruning should be made as a slight form every year or every two years by using pruning shears in the spring period when fruitful. Another wrong practice is not to cut the brunch from the bottom. The cuts must be made from the bottom of the branch.

Fertilization

Soil analysis should be done to determine the amount of nutrients in the soil for proper fertilization. Unfortunately, fertilization which according to the results of analysis is not very common in our region. Fertilizers are generally used by observing the neighboring orchards. Fertilization in the olive orchards in our region is either not done or is made inadequate or inaccurate. Soil and leaf analysis should be done in both organic and conventional olive orchards, the nutrients required by the olive tree should be added to the soil at the appropriate time. Farm manure is placed on tree around or the surface of the soil, is a wrong application. Both farm manure and other fertilizers except N should be given 15-20 cm deep and covered (Figure 7). N, a critical element for the olive tree, should be sprinkled onto the crown projection and mixed with the help of the rake.

Figure 7. Fertilizer Application

Soil Tillage

The purpose of soil cultivation in olive orchards is the destruction of weeds, preservation of precipitation and irrigation water in the soil, better development of roots and easy harvesting. Soil tillage is carried out in our region in a large number and generally deep. Whereas, olives root system which is used for water and nutrient intake is superficial. In order not to damage this root structure, the tillage should be made superficial and the number of tillage should not exceed 3-4. To avoid erosion in sloping areas, tillage should be perpendicular to the slope, terraces should be created.

Irrigation

Olive tree is known to be a drought-resistant plant. However, water is an important factor on efficiency and quality. There is a very close relationship between rainfall and yield. The small amount of water negatively affects both that year and next year's product. Irrigation when the olive tree needs will have a positive effect on yield and fruit quality. Very few of the olive orchards in the region are irrigated.

Harvest

Due to the large amount of parthenocarpic fruit formation in regional varieties, sticks are usually used in the harvest. The use of sticks causes loss of quality with the physical damage it creates in fruits Also causes damage to the buds which will give the product of the next year. Instead of sticks, it is recommended to use branch and trunk shaker harvest machines, combs and beaters. In this way, fewer leaves are fall down in the harvest.

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Agricultural Water Retention for Sustainable Protection Against Floods and Heavy Rains

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ABSTRACT

Due to climate changes and growing human occupation of floodplains, flood related damages are rising. In many regions, agricultural lands make the largest contribution to flooding. The outflow comes from not sufficiently erosion-protected fields. The conventional methods of protecting floods such as build a canals, tunnels, pipes or large retention basins are expensive and inefficient and offer no retention, no soil and water protection, and often pass the flood to neighboring areas with more momentum and volume. Agricultural retention methods including avoiding soil compaction, ensuring good humus supply, reduced plowing, limiting the cultivation of erosion-promoting crops especially on slopes with silty soil and building small retention basins are cost-effective and environment friendly. Such retention methods not only can reduce flooding and its consequences significantly but also retain nutrients, water, soil and pollutants, thereby, protecting the field from erosion, the waters from eutrophication and pollutant intake, and public and private goods from being damaged eventually benefiting farmers, nature and society. That is, farmers protect their fields and keep needed water and soil back on their fields with very little effort while the citizens are safer from the threats and avoidable damages, and the municipalities are spared from very expensive costs for restraint measures and expenses to repair bridges, canals, roads, paths and other emergency operations. Therefore, the use of agricultural retention method to mitigate flood, can be seen as a perfect win-win situation.

Keywords: *Agricultural Land, Water Retention, Flood, Soil, Erossion.*

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Introduction

Due to climate changes and growing human occupation of floodplains, there is an increase in the magnitude and scale of flood related disasters [1,2]. Climate change scenarios generally imply an increase in rainfall variability and an increase in total precipitation [3-5]. This could lead to severe natural disaster in particular the hydro-meteorological-related disasters such as floods. In recent years, extreme river flooding has occurred in several regions, affecting the lives of millions of people, as well as infrastructure and the natural environment. As a result, there is greater research interest to understand natural disasters and to reinforce risk management.

Floods are known to cause most frequent and widespread disaster in the world [6]. They are not only as a consequence of climate change, but also a consequence of human activity or inaction. Recognizing drainage and erosion by improper human activity can be significantly mitigated by appropriate management. This has been evident since the early Middle ages, or since the beginning of deforestation and subsequent agriculture in the Neolithic age, marked with erosion and flooding in many settlement areas [7]. This damage has already been encountered in ancient civilizations through terracing. The damage caused today is greater than before, because of climate changes, denser residences even in flood areas and land use changes.

Conventional method of flood control

Conventional method involves the direct dissipation of harmful amounts of water away from immediate settlement. It involves more or less of building a wall around a house and pass the water on to neighbors. This method not only transfers the flood risk to neighbors but also it is non-solidarity measure. Currently it is still predominantly practiced protection measure. It continues to harm many with its subsistence, especially those residing on smaller and larger streams and rivers. That is it continues to harm as the subsistence are not relieved it become even faster and more volume.

Conventional flood control measures are often inefficient and offer no retention, no soil and water protection. In addition to that, flood waters, often carry pollutants including microbes, diapers, and hazardous needles that can adversely affect public health [12,13]. Therefore, there is a need for a shift of methods to retain water on agricultural land. The most appropriate measure should be containment at the site of the origin. However, flood control measures are primarily dominated by hydrologists and engineers of municipalities planners, therefore, agricultural expertise are primarily needed to be added in the planning.

Water retention measures

Water retention, according to the ecosystem services regulating concept of flood mitigation, is the capacity to store and retain quantities of water. Therefore it can reduce the impacts of extreme climatic changes and mitigate flooding.

Retention focus on the containment at the site or source in this case agricultural fields. In other word each region would withhold much of their "outflow" and would no longer pass it on to their subsistence with dramatic consequences. The benefits of such measures are the farmers protect their fields and keep needed water and soil back on their fields. The municipality will avoid expensive costs for restraint measures or repairs to bridges, canals, roads, paths and expensive firefighting operations.

It makes more sense, cost-effective, environmentally sound and generally well-to-do, to protect the water on the field by erosion control measures. It is inexpensive and beneficial than to build expensive conventional canals, tunnels, pipes or large retention basins. Overall, retention methods offer a perfect win-win situation for the farmers, residents and municipalities. Because the farmers protect their fields and keep needed water and soil back on their fields with very little effort, thus taking responsibility for the consequences of their cultivation. The citizens are spared threats and avoidable damage, and the municipalities from coasts of restraint measures.

Use of agriculture to mitigate flood damage.

The threats and damage to settlements in many regions do not come from flooding by large rivers, but by torrential streams and large-scale over-flushing of the villages by drains from not sufficiently erosion-protected agricultural fields. [8-10]. The intensification of agriculture over the years has resulted in greater floods after intense rainfall. Although urban landscape contributes to flooding, the possibilities of agriculture to mitigate damage by flooding are a plausible defensive measure. This is because agriculture occupies a large proportion of the landscape and can play an important role in flood mitigation as well as adaptation. For successful accomplishment therefore, every effort is needed to retain as much water as possible on the fields.

Agricultural practices that reduce the infiltration capacity of the soil are contributing factors for flooding [11]. For example, a drainage system that removes water from agricultural land more quickly, reduce the potential of water retention in the agricultural fields. However, agricultural practices that promote retention of water in the fields can contribute to flood risk mitigation. For example, low ground pressure tyres, low stocking rates, grazing management, contour ploughing, retention ponds and other soil improvement measures can significantly reduce or slow surface runoff from the land, thereby increasing retention.

Where and how can heavy rain be held back effectively can diepent on multiple factors. Settlement areas occupy less area compared to agricultural and forestry land. Forest and grassland have a high infiltration and retention capacity and correspondingly low runoff due to protection of the near-natural vegetation. The problem are arable land and special crops, especially under foil cultivation. Those problematic arable land and special crops are the main flood supply areas, especially the hilly loess-covered erosion-prone areas. Therefore, management of those areas must be carried out in such a way that they absorb the rainfall in the best possible way and guide it into the ground and drain.

Agriculture fields derive large part of the outflow, therefore, the land used by agriculture can potentially contribute to the retention. One of the advantages of retention in agriculture are most efficient and cost effective. Moreover, retention can be operated under soil and water conservation. The retention capacity of agricultural fields are often and are overlooked mainly due to the paradigm that considers agricultural land as an inherent, unchangeable and untouchable. As the result the focus has been on conventional method of flood protection.

Necessary protective measures of agricultural fields.

Agricultural water retention is environmentally friendly and as mentioned before it has collateral benefits for farmers, nature and society. It keep water back, protect the field from erosion, protect the waters from eutrophication and pollutant intake and protects the public and private goods from being damaged. However, it requires large-scale planning and orders beyond local consensus, as it may involve multiple parties and villages and towns. Therefore, it can be achieved only through a common constructive approach and mutual understanding and interests between town and the villages. As the result, retention measures could be carried out wherever they are cheap and efficient to implement, even if they are of no use to the immediate neighborhood.

As part of an integrative agricultural management multiple approach could be used to reduce soil compaction and erosion, thus flooding. Those approaches include mulch tillage, non ploughing, conservative soil cultivation, intercropping, deep loosening of compacted soils, construction of retention basins, cascades and grass stripes below hills.

Use of soil cover, grow erosion-reducing crops and use no-till methods

Mulching refers to the practice of leaving a cover fouling or mulch over the soil surface, for soil and water conservation and growth. Different materials, such as vegetative residues, gravel and crushed stones can be used as mulching. It protects the soil against raindrop impact and the effects of rain on the soil are significantly reduced and consequently also runoff and erosion. Mulching also reduces both the velocity and overland flow generation rates by increasing resistance. [14,15]. Moreover, mulching improve infiltration capacity and increases water intake and storage [16,17].

The formation of runoff depends on the type of crop and the management. Outflows and discharges from cereals, for example in beets and maize, are not only several percent higher, but several hundred percent. For example, soil removal is reduced from 100% at 0% soil coverage (or greening) to 1% at 70% coverage and according to other literature, it reduces from 100% with conventional tillage to less than 10% with preserving tillage, and the overflow drops from 100% to 14% [18]. These few examples may show what extraordinary possibilities farmers have through erosion protection and thus flood control in their hands - and can secure or increase their yields with water retention. And these options will become requirements if damage continues to occur. Farmers therefore have to include the aspects of erosion protection in their planning when selecting their own special crops.

For erosion-prone fields, the urgent recommendation is not to sow or plant erosion-promoting crops in a previously plowed seedbed, but to directly sow in a stubble harvested or green manure supplied field. Because of the risk of erosion on the cultivation to completely abandon cultures would be a serious step. Therefore, all other avoidance options must be used. And it must be noted that small areas of critical crops can significantly increase overflow and damage.

Orchards (tree and shrub crops) protected by grass undergrowth take water by drain, even from additional extraneous water hardly damage. If, however, extraneous water penetrates into them from the upper surfaces, they form ideal routes when arranged on a slope for the drain and speed it up. Grain harvests barely drain at low and moderate slopes; at an advanced stage of growth however, they can use stalks to exert protective effect by restraining sediment from overlying erosive impacts, significantly slowing down the flow rate and allowing infiltration.

No-till farming or conservation tillage is a cultivation that avoids soil inversion and seeds are drilled directly into the ground [21]. This promote stable soil structure and that can provide better habitat for beneficial soil biodiversity [22]. No tillage was first adapted as a soil and water conserving and can reduce runoff from agricultural fields thus, nutrient and sediment losses to downstream . That is no tillage or conserved tillage are necessary in erosion situations, it gives soil stability and as a result, earthworm stocking increases considerably and subsequently the infiltration capacity of the water (infiltrability, permeability) and eventually, the surface runoff is greatly reduced.

Create a small polder (field polder)

As meticulous as the retention measures on the land may be; they alone can not eliminate the risk. Since the floodplains of the receiving water masses are unable to withhold or to dissipate it without damage, thus the inflow of arable land must be further reduced beyond the small damp management.

Overflow and erosion can be significantly reduced if, in addition to the established erosion protection measures on the underside of the slopes of erosion-prone locations a small dam or polders can be created. Although they may not hold back all water, but it can slow down the flow rate, thereby holding back a lot of sediment to which nutrients and pollutants are bound. For example, strong rain on silty fields can not be seeped directly into the ground even with the best management. For short-term retention small dams or "field polders" will be essential especially in areas where surface water and a lot of soil frequently run off the field and endanger roads and settlements. Because the sediments settle as soon as the flow rate decreases when entering the stagnant standing water, the sediment is distributed well within the polders during the sedimentation. In standing water erosion no longer take place, since flow and vortex formation (impact and plan effect) are omitted. That is the accumulated water in a polder protects the soil from further erosion damage, as the result it saves the farmers from channeling and grooving, and extensive removal of water and from stronger local deposits and spills on the lower slope.

Small earth walls or field polders are essential, especially in critical locations, which can hold back the inflowing water for a few days. After passing through the flood peak or even during heavy rainfall it can then be drained under control. During this time soil particles and with them nutrients and pollutants reside. As a result, the land suffers no loss of soil and water, as well as flood areas and sewer systems and residential areas will get lower loads.

The dammed-up bodies of water are "pre-clarified" because sediments and a large part of the suspended matter remain in the polder. After the heavy rain event, the accumulated water gradually oozes - after a few days or is gradually drained through a small pipe without the significant damage of cultures and without losing soil particles and without further supplying additional water for the flood-causing rivers.

Field polders, first and foremost, they are to be laid out where roads and settlements are endangered, where a large retention capacity is needed and where the topography favors their installation. The water can be used for irrigation at the same time retention is also beneficial for the regional water balance and groundwater recharge - especially when climate change progresses.

In sensitive areas, in addition to ditch drainage the integration of ditch-dam system for the protection of roads and settlements have numerous advantages. These include the retention of nutrients and pollutants, water, soil in the field and the reduction of on- and offsite damage.

Terracing across the hill slope.

The major objective of terracing is to reshaped land surface morphology and thus can so that to reduce on-site runoff and soil loss and subsequent effects such as flooding, sedimentation of reservoirs and water pollution. Terraced fields as compared to non-terraced hill slops, greatly contribute to flood control, water and soil retention, and reduce soil disturbance. For example, soil erosion was reduced up to 20 times at terraced sites [23] and, the efficiency of soil and water conservation by terracing with proper field management was up to 99.9% [24].

The effectiveness of terracing can be affected by many factors including the cultivation, terrace structure, soil texture, climate, land use, and topography. Therefore, it is important to understand the effects of tracing when selecting water overflow mitigation strategies. For example, lanes running crosswise and the plants themselves, especially by stalks, shoots and (crown) roots greatly reduce the flow rate of the runoff. Erosion-promoting crops should be change with erosion-friendly crops. This practice is one aspect of soil conservation and therefore needs attention.

Conclusion

Retaining the water in the area is the most important, cheapest, most environmentally friendly and effective flood protection. This principle applies to all erosion-prone or flood-prone areas. There is far too little knowledge about the possibilities and requirements of water retention on arable land. As the result, there is continue rely on large-scale technical construction measures, without paying any attention to the ecological aspect. Agriculture should promote its soils and the landscape, so that it need to be cared to adapt to the climatic and other condition changes.

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Environmental Mitigation Through Soil and Water Conservation in Sub-Saharan Africa

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Abstract

Soil and water degradation and derived effects are getting more importance throughout the world, particularly in Africa. In semi-arid areas, soil erosion by water is the greatest land degradation problem and is an important driving force in the process affecting the landscape and has become one of the most serious environmental problem attracted much attention throughout the world. Unwise use and over exploitation of the natural resources in semi-arid areas of Africa has caused severe land degradation, reducing the quality and quantity of different landscapes, which resulted in drought and famine but also affected the environmental and ecological services. Soil and water conservation (SWC) is the most important part of environmental management and mitigation. It has the capacity to sustainably restore degraded landscapes, thereby, improving the environment and livelihoods of the society. Many studies have shown, successfully implemented SWC interventions, which converted degraded lands into well-established environmental and economic achievements. Proven benefits from restored lands, include increase in the soil fertility and water availability, thereby, increase in agricultural productivity and ecological services. Therefore, SWC programs must be seen as a path toward a successful environmental mitigation and agricultural production.

Keywords: C*limate change Conservation, Soil and Water, Land degradation, Erosion,*

INTRODUCTION

By 2050, the current world population is expected to add 2.4 billion to reach to 9.7 billion. This will result in more pressure on the agricultural systems. On the other hand, climate change could threaten agricultural production by limiting water and soil resources. As the result, the increased pressure on agricultural system coupled with climate change could threaten the environment and world food security.

Soil and water degradation and derived effects are getting more importance throughout the world, partially due to a lack of appropriate identification and evaluation of the degradation processes and of the relations cause-effects of soil degradation for each specific situation, and the generalized use of empirical approaches to select soil and water conservation practices [1]. Soil erosion by water is the greatest land degradation problem and is an important driving force in the process affecting the landscape and has become one of the most serious environmental problem attracted much attention throughout the world [2,3]. For example, inadequate land management and agricultural activities have largely resulted in land degradation [4].

Such negative impact could be potentially mitigated though conservation practices and policies. That is good environmental policies and conservation practices can contribute to positive impact on the environmental quality and its subsequent benefits.

Africa is the main population and climate change hotspotes. Agriculture is highly sensitive to changes such as climate variability. Population is also an important factor related to climate change. In Africa around 30% of the total land area is degraded and around 65% of this is agricultural land [4]. Soil erosion is a major environmental threat affecting food security and environmental health [5]. In addition to soil erosion by water and wind, this degradation is also due to harsh climate conditions and increased pressure on the land resources due to socio-economic factors of increasing needs of a growing population, coupled, with inappropriate land management practices [6,7].

Sub-Saharan Africa, the youngest region of the world, home to over 900 mi people, the population is growing very fast. Sub-Saharan Africa is particularly vulnerable to the impacts of climate change and to natural resource degradation due to the increasing in population size and pressure on agricultural lands that fellow it. Because the livelihood of over 65 % of the population greatly depend on directly rainfed agriculture and natural resources, the impact is greater.

Soil and water conservation is the most important part of environmental management and mitigation. Soil and water conservation programs must be seen as a path toward a successful agricultural production for agriculture. In the last decades, many studies have been conducted in Africa, reporting the effectiveness of SWC [2,4,8,9] such as on regenerating vegetation, rehabilitating the soil [10], and reducing sediment yield [8], but also stating difficulties in implementing SWC, as done for Ethiopia [11,12].

In sub-Saharan Africa, land degradation is related to soil erosion and declining soil fertility as well as increasing drought and loss of biodiversity. Therefore, soil and water conservation is crucial in sub-Saharan Africa for environmental mitigation.

The aim of the present study was to evaluate the applicability of SWC methods and their effects on environmental mitigation in Sub-Saharan Africa.

MATERIAL AND METHODS

The present paper contains a summary of papers dedicated to soil and water conservation and environmental considerations in order to reflect the progress that has been made in publishing articles in the field of environmental mitigation, in Sub-Saharan Africa. In order to fulfil our goals, we searched for articles on soil and water conservation in Science direct, Research gate, Scholar Google and Web of Science. We firstly selected all the articles on soil and water conservation. Then, we selected the articles which clearly mentioned the environmental mitigation and soil and water conservation in Sub-Saharan Africa to understand what has been made.

RESULTS AND DISCUSSION

The literature review indicated that integrated watershed management could be an effective approach in environmental mitigation through soil and water conservation. From the documentary, it appears that:

In sub-Saharan Africa, where the majority of soils are encrusted on the surface and thus generate significant runoff, many techniques of water management and soil fertility such as Zai (improved traditional planting pits), half-moons, benches, micro-dams, grass strips, earth bunds, and stone bunds have been developed and improved over time. These technics are applied in several countries (e.g. Niger, Eritrea, Mali, Ghana, Togo, Cameroon, Tanzania, Zambia, Zimbabwe, Senegal, Burkina Faso, Kenya, Ethiopia, Uganda, South Africa and Madagascar) [13-16].

Several phase of soil conservation technics showed the development of policies and techniques on soil erosion control and the successfully implemented of SWC interventions, converted degraded lands into well-established environmental and economic achievements.

Proven benefits from restored lands, include increase in the soil fertility and water availability, thereby, increase in agricultural productivity and ecological services, expense of grazing lands and bushland, and decreased runoff.

The success of the integrated watershed management was the effectiveness of the implementation approaches including the participation of the local community in the form of a contribution.

Environmental mitigation through Soil and Water Conservation

Principles for success

Communication: Environmental mitigation through soil and water conservation are only successful when all parties especially the primary beneficiaries, that is farmers, are involved in planning and decision-making. Therefore, communication with the farmers as well as with the general public is necessary to produce awareness of the benefits of soil and water conservation which is essential for sustainability of the mitigation process. On top of that, continuous training will help to have an educated workforce.

Conservation practices: Keeping the surface covered, with plant residues, for example by avoiding harvesting of plant residues if soil function will be affected. This will prevent soil erosion greatly. Moreover, agro-forestry can help improve landscape diversity benefiting the environment. Moreover, there is a need for protecting water quality and an increase in water-use efficiency. For mitigation and adapting to climate change, having diversity through diverse cropping systems will be essential.

Research programs: New Science and Technology developments, can greatly contribute to climate change mitigation and adaptation, through soil and water conservation. That is, as different soil and water conservation measures are taken, they need to be researched to asses their effects. However, if the mitigation measures are not properly registered and there will be lack of enough evidence to make a decision in policy making.

Challenges

There are many soil and water conservation initiatives in sub-Saharan Africa with successful implementation. However, many initiatives were not realized due to multiple challenge. Some of the challenging factors include, extreme weather, the absence of education, planning, incentives, technology and community involvement.

Extreme weather: In Sub-Saharan Africa countries extreme weather is one of the main challenges of soil and water conservation. Not only it accelerate the rate of erosion but also threatening agricultural production and crate create environmental problems. For example, in arid area, irrigated agricultural system have on average double the yield as compared to non-irrigated agricultural systems, this lead to salinization and water depletion which exert additional pressure to the environment.

Migration of Work Force: Implementing of soil and water conservation is a labor demanding process, especially in regions, such as sub-Saharan Africa, where Agriculture is greatly dependent on man power. However, in search of job, and better life many people in the rural areas mover to urban areas, subsequently leading to lack of work force.

Cultivation of Cash Crops: Since cash crops are targeted on profit, many practices that are implemented to increase yield result in a greater environmental damage. For example, mechanized soil tillage that would make the soil vulnerable to erosion, use of chemical fertilizers and pesticides that would pollute the water and affect the micro flora and fauna of the soil would eventually distract the ecosystem balance.

Land Tenure Security: Lack of ownership of the land by the farmers can put not only lots of pressure on the land to generate maximum crop yield and profit within their time frame but also it cause to unwillingness to implement soil and water conservation. The absence of ownership to the land, since the ownership is expected to change with time, it discourage the farmers to maintain the land for the long term.

CONCLUSION

In this century, without conservation practices to adapt to climate change would be difficult and conservation practices are the necessary tools to adapt to a changing climate. Generally, the approaches of the integrated water management resulted in marked improvements in land rehabilitation, increased in vegetation cover and surface roughness and led to a significant decrease of runoff and soil loss. The success of the integrated watershed management was the effectiveness of the implementation approaches including the participation of the local community in the form of a contribution. Research, transfer of technology to farmers, forums to exchange information, and education will be needed to adapt to climate change.

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Cholinesterase Inhibitory Activities and Phytochemical Composition of Pods of Senna (*Cassia angustifolia* Vahl.) as Potential Neuroprotective Agent

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ABSTRACT

Cassia angustifolia Vahl., commonly known as 'senna, sanai, marknadi or sonmukhi' around the world, and known as 'açlık otu' in Turkey. It has been extensively used in traditional and folk medicine since its laxative properties. Although its every part has medicinal and economic importance, no detailed studies on neuroprotective properties have been performed with extracts obtained from the pods of *C. angustifolia* Vahl. Therefore, the current study was undertaken to evaluate their potential memory enhancing effects through enzyme inhibition tests as well as antioxidant test systems. The pods of the plant were extracted with water and methanol solvents, and subjected to enzyme inhibitory assays on acetylcholinesterase (AChE) and butyrylcholinesterase (BChE), which are closely linked to pathogenesis of Alzheimer's disease. *In vitro* methods including 2,2-diphenyl-1-picrylhydrazyl (DPPH), 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid) (ABTS), ferric reducing antioxidant power (FRAP), and cupric ion reducing capacity (CUPRAC) were performed to reveal antioxidant activity of the extracts. Total polyphenolic compositions of the extracts were also identified spectrophotometrically. The methanol extract was possessed of higher total phenolic and flavonoid contents (1.428±0.12 mg g-1 extract as GAE and 2.861±0.24 mg g-1 extract as QE, respectively) comparing with that of the water extract. In general, a significant correlation was found between the total antioxidant capacities and neuroprotective potentials of the tested extracts. As for the cholinesterase inhibitory potentials, the water and methanol extracts of pods showed the remarkable inhibition on both of the enzymes even at the lower concentration. In the contrary of total phenolic contents, the water extract of pods was showed higher enzyme inhibition 83.81±0.33% and 74.42±0.18% on AChE and BChE, respectively. In the light of the findings of results, it is exceedingly important to indicate that, pods of *C. angustifolia* Vahl. with excellent AChE-inhibiting properties; strong antioxidant activities as well as rich polyphenolic contents are worth to conduct further *in vitro* and *in vivo* investigations.

Keywords: *Cassia angustifolia* Vahl.; senna; açlık otu; pods; enzyme inhibitory; neuroprotection; antioxidant; polyphenolic content.

GRAPHICAL ABSTRACT

1. INTRODUCTION

Cassia angustifolia Vahl. synonymous with *Senna alexandria* Mill. (belonging to the fam. Caesalpiniaceae; Leguminaseae), commonly known as ‘senna, sanai, marknadi or sonmukhi’ and “açlık otu” in Turkey, is extensively used in traditional folk medicine as herbal tea, functional food, and dietary supplements. The senna products are also available in the forms of tablets and gum, which are very popular around the world (Ahmed et al., 2016; Osman et al., 2017; Reddy et al., 2018).

The senna has been applied for treatment of various ailments and diseases such as constipation, loss of appetite, hepatomegaly, spleenomegaly, skin diseases, liver diseases, indigestion, malaria, Jaundice, and anemia for millennia. Besides, it has been used for purgative, laxative, expectorant, wound dresser, antidysentric, and carminative purposes (Srivastava et al., 2006; Reddy et al., 2015).

Its rich bioactive components including sennosides (anthraquinone glycosides), sennidin-8.8-diglucoside, aloe-emodin, emodin glucoside, glycosides of rhein and chrysophanic acid were revealed by previous researches (Khan and Srivastava, 2009; Reddy et al., 2015; Reddy et al., 2018). Furthermore, its wide range of biological activities e.g. antidiabetic, anti-inflammatory, antibacterial, antihelmenthic, antihyperglycemic, etc. were shown previously, leading to a tremendous growth of its pharmaceutical usage (Silva et al., 2008; Ahmed et al., 2016; Osman et al., 2017; Reddy et al., 2018).

The formation of Reactive Oxygen Species (ROS), including superoxide ion (O_2), hydroxyl radical (OH) and hydrogen peroxide (H_2O_2), have often been reported to induce DNA damage, protein carboxylation, and lipid peroxidation, causing a variety of chronic health disturbances and diseases, such as cancer, ageing, cardiovascular diseases, Alzheimer's and Parkinson's diseases. Recent researches have indicated that several herbal plants can offer alternative sources of dietary ingredients to promote human health and might open promising opportunities for the treatment of troublesome diseases and infections (Sun et al., 2016; Sahoo et al., 2018). Although, there are so many methods for combatting neurodegenerative diseases and disorders, they cannot always provide effective treatments and mediations. In this context, an extensive research on developing new treatment strategies against these disorders are still needed nowadays. Since ancient times, natural products (NPs), widely originated from medicinal plants and their bioactive compounds, have been used for cure and treatment of many ailments and diseases in Anatolian folk medicine ‘herbal therapies’ (Gezici and Sekeroglu, 2019a; Awasthi et al., 2016; Godyń, et al, 2016).

Up to date, various medicinal plants were analyzed by our research group in terms of their anticancer, antiproliferative, anticholinesterase, antityrosinase, antioxidant, and etc. The ultimate goal of our projects and researches is to contribute to find new and effective herbal products for prevention and treatment of cancer and neurodegenerative diseases (Gezici, 2019; Gezici and Sekeroglu, 2019a; Gezici and Sekeroglu, 2019b; Shida et al., 2019; Sekeroglu et al., 2018; Gezici, 2018; Senol et al., 2018; Gundogdu et al., 2018; Karik et al., 2018; Belkhodja et al., 2017; Gezici et al., 2017; Sekeroglu et al., 2017; Akgunlu et al., 2016; Orhan et al., 2013; Sekeroglu et al., 2012; Orhan et al., 2012, etc.). Taking our previous researches on medicinal plants and plant-derived natural products, the present study was aimed to evaluate total polyphenolic contents, in vitro antioxidant effects, neuroprotective and enzyme inhibitory activities of the extracts from the pods of *C. angustifolia* Vahl. Nonetheless, its each part has medicinal and economic importance, no detailed studies on neuroprotective properties have been performed with extracts obtained from the pods of *C. angustifolia* Vahl.

2. MATERIAL AND METHODS

2.1. Collection of Plant Material

The dried pods of *Cassia angustifolia* Vahl. were obtained from a local herbal market, and a voucher specimen was deposited in the Biology Department of Kilis 7 Aralik University, Turkey. Taxonomic classification of the plant was given in the Table 1.

Table 1. Taxonomic classification of the plant material

Kingdom:	*Plantae*
Subkingdom:	*Tracheobionta*
Division:	*Magnoliophyta*
Class:	*Magnoliopsida*
Subclass:	*Rosidae*
Order:	*Fabales*
Family:	*Caesalpiniaceae*
Genus:	*Cassia*
Species:	*angustifolia* Vahl.

2.2. Crude Extract Preparation

To prepare crude extracts, air dried samples (50 g) of the pods of *C. angustifolia* Vahl. were individually extracted with methanol-MeOH, and distilled water-H_2O for 2 days at the room temperature, as described in our previous research (Gezici and Sekeroglu, 2019b). The extracts yields (w/w%) are given in the Figure 1. Extraction yields of the methanol and water extracts of the pods from senna were determined as 16.03% and 13.08% (w/w), respectively.

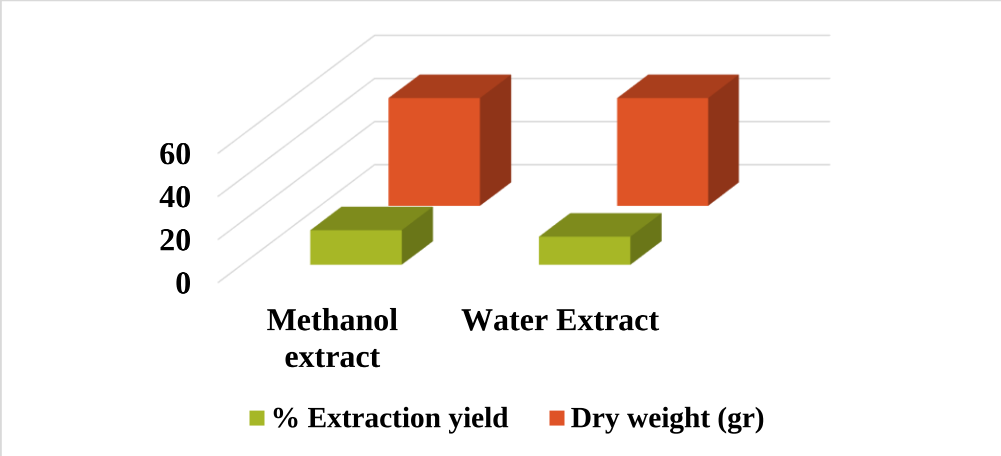


Fig. 1. Extraction yield (w/w) of the pods from senn

2.3. Determination of Total Polyphenolic Contents

Phenolic compounds in total were determined in accordance with slightly modified Folin-Ciocalteau's method (Singleton and Rossi, 1965; Gezici and Sekeroglu, 2019b). Absorption was measured at 760 nm at a using a 96-well microplate reader (VersaMax Molecular Devices, USA). Total flavonoid content of the extracts was calculated by aluminum chloride colorimetric method (Woisky and Salatino, 1998; Gezici and Sekeroglu, 2019b). A number of dilutions of quercetin were obtained to prepare a calibration curve. Absorbance of the reaction mixtures was measured at wavelength of 415 nm with a using a 96-well microplate reader (VersaMax Molecular Devices, USA). The total phenol and flavonoid contents of the extracts were expressed as gallic acid and quercetin equivalents (mg g-1 extract), respectively.

2.4.Antioxidant Activity Assays

Since oxidative damage is one of the major factor, contributing to both cancer and neurodegeneration, *in vitro* methods including 2,2-diphenyl-1-picrylhydrazyl (DPPH), 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid) (ABTS), ferric reducing antioxidant power (FRAP), and cupric ion reducing capacity (CUPRAC) were performed to reveal antioxidant activity of the extracts (Gezici et al., 2017; Sekeroglu et al., 2017; Gundogdu et al., 2018; Gezici and Sekeroglu, 2019b). The extracts and commercial antioxidant standards were dissolved in DMSO at different concentrations, ranging from 100 μg mL^{-1} to 1000 μg mL^{-1} for the antioxidant assays.

2.5.Enzyme Inhibition Assays

Neuroprotective potentials of the extracts against AChE (acetylcholinesterase) and BChE (butyrylcholinesterase) were evaluated in that study. For the enzyme inhibition assays, the extracts were dissolved in DMSO at different concentrations, ranging from 100 µg mL^{-1} to 400 µg mL^{-1}. AChE and BChE inhibitory activity of the samples was measured by slightly modified spectrophotometric method of Ellman et al. (1961). Electric eel AChE (EC 3.1.1. Sigma, St. Louis, MO, USA) and horse serum BChE (EC 3.1.1. Sigma, St. Louis, 7 MO, USA) were used, while acetylthiocholine iodide and butyrylthiocholine chloride (Sigma, St. Louis, MO, USA) were employed as substrates of the reaction. 5,5′-Dithio- bis(2-nitrobenzoic) acid (DTNB, Sigma, St. Louis, MO, USA) was used for the measurement of the anticholinesterase activity. All conditions and calculations were same as described in our previous publications (Senol et al., 2018; Gezici and Sekeroglu, 2019a). The measurements and calculations were evaluated by using Softmax PRO 4.3.2.LS software. The experiments were done in quarduplicate. Galanthamine hydrobromide (Sigma, St. Louis, MO, USA) was used as the reference drug.

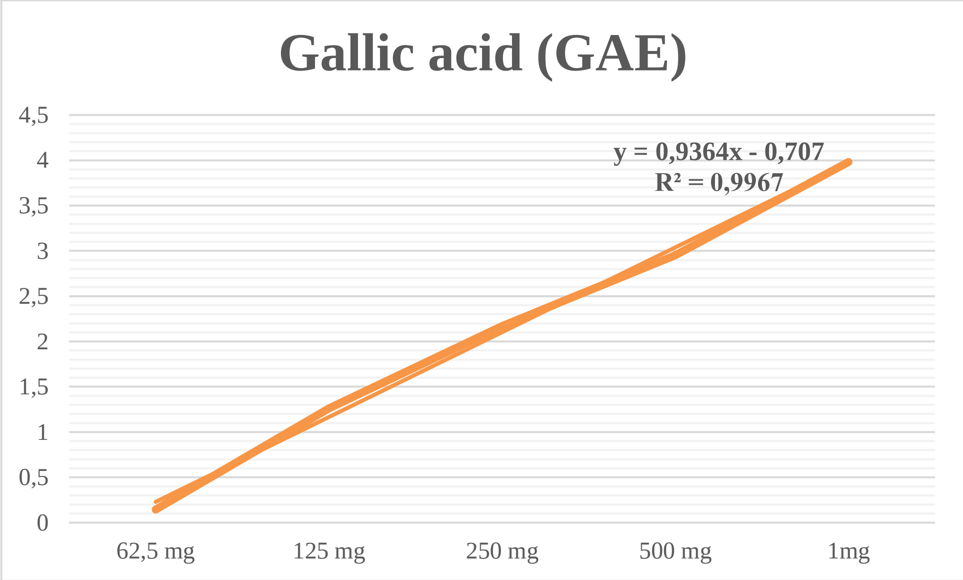
2.6.Statistical analysis

All the assays were carried out at least triplicate, and the results were expressed as mean and standard deviation values (mean ± SD). Statistical differences between the references and the sample groups were evaluated by ANOVA (one way). Correlations were performed using the correlation and regression in the EXEL program. P value of <0.05 was considered to be statistically significant, $p <0.01$ and $p <0.001$ were considered to be very significant.

3. RESULTS

3.1.Results of Total Polyphenolic Contents

Phenolic compounds such as phenolic acids and flavonoids are reported to be involved in various biochemical activities like antioxidant, antimicrobial, antithrombotic, antiartherogenic, antiinflammatory, anticarcinogenic and antimutagenic. Total polyphenolic compositions of the extracts were identified spectrophotometrically in the current research. Gallic acid (GA) and quercetin (Q) equivalent as commercial standards for total phenolic phenolic and flavonoid contents were shown in the Figure 2.



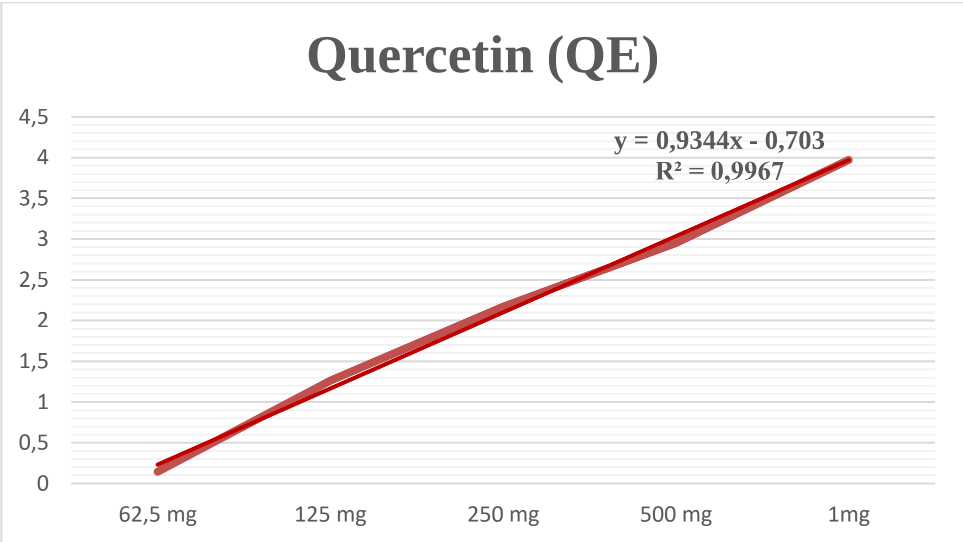


Fig. 2. Gallic acid and Quercetin Equivalent

In case of total phenol and flavonoid quantities, both water and methanol extracts possessed rich polyphenolic contents. As given in Table 2, total phenol and flavonoid quantities, the methanol extract was possessed of higher total phenolic and flavonoid contents (1.428±0.12 mg g-1 extract as GAE and 2.861±0.12 mg g-1 extract as QE, respectively) comparing with that of the water extract.

Table 2. Total polyphenolic contents of the extracts at 1000 µg mL^{-1}

Extract type	**Total phenolic content (mean ± SD)**	**Total flavonoid content (mean ± SD)**
Methanol	1.428 ± 0.12*	2.861 ± 0.24**
Water	1.326 ± 1.04***	2.086 ± 0.06**

**p value of < 0.05; **p value of < 0.01; ***p value of < 0.001.*

3.2. Results of Antioxidant Capacity

Antioxidant activity of the extracts obtained from the aerial parts of the plant were evaluated by using radical scavenging against DPPH and ABTS radicals, and ion reducing antioxidant power on FRAP and CUPRAC. Regarding of antioxidant assays, the extracts obtained from pods of *C. angustifolia* Vahl. exhibited significant scavenging activities on DPPH, FRAP, ABTS, and CUPRAC, comparing the standard antioxidants.

The methanol extract, which exerted a higher TPC and TFC than that of the water extract, was found the most effective antioxidant in all assays. Scavenging activity of the methanol extract on DPPH were determined as 85.69±1.04 mg TEs/g extract, when it was found as 78.91±0.71 mg TEs/g for the water extract. Antioxidant capacity against ABTS was determined as higher in the water extract (93.06% inhibition) than that of the methanol (82.16% inhibition). It is revealed that the tested extracts were showed the weakest antioxidant activity on CUPRAC. The results were summarized in the Figure 3.

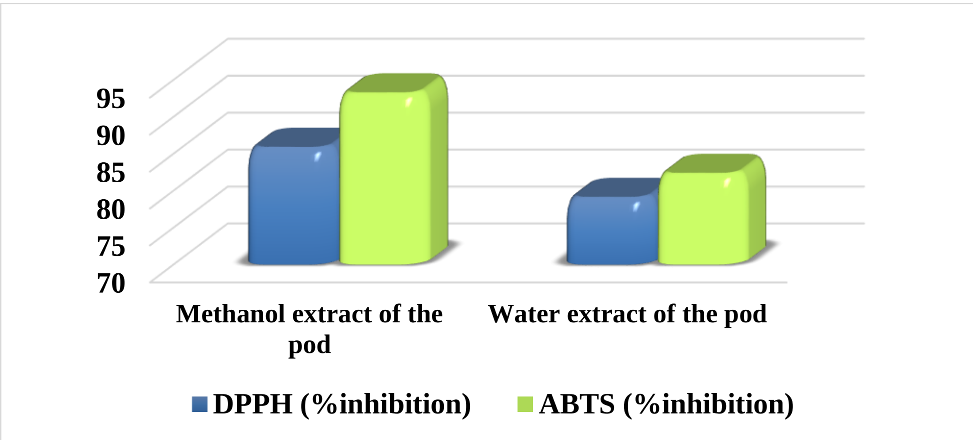


Fig.3. Antioxidant capacity of the extracts against DPPH and ABTS radicals

3.3.Results of Neuroprotective Potentials

Neuroprotective activity of the extracts was assessed through enzyme inhibition assays on cholinesterase enzymes. The pod-extracts of the plant subjected to enzyme inhibitory assays on acetylcholinesterase (AChE) and butyrylcholinesterase (BChE), which are closely related to pathogenesis of neurodegenerative disease.

Table 3. Neuroprotective effects against AChE and BChE at 400 μg mL^{-1}

Extract type	**Acetylcolinesterase (AChE) (Inhibition % ± SD)**	**Butyrylcolinesterase (BChE) (Inhibition % ± SD)**
Methanol	62.14 ± 0,60**	58.04 ± 1.16*
Water	83.81 ± 0.33***	74.42 ± 0.18**
Galantamine[a]	86.14 ± 1.01	83.02 ± 0.82

[a] *Galanthamine; commercial standard for AChE and BChE inhibition.*

**p value of < 0.05; **p value of < 0.01; ***p value of < 0.001*

As summarized in Table 3, both of extracts obtained from the pods exhibited the remarkable inhibition on both of the enzymes, and the higher cholinesterase inhibitory activity was observed against AChE, compared to BChE at the tested concentration. The water and methanol extracts of pods were showed 83.81±0.33% to 62.14±0.60% inhibition on AChE, and 74.42±0.18% to 58.04±1.16% inhibition on BChE, respectively (Table 3). In general, a significant correlation was found between the total antioxidant capacities and neuroprotective potentials of the tested extracts. Moreover, a strong correlation was observed between the phytochemical and mineral constituents of the plant and its biological properties.

4. CONCLUSION

As far as our literature survey, there has been no study so far examining neuroprotective effects of the pods extracts obtained from *C. angustifolia* Vahl. combining and correlated with the other assays. Therefore, the results presented in this work could be the first report for the literature. Our data showed that the pods of *C. angustifolia* Vahl. possesses remarkable AChE-inhibiting properties, excellent antioxidant activities as well as rich polyphenolic contents. In the light of the findings of results, the extracts from senna appear to be a significant natural source having promising inhibitory molecules, are worth to conduct further *in vitro* and *in vivo* investigations, which is under further investigation in our laboratory.

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A New Approach to Organic Agriculture: Biodynamic Agriculture

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Abstract

This study was prepared to evaluate the developments in the areas of fruit growing of application of biodynamic agriculture, which is a certified model of sustainable agriculture. Biodynamic agriculture is a system that not only constitutes the first model implementation of more environmentally but also sustainable agriculture with its understanding of organic agriculture. Currently 5.595 producers in 53 countries has been produced with biodynamic agriculture in the world. Germany (85.395 ha), France (13.665 ha), Italy (9.640 ha) and USA (9.001 ha) are important countries which certified production with biodynamic agricultural practices. In Turkey, there are 153 producers in the 937.73 ha production area that carry out biodynamic agriculture. Important fruit species grown in biodynamic agriculture system were apricots (299.96 ha), hazelnuts (206.77 ha), grapes (186.79 ha) and figs (150.83 ha) in our country. Although it is not very common in the sustainable agriculture system at present. We are of the opinion that this system will increase its use in fruit cultivation in the future and will provide a different approach to the organic agriculture.

Key words: *Biodynamic agriculture. the status and future of fruit growing*

Özet

Bu çalışma sürdürülebilir tarımın sertifikalı bir modeli olan biyodinamik tarım uygulamalarının meyvecilik alanındaki gelişmelerini değerlendirmek amacıyla hazırlanmıştır. Biyodinamik tarım, organik tarım anlayışına sahip olmakla birlikte daha çevreci ve sürdürülebilir tarımın ilk model uygulamasını oluşturan bir sistemdir. Dünya'da mevcut durumda 53 ülkede 5.595 üretici biyodinamik tarımla üretim yapmaktadır. Almanya (85.395 ha), Fransa (13.665 ha), İtalya (9.640 ha) ve ABD (9.001 ha) biyodinamik tarım uygulamalarıyla sertifikalı üretimin yapıldığı önemli ülkelerdir. Ülkemizde ise 937.73 ha üretim alanında 153 üretici ile biyodinamik tarım yapılmaktadır. Ülkemizde biyodinamik tarım sisteminde yetiştirilen önemli meyve türleri kayısı (299.96 ha), fındık (206.77 ha), üzüm (186.79 ha) ve incir (150.83 ha)'dir. Halihazırda, sürdürülebilir tarım sistemi

içerisinde çok yaygın olmasada, bu sistemin gelecekte meyve yetiştiriciliğinde kullanımının artacağı ve organik tarım anlayışına farklı bir değer katacağı düşüncesindeyiz.

Anahtar Kelimeler: *Biyodinamik tarım. meyvecilikteki durumu ve geleceği*

Introduction

Today, the world faces climate change, ecosystem degradation, biodiversity reduction and food security problems (Padmavathy and Poyyamoli, 2011). Intensive use of chemicals in agriculture (excessive nitrate and phosphate fertilization, such as the use of pesticides) (Araujo et al., 2009), intensive cultivation and changes in agricultural practices lead to a decrease in biodiversity (Padmavathy and Poyyamoli, 2011). In addition, the deterioration of the ecosystem has resulted in the lack of access to clean water, changes in the carbon cycle, the change in the rings in the food chain and the pollution of soil pollution (Carpenter et al., 2009). However, food security in agriculture is seen as another major threat to humanity. In the solution of these problems, it is expected that the creation of methods which may be an alternative to the existing conventional agricultural practices will contribute significantly. In this respect, it is obvious that the sustainability of life depends on the sustainability of agriculture.

The main objectives of sustainable agriculture are the development or continuity of natural resources, the protection of the environment, the effective use of natural resources, increasing the efficiency, increasing the quality of the products, making it possible to reach the safe food, developing the rural and farmers' socio-economic structure (Vandermeer et al., 1998; Xu. et al., 2000; Greene and Kremen 2003; Padmavathy and Poyyamoli 2011).

In the applications of sustainable agriculture, different systems such as biodynamic agriculture, organic agriculture, globallGAP (Good Agricultural Practices), soilless agriculture, rural and semi-rural agriculture, natural agriculture, eco-farming, perma culture, poly culture and integrated farm systems can be used (Fukuoka 1985; Padmavathy and Poyyamoli, 2011). However, organic agriculture, which is included in these systems and becomes widespread, is a means of controlling the sustainability of distribution. In addition, the applications of biodynamic agriculture and globallGAP are globally accepted systems.

This study was carried out to indicate the current status of biodynamic agriculture, which is a certified model within sustainable agriculture practices, and developments in this system.

Definition and History of Biodynamic Agriculture

Rodolf Steiner is considered to be the founder of biodynamic agriculture and has organized different conferences on the negative effects of artificial fertilizers on the yield loss of soil, plants and seeds to European farmers. The researcher stated that due to the intensive use of chemicals in the agriculture, the germination problems of the seeds and the soil exhaustion could only be changed by rotation, the chemical fertilizers used decreased the intake of nutrients in the soil and thus the yield losses in the perennial garden plants. He also stated that it was necessary to use its own power of the nature in order to increase yield and struggle in diseases and pests and he called it 'odic power' (Phillips 2006).

Basic Principles of Biodynamic Agriculture

Biodynamic agriculture is management system a farm that applied as closed and integrated by creating an ecosystem in a certain area. Different natural components are preferred instead of chemical fertilization in this area. Six different plants (stinging nettle, yarrow, chamomile, oak, dandelion and valerian) are prepared with quartz, animal organs (such as horns of animals). He is recommended that movements of planets (Mercury, Venus) to struggle diseases and pests and applied weed control according to full-moon status (Kirchman, 1994).

In this system, the certification process for fruit trees is 4 years and it is considered as a transition period for the first 3 years. Biodynamic agriculture, which was initiated by Steiner in 1923, is now included in sustainable agricultural practices with its cultural practices and cosmic thinking structure (Carpenter-Boggs, 2011). Biodynamic agricultural applications are a certified system control by Demeter certificate and can be applied all over the world. Today, agricultural production is realized in 20 different countries (Germany, France, Austria, England, Holland, Finland, Denmark, Luxembourg, Norway, Sweden, Slovenia, Italy, Spain, India, Brazil, Egypt, New Zealand and America) (Anonymous, 2019) (Table 1).

Table 1. Organizations in the world that give a certificate

Certification Institution		
Name	**Countrysort icon**	**Homepage / E-mail**
Demeter-Bund Österreich	Austria	www.demeter.at

IBD Certifications	Brazil	www.ibd.com.br
Demeterforbundet i Danmark	Denmark	www.biodynamisk.dk
COAE (Center of Organic Agriculture in Egypt)	Egypt	www.coae-eg.com
Biodynaaminen Yhdistys - Biodynamiska Foereningenry	Finland	www.biodyn.fi
Association Demeter France	France	www.bio-dynamie.org
Demeter e. V. Info@Demeter.de	Germany	www.demeter.de
Demeter-International e. V. - International Certification Office -	Germany	www.demeter.net
Demeter Certification Office	India	www.biodynamics.in
Demeter Associazione per la Tutela della Qualitá Biodinamica in Italia	Italy	www.demeter.it
Bio-Lëtzebuerg	Luxembourg	www.bio-letzebuerg.lu
Stichting Demeter	Netherlands	www.stichtingdemeter.nl
Bio Dynamic Farming and Gardening Association in NZ Inc.	New Zealand	www.biodynamic.org.nz
Biologisk-dynamisk Forening	Norway	www.biodynamisk.no
Zdruzenje Demeter Slovenija	Slovenia	www.demeter.si
Oficina de Certificación Demeter España	Spain	www.demeter.es
Svenska Demeterförbundet	Sweden	www.demeter.nu
Demeter Schweiz / Verein für biologisch-dynamische Landwirtschaft	Switzerland	www.demeter.ch
Biodynamic Association Certification	United Kingdom	www.biodynamic.org.uk
Demeter Association. Inc.	United States	www.demeter-usa.org

Fruit Growing Biyodynamic Agriculture System in the World and Turkey

According to the report published by the International Demeter Secretariat in 2019, this system is carried out in 44 countries together with 19 countries which members and 25 member countries which are non-members. This system is carried out on 5.595 farms in 187.860 ha area with 962 operators and 435 agencies (Anonymous 2019). Germany is the most important country which applied biodynamics with 83.395 ha area. Other important countries which is used this agricultural system are France (13.665 ha), Italy (9.640 ha), USA (9.001 ha), Netherlands (6.337), Spain (6,243 ha) and Hungary (6,049 ha). The production is made with 1.065 hectares in Turkey and is ranked 20th in the world. The largest number of producers dealing with biodynamic agriculture is Germany (1.552 producers). Sri Lanka (787 producers), France (511 producers), India (403 producers) and Italy (286 producers) are other important countries in terms of number of producers. The number of producers who biodynamic agriculture in Turkey is 159 (Anonymous, 2018) (Table 2).

Table 2. Biodynamic agriculture countries, production areas and number of producers

Country	**Production Area (ha)**	**Producers (person)**	**Country**	**Production Area (ha)**	**Producers (person)**
Germany	85.395	1.552	England	3.734	100
France	13.665	511	Czech Rep	3.541	5
Italy	9.640	286	Poland	3.532	13
USA	9.001	118	Egypt	2.839	60
Netherlands	6.337	136	Denmark	2.384	33
Spain	6.243	133	Lithuanian	1.772	14
Hungary	6.049	25	Chile	1.385	19
Austria	5.720	186	Sri Lanka	1.190	787
Swedish	5.556	255	Argentina	1.110	32
India	5.417	403	Turkey	1.065	159

Fruit growing in the biodynamic agriculture system is carried out in 123,336 ha area In the world. The important fruit species produced in this biodynamic system are grape (3.890.06 ha), olive (2.358.10 ha), banana (1843.24 ha), apple (651.73 ha), apricot (461.96 ha), mango (449.96 ha), orange (324.45 ha), lemon (295.73 ha), pear (259.23 ha) nectarine (251.63 ha), peach (193.40), fig (186.55), plum (175.19) and blueberry (131.49). The integrated fruit growing is carried out in 291.63 ha area (Anonymous, 2019) (Table 3).

Table 3. Biodynamics in the world grown important fruit species and production areas

Fruits	Production Area (ha)	Fruits	Production Area (ha)
Wine Grape	3572.84	Nectarine	251.63
Olive	2358.10	Peach	193.40
Banana	1843.24	Fig	186.55
Apple	651.73	Plum	175.19
Apricot	461.96	Blueberry	131.49
Mango	449.96	Dates	126.51
Orange	324.45	Mandarin	61.02
Grape	317.22	Avocado	56.14
Lemon	295.73	Citrus	52.41
Fruits	291.85	Oleaster	40.62
Pear	259.23	Pomegranate	35.26

Biodynamic fruit production is carried out in 911.52 hectares in Turkey. Apricot (299.96 ha), hazelnut (206.77 ha), grape (186.79 ha), fig (150.83 ha) and cherry (20.08 ha) are the main fruit species cultivated (Anonymous, 2019) (Table 4).

Table 4. Total production areas and production areas Biodynamic agriculture with rates of fruit species grown in Turkey

Crops	Total Production Area (ha)	Percentage of Production Area (ha)
Apricot	299.96	31.99
Hazelnut	206.77	22.05
Grape (Sultani)	186.79	19.88
Fig	150.83	16.08
Sweet Cherry	20.08	2.14

Strawberry	8.74	0.93
Walnut	8.51	0.91
Pear	7.68	0.82
Olive	7.34	0.78
Plum	6.67	0.71
Raspberry	3.76	0.40
Blackberry	1.69	0.18
Almond	1.41	0.15
Quince	0.50	0.05
Chestnut	0.45	0.05
Apple	0.34	0.04
Total	**991.52**	

CONCLUSION

As a result, we believe that will increase the importance of fruit cultivation in biodynamic agriculture in the future in terms of sustainability of agriculture. The contribution of this system to the sustainability of agriculture will continue to increase due to the advantages it provides to the grower. In addition, it is considered that agricultural support should be included ın order to encourage fruit growers in this system. We believed that informing the producers and consumers about the advantages / opportunities of this cultivation system will make a significant contribution.

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A Research on the Effects of the Transportation Simulation to Different Distance of Broilers to Meat Quality Properties

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Abstract

In this research, the male broilers at 6 wks of age were treated as simulating 0, 80, 160, 240 and 320 km transport distance (TD) in 0, 5, 10, 15 and 20 minutes on the simulation case (585 cycle/min; f=9.75 H_2 frequency, д=0.2 g acceleration, S=5 cm amplitude value).
After the slaughtering, meat sample from different carcass part types (breast, drumstick and tight) were taken and meat properties of pH, meat tenderness (penetrometer value), percent cooking losses (CL) and color properties (***L****, ***a**** and ***b****) with and without skin were determined. The data obtained were applied statistical analysis and the mean values were compared.

As to the results obtained; the simulated TD on penetrometer value were found statistically significant (P<0.01). It means, while the TD were increasing the tenderness of the meats were decreased. It was found that the CL were not effected by TD significantly. It was also determined that TD effected significantly (P<0.01) on pH value of the broiler meat. It means that, while the TD was increasing the meat pH values were also increased. In meat with skin, TD effected significantly (P<0.05) on ***L**** color factor. In meat without skin, it was determined that ***a**** and ***b**** color factors were effected significantly (P<0.01) by TD.

While it was determining significant (P<0.01) negative correlation coefficient (r=-0.202) between TD and the penetrometer (hardness) values, between ***L**** color factor and TD in the samples without skin significant (P<0.05) positive correlation coefficient (r=0.165) was determined. Also, the significant (P<0.01) negative correlation coefficint (r=-0.201) were determined betwean TD and ***b**** color factor of the samples without skin. For ***a**** color factor and TD in the samples both with and without skin, significant (P<0.01, P<0.05) positive correlation coefficients (r=0.259, r=0.023) were determined.

Key Words: ***Broiler, meat quality, transport distance, simulation case.***

INTRODUCTION

The broiler production is widely performed in Turkey. It was reported that the broiler meat quality properties were effected significantly by the applications during the transportation and at the slaughtering stages. For these reason, the subject has been a researche area of interst and come to the agenda intensively in IIth International White Meat Congres made in Turkey (Anonim, 2013). If the ambient temperature is high during transportation, this can be a reason of developing the meat with PSE (pale, soft, exudative). It is also reported that meat from the broilers transported in the winter season as to the summer season, the pH value was lower (5.8 and 5.9, respectively), meat color was less yellow (*b**; 3.91 and 5.90, respectively) and the hardness (penetrometer value) was higher (2.59 and 3.42, respectively) (Yalçın, 2013).

During the catching, transportation and slaughtering of the broilers, several risk factors with respect to meat quality and animal welfare have interfered (Petek, 2013). In recent years, with the increasing production capacity of the sector in Turkey and losses due to the transport, in adition to the transport duration, the effecting factors like distance, seasonal conditions, loading dansity, road properties, type of the vehicle and velocity were also reported (Arıkan at all, 2013). Shair at all (2013) determined that effects of the feed withdrawal time before transpot and the distance on the breast pH value was significant ($P<0.01$), thereby the meat quality was effected in a negative way.

Nijdam at all (2004) reported that the death on arrival (DOA) to the processing plant is affected by factors that were the environmental temperature, transport duration, catching type, genotype, flock size, mean body weight (BW), mean compartment density, holding time before the slaughter, transport time and interaction between them. The reduction of the effects of these factor are also going to reduce percent DOA and so the profitability and the welfare would be improved. As to the same researchers; in the broilers applied feed withdrawal before transpot were developed stress due to the negative energy balance. Pullets transported after the feed withdrawal had showed 0.42 % live weight (LW) losses. This value is higher, according to the pullets that were full aproched to the feed to the one hour before transportation (0.3 %). Full approach to the feed as far as to the catching time of the pullets, the higher LW before the slaughter and less stress as to the negative energy balance and meat quality is being improved as result (Nijdam at all, 2005).

Delezie at all (2007) were examined the effects of exposing the broiler pullets to stress factors like feed withdraval before the slaughtering, the cage density and transpot distance on animal welfare and energy metabolism. As to the researchers, with respect to stress and economic loses, it must be avoided from the higher cage density during the transport. The transport cage density is incased the effects of feed withdrawall and the other transportation factors for these results.

In this research, it was examined that the broiler meat quality properties affecting consumer preference like hardness, cooking losses, meat color with and without skin and pH values of broiler meat samples in the simulated transport conditions.

Material and Methods

Material: After the Ross 308 hybrid male chicks have been rised to the slaughtering age (6 wks), the experimental treatments which explained in the below headings were applied to the randomly selected pullets. It is accepted that the gender is the well known variation factor and it is eliminated at the begining. The carcass parts types (breast, drumstick and tights) obtained after the slaughtering were used as experimental material.

Methods: In the experiment, the male broiler pullets at the slaughtering age were applied 0 (control), 80, 160, 240 ve 320 km transport distance on the simulation case (585 cycle/min; f=9.75 H_2 frequency, д=0.2 g acceleration, S=5 cm amplitude value). “The Vibration Simulation Case” had beed designed and constructed during a post universitary study (PhD) (Aydın, 1993), but it is reconstructed and renewed for this study, as well.

For each treatment (TD), 2 transport cage (each having 5 pullets) were used. After the slaughtering, for each pullet the breast, drumstick and tights were reserved for experimental analyses. The experimental analyses were conducted as factorial randomized plot design (Düzgüneş at all, 1987).

Different treatment means were determined using Duncan Multiple Range Test (Düzgüneş at all, 1984). The statistical analyses were conducted by using Minitab (2009) and MStat-C (1989) statistical packages.

For determining the poultry meat properties; two parallel measurement were done for each quality properties and each carcas part type, and totally 50 data were obtained as means of the parallels.

The pH data were obtained in homogenized meat samples by using the pH meter (AOAC, 2000). Penetrometer values (PV, meat tenderness) of meat samples were obtained by the penetrometer vehicle (Koehler K 19500) with appliying the ASTMD 1321 standard method (Anonymous, 1975).

The color analysis of the meat samples with and without skin were determined using the colorimeter (CR-400 Minolta Co, Osaka, Japan) with methods reported by Hunt at all (1991). The cooking losses (CL) of the meat samples were also determined as to the method recommended by Kondaiah at all (1985).

The Findings and Discussion

In the content of this research, using the “The Vibration Simulation Case”, Ross 308 male broilers at 6 wks of slaughtering age were applied to simulation of different transport distance which were control (0), 80, 160, 240 and 320 km, and some predefined meat quality properties (meat tenderness, cooking loses, pH and meat colors) that could effect consumer preference at the meat samples from different part type are examined.

Tenderness, Cooking Losses and pH

The mean values for the examined meat quality properties that are the tenderness (PV: Penetrometre value), cooking losses and pH values were given at the Table 1. The penetrometer and pH values which were statistically significat were showed at Figure 1 and Figure 2, respectively.

Effects of TD on the tenderness (penetrometer value) had been significant ($P<0.05$). For the simulated distances which are 0, 80, 160, 240 and 320 km, the tenderness of poultry meat had been determined as 524.4, 523.0, 514.4, 502.8 and 495.0 as penetrometer values. As to these findings; in the condition of this researche, depending on the increase of TD, the penetrometer values were decreased.

Table 1.- Mean Values for the Tenderness (PV), Cooking Losses and pH Values of the Meat Samples

QC\TD	0 (0 min)	80 (5 min)	160 (10 min)	240 (15 min)	320 (20 min)	Mean
PV	524.4[a]	523.0[a]	514.4[ab]	502.8[ab]	495.0[b]	**511.9**
CL	26.07	25.80	25.01	25.32	25.53	**25.55**
pH	6.19[b]	6.29[a]	6.24[ab]	6.22[ab]	6.22[ab]	**6.23**

QC: Quality criterion, TD: Transport distance (km), PV: Penetrometre values (hardness), CL: Cooking losses

Note: The values at same row bearing same super script are not diferent from each other statistically.

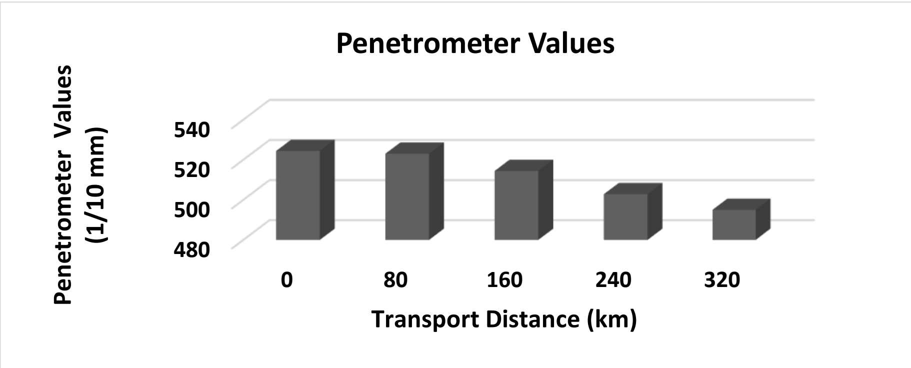

Figure 1.- Effect of Transport Distance on Tenderness (penetrometer value)

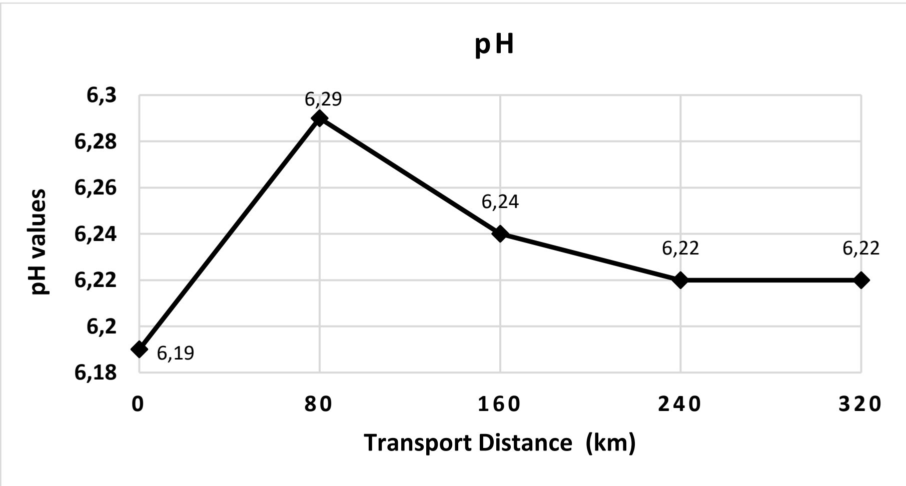

Figure 2.- Effects of Transport Distance on the pH Values of Meat Samples

This mean tenderness values of the meat was decreased by increasing TD. The differences for means between 320 with 0 and 80 km distances had been found significant (P<0.05). As to the these results, we are considering that the increasing effects of TD on developing stress would be seen (at 400 and 480 km) apparently and due to this the tenderness of the meat also would be decreased.

The cooking losses (CL) of meat samples for 0, 80, 160, 240 and 320 km TD had been determined as 26.07, 25.80, 25.01, 25.32 and 25.53 %, respectively. The mean CL of all samples were determined as 25.55 %. In the experimental condition, it is determined that CL was not effected by the TD significantly. Even if the control groups were showed higher numerical value, it was not significanly important.

General mean pH value of meat samples was determined as 6.23. Effects of TD on meat pH values were found statistically significanty (P<0.05). With the simulation of 0, 80, 160, 240 and 320 km TD of the broilers, the meat pH values for these distances were determined as 6.19, 6.29, 6.24, 6.22 and 6.22, respectively. While the difference between control and 80 km of TD were found significantly (P<0.05), even if they decreased numerically the differences between other TD treatment means were not found significantly diferent. As to the these results; it can be steated that pH values of meat samples could be decreased to a certain extend by increase of TD. This is related to the PSE problem and it can be interpreted as the reason of PSE problem of the broiler meats. The results for broiler meat pH values obtained in this research are seen in the harmony with findings of Shair at all (2013) and with the evaluations of Yalçın (2013). Becasuse of the meat pH is a quality criteria in nature of index, these results are quite important. Even if the meat pH values were slightly decreased depending to the increased TD applied in this research condition, it can be stated that more than 320 km of TD can be apparently a cause of the PSE problem.

The Color Factors (L, a* ve b*) at Tthe Broiler Meat Samples*

In the broiler meat samples, the mean values with regard to ***L**** (darkness/brightness) color factor was given in the Table 2. As to the statistical analysis results, the effects of TD on this criterion had not been found significantly. General mean value of ***L**** color factor of broiler meat samples with skin had been determined as 64.41. For the 0, 80, 160, 240 and 320 km TD, the values of ***L**** color factor were determined as 64.37, 63.88, 64.88 64.74 and 64.16, respectively.

Effects of the TD treatment on ***L**** color factor of the meat samples with skin had been found statistically significant (P<0.01). General mean ***L**** color factor value was determined as 52.39. For the TD of 0, 80, 160, 240 and 320 km, ***L**** color factor values were determined as 51.41, 51.23, 53.71, 52.72 and 52.85, respectively. As to the these results; it was found that effects of TD on ***L**** color factor was found significant (P<0.01). Depending on increasing TD, ***L**** color factor values of meat samples were seen also increased. The differences between control and 80 km with 160 km of TD had been found significant (P<0.01). Int this scope, it is considered that would be also useful to determine the consumer acceptance range for respect to ***L**** color factor. On the contrary, it would be considered that, in some intervals, the more bright meats would be accepted as good and the dark meats would be accepted as the bad.

Table 2.- The Mean Values of *L**, *a** and *b** Color Factors in the Broiler Meat Samples

Skin	**CF\TD**	**0 (0 min)**	**80 (5 min)**	**160 (10 min)**	**240 (15 min)**	**320 (20 min)**	**Mean**
With	***L****	64.37	63.88	64.88	64.74	64.16	**64.41**
	a*	3.78[b]	4.03[b]	3.92[b]	5.20[a]	4.53[ab]	**4.29**
	b*	2.45	3.39	3.36	3.90	3.06	**3.23**
Whitout	***L****	51.41[b]	51.23[b]	53.71[a]	52.72[ab]	52.85[ab]	**52.39**
	a*	3.28	3.57	3.59	3.76	3.96	**3.63**
	b*	3.64[a]	3.22[ab]	2.88[ab]	2.58[b]	2.45[b]	**2.95**

CF: Color factor, TD: Transport distance (km)

Note: The values at same row bearing same super script are not diferent from each other statistically.

It can be encountered consumers preferring broiler meats without skin at today. In this respect, some consumers says to the butcher their requests at the buying time and he removes the skin immediately for meeting the demand.

If the table is examined, it can be seen that the effects of TD on ***a**** color factor of meat with skin were found significant (P<0.01). General mean of ***a**** color factor is determined as 4.29. In the meat samples with skin, for the 0, 80, 160, 240 and 320 km of TD, the mean ***a**** color factor values were determined as 3.78, 4.03, 3.92, 5.20 and 4.53, respectively. In the meat samples with skin, ***a**** color factor walue determined for 240 km was quitely higher than the values determined for the 0, 80 and 160 km TD and also found similarly with the value determined for 320 km of TD.

As to the this; it can be stated that the values for the ***a**** color factors (redness) are also increasing as to the increased TD. This stuation can not be steated by us suitable in terms of the consumer color expectations for the broiler meats.

In the meat samples without skin, effects of the TD on ***a**** color factor had not been found significant. General ***a**** color factor value was also determined as 3.63 in the meat saples without skin. The mean vaues of ***a**** color factors in the meats samples without skin for the 0, 80, 160, 240 and 320 km of TD were determined as 3.28, 3.57, 3.59, 3.76 ve 3.96, respectively. In the meat samples without skin, the effects of TD on ***a**** color factor were not found significan, but it can be stated that with increasing TD the values for ***a**** color factor (redness) are also increases numerically. Of course, we can not say this stuation is suitable for the consumer preference point of view.

In the meat samples with skin, the effects of TD on ***b**** color factor was not found significant. General mean of ***b**** color factor value was determined as 3.23. For the 0, 80, 160, 240 and 320 km of TD, ***b**** color factor values of meat samples with skin were determined as 2.45, 3.39, 3.36, 3.90 and 3.06, respectively.

In the meat samples without skin, the effects ot TD on ***b**** color factor was found significant ($P<0.05$). The general mean of the ***b**** color factor value was determined as 2.95. For the 0, 80, 160, 240 and 320 km of TD, the b* color factor values were determined as 3.64, 3.22, 2.88, 2.58 and 2.45, respectively. With respect to this criterion, it can be seen that the values of ***b**** color factor were decreasing depending on the increases of TD. The differences for the ***b**** color factor values determined between 0 km with 240 and 320 km were found significant ($P<0.01$). The values determined for 80 and 160 km were found similar to the other values. In this stuation, it can be stated that while the TD are increasing, the yellow tint is decreases and blue tint is increases, but this results unfortunately negative effect in meat samples without skin.

The Correlation Coefficients

The correlation coefficients between TD and the examined meat quality properties were also determined in the experiment. While the significant ($P<0.05$) negative correlation coefficient (r=-0.202) were determined between TD and PV (hardnes/tenderness), between ***L**** color factor values in the meat samples without skin and TD determined significant (P<0.05) positive correlation coefficient (r=0.165). As to the these results; it can be stated that ***L**** color factor values increases with increased TD and due to this, brightnes is also increases. In adition to this, it was determined that TD has signinificant (P<0.05) negative relationship (r= -0.201) with ***b**** color factor values in the meat samples without skin. Also, between pH and PV (hardness/tenderness) significant (P<0.01) positive correlation coefficient (r=0.535) was determined. This stuation is important due to the showing an existence of linear relationsip between pH and PV (tenderness) in the broiler meat samples.

RESULT AND SUGESTIONS

In this research; the male broiler pullets rised in 6 weeks were treated as simulating 0, 80, 160, 140 and 320 km of TD on The Vibration Simulation Case (the properties is explained above) with the duration of 0, 5, 10, 15 and 20 minutes. After slaughtering; the bereast, drumstick and tights samples of each pullets were reserved for further quality analysis. In the meat samples, quality properties considered affecting the consumer preference which are hardness (tenderness), pH, cooking losses (%) and color factors (***L****, ***a**** ve ***b****) were determined in the labroratory condition. The data obtained are analyzed and the results were interpreted. Here, the knowledge obtained was shortened like belowe.

a) In the statistical analyses done, without cooking losses, TD has effected significantly (P<0.05) on meat quality properties in the consideration.
b) It was determined that TD has effected significantly (P<0.01) on tenderness (penetrometer value). While the TD was increasing, the tenderness of the broiler meat was decreased (P<0.05) considerably.
c) TD has not effected significantly on the cooking losses.
d) It is found that TD has effected significantly (P<0.01) on pH of the broiler meat. In the experimental condition, while TD was increasing the pH walue of meat samples was slightly decreased, evef if it is increased at the beginning (0 – 80 km).
e) With respect to the meat colors; TD has effected significantly (P<0.05) on the ***L**** color factor of the meats with skin. Also, TD has effected significantly on the ***a**** (P<0.05) and the ***b**** (P<0.05) color factor of the meats without skin.
f) With respect to correlation coefficients; while the significant (P<0.01) negative

correlation coefficients (r) were determined between TD with penetrometer values and ***b**** color factors of meats without skin, again between TD with ***L**** color factor of samples without skin and ***a**** color factors of meats samples with and without skin significant (P<0.01) positive correlation coefficients (r) were determined.

The recommendations below could be done to the researchers who will work on the similar subjects.

a) When deciding on real or simulated transportation, it is better to decide to the quality properties taken in to account. In case of real logistics, if the duration of transportation would be increased, depending on to transport conditions, the stress woud take more time and the data would be obtained as nearly as the real.
b) With respect to the quality criteria affecting consumer preference; how much time would take the stabilization of the quality of the poultry meat after the slaughtering. This could be a new researche subject, considering the slaughtering time, immediately or holding for resting for a while after the transportation. It needs holding area in the processing plant, as well.
c) The process of slaughtering also would effect meat quality, thereby it can not owerlooked.
d) Death on arrival to the processing plant and the status of the pullets would be examined considering also the animal welfare aspects.

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ORAL PRESENTATIONS ABSTRACTS

Manure Affects the Fate of Antibiotic Pharmaceuticals in Soil

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Abstract

Liquid manure is used as an organic fertilizer in agricultural practice. Often veterinary antibiotics are also contained in manure and are co-applied to agricultural soil. Knowledge is accumulating about the fate and effects of pharmaceutical antibiotics in soil, however, there is a strong and largely unknown interference with manure. Liquid manures are extremely heterogeneous matrices, varying with live stage of animals, feeding, and finally manure collection systems at the farm (Fig. 1). Their composition is already altered by antibiotic action in the digestive tract of medicated animals. This also applies for the microbial community in manure. On one hand, manure and manure constituents differently affect the further fate, transport and retardation of antibiotics in soil. Depending on the composition and particle size, increased mobilization but also immobilization are determined (Fig. 2). On the other hand, antibiotic effects on microorganisms are strongly influenced by manure as a nutrient source and activator of microbial growth, so that manure contaminated with antibiotics affects soil microorganisms directly but also indirectly through an altered, and antibiotic-adapted, microbial community within the manure itself (Fig. 3).

Keywords: Sulfonamides, Livestock slurry, Sorption, Soil leachate, Structural diversity, Molecular composition

Impact of Heavy Machinery in Agriculture and Forestry – Harmful Soil Compaction

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Abstract

Environmental degradation processes triggered by human impact reduce the performance and functions of soils worldwide. Production of food as well as timber nowadays is directly related to global market rules. To reduce costs expensive manpower is minimized and mechanization is pushed. For this reason, machinery is becoming more and more powerful and thereby heavier. The use of very heavy equipment in combination with unfavorable soil conditions (e.g. loose, wet) cause tremendous mechanical soil stress, leading to harmful soil compaction, deformation or even total damage of soil structure and functions. Ecological and economical losses are the final result of mechanical overloading of soils. The deeper the harmful compactions reach the more negative and long lasting the induced negative impacts are.

Short- and long-term investigations showed that physical soil properties become unfavorable and by that, e.g. water balance is disturbed followed by surface runoff and erosion. Conditions for soil biota and also for root development as well as water and nutrient uptake are impaired which leads to worse plant growth and yield.

Melioration of deep reaching subsoil compactions in agriculture is possible but expensive and special equipment is needed. Mechanical loosening of soil compactions in forestry is more difficult because of specific forest soil conditions (e.g. strong root systems of trees).

The worldwide goal therefore should be reduction of harmful soil compaction and even better prevention of compaction. Many management strategies are discussed and tested to prevent soil compaction and especially deep reaching subsoil compaction in agriculture and forestry.

Optimization of Ultrasound Treated Traditional Apple Vinegar by Surface Response Method

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Abstract

In recent years, there has been an increase in research on the use of non-thermal technologies due to the increase in the interest of consumers in natural products, the preservation methods such as pasteurization and the loss of nutrients in the final product. In this study, the application of ultrasound, which is a non-thermal technology compared to thermal methods, to apple vinegar which is produced by conventional methods and application with surface response method is provided. The study model factors, the interval of independent variables was preferred as time (2-10 minutes) and amplitude (40-80). Dependent variables are total phenolic substance, total antioxidant (DPPH) and color values (L, a, b). The optimal conditions of ultrasound were traditional apple vinegar (7.5 minutes and 63.8% amplitude). Optimum total phenolic content (84.88 mg GAE / L), total antioxidant (mg TEAC / mL), L (33.36), a (6.24) and b color values (12.92) were obtained as a result of optimization. In particular, the results of optimization of total amounts of phenonic substances and antioxidants were higher than the untreated samples. At the end of the study, it was determined that ultrasound optimization improved the quality parameters of traditional apple vinegar.

Keywords: *Ultrasound, Traditional Apple Vinegar, Total phenolic content, Response surface optimization*

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Evaluation Of Animal Wastes In Gaziantep City

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Abstract

The presence of new and renewable energy sources and ensuring sustainability has become a necessity rather needs to come out today. One of the most important reasons for this is that the intensive consumption of fossil fuels is the source of greenhouse gas generation, causing global climate changes and many environmental pollution. It is also important for the national economy to meet the energy needs by evaluating alternative energy sources. One of these renewable energy sources is biogas produced by the processing of animal and domestic waste. Obtaining biogas from animal wastes will provide economic benefits to the region as well as numerous positive environmental and social impacts. The manufacture of biogas in the agriculture and animal husbandry industry has been practiced successfully in developed countries for years. The expansion of this practice in our country and especially Southeastern Anatolia Region is very important in terms of economic returns.

Turkey Statistical Institute (TUİK) announced in 2018 that according to statistics cattle and sheep; In our country the number of 17 million 338 thousand head of cattle, and sheep are expressed as the number of animals was 47 million 362 thousand head. One of the important centers of the Southeastern Anatolia Region In Gaziantep City also is in Gaziantep in 2018 has increased with each passing day the number of cattle that this number 191 thousand 842 thousand was cattle, and until today in 2002 it is stated that an increase of 410 percent in the number of cattle. In this study was established by Gaziantep Metropolitan Municipality in Gaziantep City and became operational in 2018, "Gaziantep-Oğuzeli Center Biogas Plant" was examined in the evaluation of animal waste.

Keywords: Biogas, Biogas Potential, Gaziantep, Animal Waste, Renewable Energy.
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The Gross Profit Analysis of Corn Production Farms in Karatay District Of Konya Province

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Abstract

The aim of this study is to analyze the gross profit in the corn production enterprises in Konya Closed Basin (Karatay district of Konya province where sampling is made). In order to conduct the study, data were obtained from the 37 farms operated face-to-face questionnaire methods determined by simple random sampling method in Konya. The data of the study belong to the production period of 2016-2017 and the questionnaires were carried out by the researcher himself. The surveys were conducted with the farming enterprises that produce corn in the Yarma and Göçü villages of the Karatay district of Konya province. The average total gross production value of the enterprises surveyed is 242,296.74 TL, 72.35% of this value is from plant production value and 27.65% is from animal production value. The total changed costs in the examined enterprises are determined as 177,804.65 TL, 59,56% of this value is due to the changing costs in plant production and 40,44% is the cost of changing in animal production. The average gross profit of the inspectors was calculated as 124,492.08 TL and the charge was determined as 546,12 TL. The research area is a farm with intensive farming of corn with animal husbandry. In general, livestock enterprises are turning to corn farming in order to raise their own feed in order to reduce feed costs, which is one of the biggest input items. Maize agriculture is successfully carried out in this region in order to obtain both silage and grain. Farmers are complaining of rising input prices. If we look at the amount of gross profits, it is seen that farmers are not profitable enough.

Keywords: Konya Closed Basin, gross profit, corn production, Konya

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Comparison of Aggregate Stability of Pistachio, Grain and Pasture Soils in Gaziantep

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Abstract

In this study, it is aimed to compare the aggregate stability of pistachio, grain and pasture soils of Gaziantep.The material of this study consists of soil samples taken from 3 different product patterns of Gaziantep as pistachio, grain and pasture between 2016-2019.Aggregate stability of soils taken from their lands was determined by Eijkelkamp wet sieving apparatus 08.13 device according to wet sieving method. In addition to aggregate stabilities, structure, color determination, organic matter content (Corg), C/N ratio, pH, salt, EC (Electric Conductivity) and lime analyzes were made. Soil aggregate stability values were compared in terms of product pattern. As a result, it was determined that aggregate stability has the highest value in pasture soils where organic matter is high.

Keywords: *Aggregate stability, pistachio, grain, pasture*

Investigation of Halophytic Plants in In Secondary Vegetation Due To Global Warming in Araban (Gaziantep, Turkey)

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Abstract

As a result of the global warming caused by increasing industrialization, changes in vegetation have occurred on the earth. Halophyte species have been observed in many areas including native vegetation and agricultural land due to increased drought and warming and also overirrigation during formation of seconder vegetation.

Soil samples were taken seasonally from selected three areas in Araban (Gaziantep Turkey) and the pH, EC, lime ($CaCO_3$), nitrogen (N), phosphorus (P), potassium (K), sodium (Na) and calcium (Ca) analyzes were performed in these samples. In addition, the presence of taxa known to be halophytes in these areas has been investigated.

As a result of the analyzes, it was found that there was no seasonal difference ($p> 0,05$), but there were significant differences between lime ($CaCO_3$), phosphorus (P), potassium (K) and calcium (Ca) among the localities ($p <0,05$). *Alhagi pseudoalhagi* (M.Bieb.) was found to be in Timurlenk and Karapınar, *Salsola kali* spp. *ruthenica* (Iljin) was found to be in Timurlenk and *Juncus inflexus* (L.) was found to be in Timurlenk, Karapınar, Fakılı.

Although the soil is not salty, the presence of three different taxa that can tolerate the salt in three localities shows that the amount of salt in the soil may increase in time. The information presented in this study contributes to the salinization of soils and their effects on agriculture in the region.

Keywords: *Soil Salinity, Alhagi, Juncus, Salsola, Agriculture*

Acknowledgement: *This work was supported by Gaziantep University. All authors would like to thank Gaziantep University.*

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Genetic Characterizations of Vitis Genetic Resources Belonging Mardin, Şırnak, Siirt By Using Simple Sequence Repeats (SSR)

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Abstract

Studies on genetic characterization are useful way to determine genetic diversity within species as well as between species and identify species. Grown almost everywhere in Turkey vine has abundance of local varieties and kinds. However, as a result of different denomination and variation within varieties, there is confusion of grape varieties. Moreover, some varieties which is out of production nowadays have risk of extinction Aiming to overcome problems mentioned above, SSR markers method has been used. In this study, belonging Mardin, Siirt and Şırnak 44 variety and kind from Pistachio Research Center Southeast Anatolian Vitis Genetic Sources Vineyards and together with 2 reference variety, 46 varieties (*Vitis vinifera* L.) were analyzed for genetic characterization by using 6 microsatellite markers (VVS2, VVMD5, VVMD7, VVMD27, ZAG62, ZAG79). In 6 loci, 46 alleles were designated. Genetic relationship dendogram has showed that varieties used as reference had independent branch from studied varieties and within 2 branches 3 synonyms were found. Genetic findings as research results belong to Pistachio Research Center Southeast Anatolian Vitis Genetic Resources Vineyards were integrated with Turkish Vitis Genetic Resources Databases created by Ankara University Faculty of Agriculture Department of Biotechnology. Employing SSR markers, this study reveals the first identification results of genetic Vitis resources of Mardin, Siirt and Şırnak in Southeast Anatolia. Obtained by this study, the results have value in better identification of varieties in Pistachio Research Center Southeast Anatolian Vitis Genetic Resources Collection Vineyards, regulation the number of varieties in National Collection and new breeding studies.

Keywords: *Türkiye, Southeast Anatolia, SSR, Vitis, SSR*

Acknowledgement: *This work was supported by TAGEM. All authors would like to thank TAGEM.*

Agricultural Policies in Turkey in The Period of Democratic Party

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Abstract

In the early 20th century, agriculture in Anatolia was carried out black plows, and the number of fields entering the tractor and iron plow was very low. For this reason, the peasant was in bread to eat the land and sell it in nearby markets. Although some positive studies were carried out in the field of agriculture with the coming of the Party of Union and Progress, the endless wars caused a decline in the field of agriculture as in all areas of the country. During the First World War, because the male population was recruited, agricultural activities came to a halt and scarcity had emerged in the country. There were big problems waiting for the leading squad of the National Struggle, which urged the people of Anatolia to fight against the occupation of the country after the war. One of the problems was to remove the invaders from the country and solve the problem of famine in the country. After the war period of the National Struggle was completed, important decisions were taken in the development of agriculture at the Economic Congress held in İzmir between 19 February - 4 March 1923. In line with these decisions, the land tax was abolished in the single-party years of the republic, land reform was started, farms were established so that it could set an example for the villagers, seed breeding activities were carried out and schools and institutes were opened for the modernization of agriculture. In spite of these reforms in a single-party period, production could not be increased sufficiently because agriculture could not be mechanized. Mechanization in agriculture took place during the Democratic Party. While the number of tractors was 9.170 in 1949, this number reached to 16.585 in 1950 and 42.136 in 1960 with the power of Democratic Party. A significant increase was observed in the cultivated field areas with the introduction of the tractor into the agricultural land. In 1948, 13 million hectares of cultivated land increased to 14.120 million hectares in 1950 and 23.2 million hectares in 1960. Through the construction of the irrigation dam by the Democratic Party, many arid soils met with water. Again in this period the peasant was supported in the use of seeds and fertilizers. The studies for the development of agriculture have yielded results during this period and there have been serious increases in production.

Key words; Democratic Party, Agriculture, Mechanization in Agriculture

Fermentation, Prebiotic Covering and Producing Ornamentation Material of Stevia Plant

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Abstract

Fatherland of Stevia (*Stevia rebaudiana*) plant is the South America and the extract of it gets use as natural sweetener in Japan, China, South Korea, Brazil and countries such as these. First demo producing has been done in Mediterrianean region in our country and it still gets produce in 29 cities in Turkey at present. Aquaculturing is tested in Black sea region but plantation did not obtain literally in the Black Sea Region due to efficient product could not produce from the acidic soil. Stevia leaves from other plants owing to sensorial advantages like having heat resistant, not leaving bitter taste in mouth, having high fiber and liquid capasity. Steviol glicosid the component of *S. rebauidana* gets detected 250-300 times sweeter than normal sugar by taste sensors in our body. This plant is known as powerfull prebiotic owing to fiber ingridient and it is considered to be used as prebiotic booster for the products has got heat treatment. On this job of work the aim is producing a new probiotic product by using the stevia's prebiotic feature by entegrating stevia plant and semi product which is a result of successor heat treatment processor and supplementing kefir. This mixture is going to make a fermentation after that the probiotics will be increase.

Keywords: Stevia (*Stevia rebauidana*), Prebiotic, Probiotic, Fermentation, Process

Investigation of The Use of Resistant Starch in The Production of Gluten-Free Biscuits

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Abstract

In this study, resistant starch (RS) were used as a functional component and a source of dietary fiber in the production of gluten-free biscuits. The aim of using RS in replacing of gluten-free flour; to investigate the use of gluten-free biscuits and to increase the dietary fiber ratio of gluten-free biscuits produced. Chemical and physical properties of produced biscuits were investigated. The amount of gluten-free flour in the biscuit formulation was reduced by 10%, 20% and 30% and DN was used instead of gluten-free flour; and the cooking time of the biscuits was kept constant, and they were cooked at 175 ^{o}C, 200 ^{o}C and 225 ^{o}C temperatures. The control group biscuits were completely made with gluten-free flour. Biscuits were compared by measuring the quality parameters in terms of moisture, water activity, pH, color, diameter, height, texture and dietary fiber. When the biscuit samples are cooked at different baking temperatures observed that as temperature increased, moisture, water activity, pH, biscuit diameter, L *, hardness and fracturability decrease; biscuit height and a * and b * values increased. Generally, as the proportion of RS increases at each baking temperature, moisture, water activity and L * value increased; pH, a *, b *, biscuit diameter and height decreased. As the proportion of RS addition increases, hardness value increased, fracturability value decreased compared to the control value. But with the exception of control biscuits, as the amount of RS increases, the hardness value decreases. Despite this decrease, the results are above the control biscuit values. Dietary fiber amounts of biscuits baked at 200 ^{o}C were measured. Control biscuits, 10%, 20%, 30% RS instead of gluten-free flour dietary fiber amounts were measured as 1.5 %, 2.8%, 5.3% and 5.8%, respectively. The amount of dietary fiber increased with increasing the amount of RS. As a result, according to the study, it was observed that the use of DN instead of gluten-free flour had positive effects and enabled the production of healthy biscuits.

Keywords: *Functional Food, Dietary Fiber, Resistance Starch, Gluten-free biscuit, Celiac Disease*

The Effects Some Bio-agents and Organic Substances to Verticillium Dahliae

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Abstract

In this study, the biological control effects of some fungal (*Trichoderma harzianum, Trichoderma virens*, *Trichoderma asperellum*, *Trichoderma virens*) and yeast (*Saccharomyces cerevisiae*), and the organic substances effects of vermicompost and salicylic acid against the development of *Verticillium dahliae* which is very difficult to control were investigated. The experiment was carried out in *in-vitro* with 5 replications. When testing the bio-factor fungi against the pathogen, a scale of 1 to 5 was used to determine the degree of antagonism and the inhibition rate was determined in percentage. In other parameters, colonies were measured. As a result of the evaluations, by its antagonistic properties, *Trichoderma* species were found to inhibit the development of *Verticillium dahlia*. It was also determined that salicylic acid completely inhibited the development of *Verticillium dahliae*. As for vermicompost and yeast; It was observed that their effectiveness against the pathogen was not as much as *trichoderma* species and salicylic acid.

Keywords: *Trichoderma, Verticillium dahliae. Saccharomyces cerevisiae,* Salicylic acid

Determination of Pods Properties And Yield Quantity of Pea Varieties And Lines (*Pisum sativum* L.)

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Abstract

This study was conducted to determine the yield and pod properties by using 3 pea lines that was hybridized by the investigators (Line 1, Line 2 ve Line 3), 6 commercial cultivars (Bolero, Jof, Karina, Nihal, Reyna, Utrillo) and 2 natural vegetation pea genotypes (*Pisum sativum* L. ssp.*elatius*, *Pisum sativum* L. ssp. *sativum*).The research was arranged in a randomized complete block design with three replications at the Bayburt University, Aydintepe Vocational School research area in 2016 and 2018.

Considering the two-year results obtained from the research; first pod height 8.60-36.30 cm, pod lenght 4.148-7.845 cm, pod width 1.051-1.871 cm, seed number per pod 5.63-7.57, pod number per plant 7.60-21.33, seed yield ranged between 57.5-124.0 kg/da.There were significant differences between the genotypes for all measurement parameters ($p<0.01$). On the other hand the statistical difference between years was found to be significant for all properties except for the pod width ($p<0.01$).

According to the two year results, in terms of the number of pods per plant, Line 1 had the highest value between all used genotypes. In 2016 year, in 2018 year and as a result of these two years, the highest seed yield value was obtained from the Reyna commercial cultivar.

Keywords: *Pisum sativum L., Genotype, Wild Pea, Yield, Pod Properties*

Acknowledgement: *The project was supported by Bayburt University Scientific Research Projects Units. Special thanks to Bayburt University Scientific Research Projects Units.*

A Research Conducted on Yield and Yield Characteristics of Chickpea Genotypes (*Cicer arietinum* L.) Under Bayburt Conditions

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Abstract

The research conducted to determine yield and yield characteristics on chickpea cultivars and some local chickpea genotypes of Bayburt province, during growing seasons of 2017-2018 in Bayburt University, Aydintepe Vocational School research area, according to randomized complete block design with three replications. In the study, 8 chickpea cultivars (Çakır, Aydın-98, Yaşa-05, Işık-05, Menemen-92, Hisar, Azkan, Sarı 98) and 3 local genotype of Bayburt province were used. According to the results of the research; plant height 38.33-51.83 cm, first pod height 19.20-28.07 cm, branch number per plant 3.20-4.67, pod number per plant 8.33-17.80, seed number per pod 1.00-1.20, thousand seed weight 370.00-526.00 g and seed yield ranged between 60.00-116.00 kg/da. There were significant differences between the genotypes in terms of first pod height, thousand seed weight and seed yield ($p<0.01$), plant height and pod number per plant ($p<0.05$).

The highest values of plant height, first pod height, pod number per plant, thousand seed weight and seed yield were obtained from Aydın-98, Azkan, Bayburt local genotype-3, Bayburt local genotype -2 ve Azkan genotypes respectively.

Keywords: *Chickpea, Cicer arietinum L., Genotype, Cultivar, Yield, Yield Components*

Converting The Maraş Pepper Industrially to High Value Added Products

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Abstract

In Kahramanmaraş and its surroundings red pepper farming is done intensively. The obtained product is generally flaked red pepper, powdered red pepper and isot pepper; in some facilities pepper is processed into pepper paste. It is consumed in high amounts due to the fact that it suits the palade of the people living in the area. The number of the firms that sell pepper paste is limited. The number of the firms which package and sell other spices as well or produce different products by using pepper is only a few. Most of the firms make a sale in a restricted area by using their own brands. There are many facilities which make production in low amounts under the counter in primitive conditions. Some of them export directly. Furthermore, farmers sell the pepper they produce to wholesale buyers by drying it. With this clustering it has been aimed to obtain alternative products from the manufactured pepper, provide a high amount of added value to the producer and the industrialists, gain healthy products in hygiene conditions with the help of advanced technology and build facilities to produce valuable products that will be an example in the area with high added value.

Red pepper has an important place in Kahramanmaraş. The purpose of this study is to process Maraş pepper, which is intensively cultivated in Kahramanmaraş and its surroundings but can not be put to good use as desired, into alternative different products with high added value. As the high amount of produce that is gained does not have a different processing technology, the raw material that is wasted will be brought back into production. Another aim is to obtain new, innovative and competitive products from the pepper that is produced in the area with high added value. It is also aimed to increase the income level of the employer and the employees and to provide added value to the producers in the area by encouraging the entrepreneurs who want to start similar businesses.

Keywords: Value added products, Maraş Pepper, Innovative Ideas, *Capsicum annum*

Impact of Phosphorus Fertilizer on Soil Organic Carbon Sequestration and CO_2 Flux

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Abstract

Long-term agricultural researches with annual and perennial cropping systems provide significant insight into the carbon sequestration potential of agriculture in the South-East Anatolia region. This study was exploring an effect of different phosphorous (P) fertilizer application rates on the storage and quality of soil organic carbon (SOC), permanganate oxidizable C (PoxC), plant biomass and carbon uptake, plant CO_2 assimilation rate to assess the relationship between Carbon Sequestration and P fertilizers application.

Different cropping sequences of corn (*Zea mays* L.) -wheat (*Triticum aestivum* L.) (CW system) and application of 4 fertilizer dozes (0, 50,100, 200 kg ha-1) were repeated annually during last 20 years. The study was based on the hypothesis that long-term P-fertilization can affect Carbon Sequestration is soil and plant biomass and impacts on soil CO_2 flux. The objectives of the present study were to: (i) analyze the effect of long-term inorganic chemical P fertilization on the plant biomass carbon uptake and SOC amount for wider environmental protection, (ii) estimate effect of long-term P fertilization on CO_2 flux related with SOC accumulation. The results demonstrated that P fertilization has positive impact on plant biomass, higher carbon fixation and more carbon residue left in soil, that in a long perspective has a positive impact on soil carbon sequestration. The P fertilizer did not have direct impact on SOC of summer-maize growing season, and had positive impact on SOC while winter-wheat growing season. The fertilization also did not demonstrate direct impact on soil CO_2 flux.

Key words: Soil organic carbon, Climate change, Carbon dioxide

A Sustainable Agricultural Approach: The Philosophy of Permaculture

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Abstract

Under the umbrella of sustainable agriculture practices are ecological concentration, organic agriculture, permaculture and biodynamic agriculture, integrated livestock and forestry systems. In the early 1980s, the concept of permaculture, from these systems, has expanded from the design of agricultural systems to sustainable human living spaces. The term permaculture is a combination of permanent, agricultural and cultural words. This sustainable system is based on ethical values, equal interaction with the environment and design principles. Basically, it has adopted the principle of managing natural resources. The main emphasis in permaculture is agricultural sustainability. It starts doing this by designing nature. This design approach increases biodiversity in agricultural areas. Thus, the use of land is increasing when processing agricultural land. Energy is saved by selecting natural materials, preferring renewable resources and providing waste management, while processing agricultural land or using land. Permaculture adopts the philosophy of how less intervene to nature while creating agricultural areas. In the areas where permaculture is used, neither soil is processed nor chemicals are used. Moreover, fertilization is not applied to soil or plants.

In permaculture areas, the creation of each part in relation to each other is based. The location and selection of plants in garden design is important. Similarly, the location of buildings in the field should also be functional. When creating permaculture areas, the applications in the areas should be available in the longterm. Permaculture includes not only the philosophy of designing agricultural areas, but also the principles that design buildings, work places and unused areas. Primarily, the resources in the land must be determined. This should be done in the form of observation, land mapping, gathering information from people living in the environment. Agricultural products should be planted in proportion to the total vegetation. Construction of gren houses and coops close to home both provides heat insulation for the house and facilitates Access to plants and coops from home. Planting companion plants in gardens and planning the use of bait plant are important. Also used seeds should be natural.

In the initial phase of permaculture, the use of non-natural resources such as application of chemical fertilizer for the need of gren manure to the soil is allowed until a sufficient and appropriate soil environment is achieved. Besides, biological resources in the designed lands, for instance planting for wind break, plants grown using the sun's rays effectively, nitrogen-catching legume plants, pits in high areas that allow rain water to be kept in the field, should be checked. The materials to be used during all these stages are also important. For example, materials such as feltorwool products, wood chips and straw for insulation are used to absorb heat in house design.

Generally, the needs of these parts while a section is created for each living in the permaculture areas are supplied from other living spaces or sections.

Consequently, it is aimed to present particulars about the basic principles of permaculture philosophy which is one of the sustainable agriculture systems.

A Fungal Spore Calendar for The Atmosphere Of Yalova, Turkey (2005)

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Abstract

Fungal spores represent a major component of bioaerosols of the atmosphere. Airborne fungal spore studies are of great interest because they can be applied to several fields, from agriculture to cultural heritage conservation, as well as to animal diseases and the prevention of several human allergies. The aim of this study was to assess the fungal atmospheric spore content in Yalova and to construct fungal spore calendar of the year (2005). Daily airborne spore counts were collected during 2005 using a Hirst-type seven day volumetric spore trap, which situated on the roof of a building in Yalova. The fungal spores were observed and identified using light microscopy. Analyses were performed on the slides and the spore concentrations were estimated as the average daily spore concentrations per cubic meter of air. The spore calendar construction was based on Spieksma's model. A total of 286.356 s/m^3 belongs to 47 fungal taxa and 4 fungal groups were recorded during the study period. One-year spore calendar of Yalova was prepared by evaluating the data. The prepared spore calendar can assist clinicians to identify and control fungal allergy symptom. In addition, it can be helped to agronomists and farmers to prevent plant diseases, determine using time of fungicides and solve the problems in suitable times with using less fungicides.

Keywords: *Airborne fungi, volumetric method, spore calendar, Yalova*

Determination of Some Soyabean Genotypes Yield and Technological Properties Grown as a Main Crop in Diyarbakır Conditions

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Abstract

This study was carried out to determine the high yielded some new soyabean genotypes for suitable soyabean cultivation as a main crops in Diyarbakır conditions. In this experiment; (Arısoy, Nova, Ataem-7, Çetinbey, SA-88, Umut-2002, ANP2018 (ÇU-04-07) cultivars and ÇU-04-122, S01-08-15, KA-04-03-05, KA-04-05-02, KA-04-06-01, KA-04-07-04, KKMA-118, KSA-26, KWO-60 lines) 16 genotypes were used as a research materials.. The experiments were conducted the trial field of GAP International Agricultural Research and Educational Center in Diyarbakır with randomized complete block design with three replicate in 2015 year. According to the findings of experiment; plant height ranged (122.5-152.6 cm), first pod height (7.0-9.7 cm), pods per plant (47.2-63.0), grain number per pod (2.7-3.1), 1000 seed weight (109.8-169.4 g), seed yield (203.1-330.4 kg/da), oil content (20.60% - 23.33%) and protein content (37.20%-41.48%) respectively. Results of this study indicated that; Arısoy, SA-88, Umut-2002, ANP2018 (ÇU-04-07) cultivars and S01-08-15, ÇU-04-122, KA-04-03-05, KA-04-06-01, KKMA-118 lines in respect to yield and investigated agricultural characteristics can be grown in Diyarbakır main crop conditions.

Keywords: Genotypes, main crop, seed yield, soyabean cultivars

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Colorectal Cancer and miRNAs

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Abstract

Colorectal cancer is the third most common type of cancer worldwide and is the leading cause of cancer death. Surgery represents the basis of treatment in the early period, but often patients are diagnosed in a progressed stage of the disease and sometimes distant metastases are seen. Molecular characterization of cancer-related mutations gives valuable information about disease prognosis and response to treatment. MicroRNAs (miRNAs) are small non-coding RNAs of 18-24 nucleotides that regulate gene expression through mRNA degradation and translation inhibition. A single miRNA may affect the expression of thousands of genes and multiple cellular processes required for cancer development. miRNA expression can also be regulated by DNA methylation. The studies that were investigated miRNA-mRNA interaction in colon cancer, were identified gene networks that contribute to the transformation of a malignant phenotype. Recent expression studies were shown that miRNAs play an important regulatory role in various cellular functions as well as in every type of cancer studied so far. In this review, the role of miRNAs in the development of colorectal cancer has been described and the expression levels of miRNAs (miR-21, miR-210, miR-122, miR-429, miR-224, miR-215, miR-196a, miR- 196b, miR-182, miR-183, miR-17-92, miR-17, miR-155, miR-31, miR-625-3p, miR-181b, miR-27b, miR-622, miR-215, miR-107, miR-99a-3a, miR-17-5p, miR-125b, miR-137, miR-31-5p, let-7a, miR-126) studied in colorectal cancer were discussed.

Keywords: *miRNA, Colorectal cancer, Expression.*

HASSAS – Widespread Application of Sustainable Precision Agriculture Practices in GAP Region

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Abstract

Southeastern Anatolia Project Regional Development Administration (GAP BKİ) supports sustainable agriculture through Widespread Application of Sustainable Precision Agriculture Practices in GAP Region project. GAP BKİ collaborated with TÜBİTAK Space Technologies on this project. HASSAS Project aimed to improve crop yields of farmers while using optimal agricultural inputs such as fertilizers or pesticides. In the first phase of the project, satellite multi-spectral and SAR data and aerial hyperspectral imagery were collected for developing semi-automatic agricultural analysis software. The software let agriculture experts analyze crop fields and share their findings via a farmer portal. In the second phase, variable rate fertilization applications are planned for the corn crop. Our findings will be shared with related institutions and help sustainable agriculture in the region.

Keywords: Multi-spectral imagery, optimal fertilization, farmer portal, GAP Region

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GAP Agricultural Training and Extension Project (GAP TEYAP)

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Abstract

"GAP Agricultural Training and Extension Project" towards increasing efficiency of agricultural training and extension services was launched in 2011 under coordination of Ministry of Development GAP Regional Development Administration in order to find solutions to problems faced in agricultural matters in our region and to provide agricultural development and sustainability by efficient use of potentials and natural resources of the region, Project's purpose is to increase efficiency of training and extension services first in irrigated and to-be-irrigated areas, effiencient use of water, farmers' organizations, establishing group, alternative crop, increasing agricultural consultance service capacity and developing an agricultural training and extension model peculiar to the region.

Under the scope of Project (April 2011-December 2018), up to date, 10,619 tecnical staff and 158,693 farmers were reached with 3567 activities under main subjects of training, extension, organization, irrigation and coordination. The Project, according to interim monitoring and evaluation reports, has been a model in development of national and international agricultural training and extension (KOP TEYAP, CYPRUS TEYAP). Besides, an increas of 35% in beneficiaries' annual income was observed considering the project activities conducted and the budget spent.

Keywords: Multi-spectral imagery, optimal fertilization, farmer portal, GAP Region

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Effect of some commonly used fungicides on photosynthetic pigment in tomato (*Lycopersicon esculentum*)

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Abstract

In modern agriculture, fungicides application is an important factor for increasing the yield by reducing the fungal diseases. However, extensive use of fungicides results in its accumulation in ecosystems, thus causing to toxicity in nontarget agricultural crops. The fungicides toxicity can deleteriously affect plant physiology and biochemistry, especially photosynthesis process. Therefore, this study aimed to investigate the effect of different dose of fungicides, mancozeb, and propineb, on the photosynthetic pigments of tomato leaves. The tomato plants were grown for 45 days in plastic pots containing perlite irrigated by ¼ Hoagland solution. The tomato leaves were sprayed with three different concentration of mancozeb and propineb; recommended dose (x), two times higher (2x) and a half (1/2x) of the recommended dose. The fungicides effect on chlorophyll a, b, carotenoid (car) and total chlorophyll (chl) content/carotenoid were determined in tomato leaves which were harvested at 1, 3 and 7 days after the treatment (DAT). The chl a, b and car content were significantly reduced under all dose of mancozeb and propineb treatment. Propineb treated leaves were observed to the highest pigment degradation at 1 DAT, whereas mancozeb-treated leaves were at 7 DAT. In addition, propineb was the more destructive effect on pigment content according to mancozeb in tomato leaves. The finding revealed that mancozeb and propineb fungicides were caused to damages in pigment content of tomato leaves. The pigment parameters can be used to indicate the rapid and preliminary diagnosis of fungicide toxicity.

Keywords: *Fungicides, tomato, cholorophyll, mancozeb, propineb*

Acknowledgement: *This work was supported by Research Fund of Istanbul University.*

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Changes in the Antioxidative Enzyme Activities and Lipid Peroxidation in Maize Roots Exposed to Lead Stress

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Abstract

Lead (Pb) is one of the most widespread, persistent and toxic heavy metals in agricultural soils. The production of reactive oxygen species (ROS) is primarily increased in plants exposed to Pb stress. To prevent Pb-induced ROS damage, plants have developed enzymatic antioxidant systems such as catalase (CAT), peroxidase (POX), ascorbate peroxidase (APOX). Maize plant can be used in phytoremediation applications because of its rapid growth and high biomass. However, studies on the regulation of antioxidant enzymes in the tolerance mechanism against Pb stress in maize roots are very limited. In this study, changes in the ROS production and the activities of antioxidant enzymes detoxifying ROS were investigated in maize exposed to Pb stress. The different concentrations (0, 50, 500, 5000 μM) lead ($Pb(NO_3)_2$) solutions were applied to 25 day-old maize plants for 24 h and 96 h in hydroponic culture. Following the applications, hydrogen peroxide (H_2O_2) amount, lipid peroxidation (MDA) level, protein content and changes in the activities of CAT, POX and APOX enzymes were determined in maize roots. According to the data obtained, Pb stress caused oxidative stress by increasing the H_2O_2 content during both application times and the activities of antioxidant enzymes detoxifying H2O2 with elevated lipid peroxidation level enhanced. The available data will contribute to a better understanding of the Pb tolerance mechanism in plants and improve the phytoremediation capacity of plants in the long-term.

Keywords: *Lead, Antioxidant enzymes, Oxidative stress, Maize, Phytoremediation*

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Traditional Agricultural Systems Of Azerbaijan

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Azerbaijan's geography and climate have determined the development of agriculture, small and large livestock breeding areas from the earliest ages. Agriculture started to develop from the New Stone Age, and the demolition of the Enolithic era was formed, and the transition from the end of the Bronze Age to the conifers of the Bronze Age began. The Iron Age has led to agriculture-based concepts. From the territory of Azerbaijan, it seems clear that in the IX century BC, the manna's three bronze harness figures in the Manna era went to the ravine. Such archeological findings prove that there was developed agriculture in Azerbaijan in the early millennium BC.

In subsequent centuries, Atropatena has grown intensively in agriculture on the lands of the Albanian states, using soft and hard wheat, millet, barley, artificial irrigation systems, from the "horses" (Saban) in the soil, and "Vel" in the cereals. In ancient times, plows were used for plowing with metal gavahin (ground cutter), and in the Middle Ages, "Black Quotas" or "Heavy Quaternion", "Carcar" (vel type). It has developed intensively and consistently over the ancient times since the end of XIX century - the preceding XX century in the early 19th century in Azerbaijan. Historically, in Azerbaijan, there are different "Chala", "Tala", "Dincekoyma", "Herik" and other agricultural systems.The "trench" was mainly spread in the coastal zone of Kur, Araz, Alazan and other rivers. The so-called "tea-bass", "steal", "non-flowing" soils were cultivated in this agricultural method. There are fields suitable for wheat and barley cultivation along the shores of the Kura, Araz rivers. In Anatolia, the name of the place called "Cala" (Cala) is found on the coast of rivers. One of the rarity agricultural systems in Azerbaijan was "Tala ekincilik". This is often found in forested areas. In this way, the forests are breaking, burning and transforming into an agriculture sahesine. The areas cleared from the forest have the same content, although they are called "salad", "kolabat", "kötüklük", "baltalık", "tala", "kolat", "abad", "kıran", "tomarlık". One of the commonly used systems in agriculture was "Dinçekoyma". In this system, the tired land that had been planted for several years was buried several times, and the fertility of the field was 1-2 years.

At the end of the XIX - early XX centuries economic development in the agriculture of Azerbaijan gradually eliminated the "restoration" of the fields. Under cultivated crops, melons and technical herbs were grown in fields falling from power. This new farming method is called "Herik" system. In this system, one of the plants was replaced by the other. In the field of irrigated agriculture one year was planted in the field, and the second year was taken to the "herik" area. It was used as a grazing or mowing on the "Herik" field. Cultivated areas such as cotton, rice, clover, etc., were considered the most suitable for wheat and barley in the next sprinkle. In the twentieth century, the introduction of new crop cultivation in agriculture, the use of tractors and mechanisation, and, most importantly, property relations on the land (the Soviet-sovkhoz establishment of the Soviet era) undermined the traditional agricultural systems and reduced its role. At the end of the twentieth century, the villagers implemented some traditional crop cultivation systems as a result of the land reform in the Republic of Azerbaijan.

Evaluation of Plant Protection Practices of Garlic Growers in Gaziantep Province

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Abstract

This study was carried out to determine the plant protection practices of the garlic growers in Gaziantep province, in 2018. For this purpose, a survey consisting of 20 questions and based on simple random sampling method was conducted with 81 growers in each of the districts of Araban, Oğuzeli, Yavuzeli, Nurdağı, Nizip, Karkamış and central districts. The data evaluated and expressed as percent ratio. According to the findings from the surveys, garlic growers stated that they preferred pesticide markets suggestions for the selection and determination of doses of pesticides used in pests and diseases, they also stated that the price and expiry date were not an important factor in the selection of pesticides. In addition, it is found that growers avoid using the same pesticide continuously against same diseases and pests, they do not make any changes in the recommended pesticide doses, pesticides leave residues on the products, they paid attention the time between the last application and harvest. It has been reported that the use of protective clothing and mask during the application by the growers is relative, they do not use pesticides as a mixture, they apply different processes to empty pesticide packaging. It was determined that garlic growers prefered chemical control and did not have knowledge about the concept of biopesticides.

Keywords: *Garlic growers, Chemical control, Pesticide market, Survey, Gaziantep*

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Insecticidal and Behavioral Effects of *Achillea millefolium* L. (Asteraceae) Essential Oil Against *Sitophilus granarius* (Coleoptera: Curculionidae) and *Rhyzopertha dominica* (Coleoptera: Bostrichidae)

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Abstract

In this study, the insecticidal and behavioral effects of essential oils obtained from *Achillea millefolium* plant against two major stored product pest, *Sitophilus granarius* and *Rhyzopertha dominica* were tested in laboratory conditions. Contact and fumigant activity tests were established at a concentration of 10% and 15%, and mortality rates at the end of 24th and 48th hours were recorded. Pure acetone was used in the control group. Repellent activity tests were established at three different concentrations (1% -2.5% and 5%), and the effects of 2,4,8 and 12 hours were recorded. In addition, the essential oil contents of *A. millefolium* were determined by using GC-MS Essential oil for the experiment did not show significant fumigant activity for both insects. the highest activity was determined at the end of 48 hours with a mortality rate of 19.66%. Fumigant activity was not determined for *Sitophilus granarius*. As a result of the contact activity tests, the highest activity was determined as 99.19% mortality rate at the end of 48th hour in *R. dominica* and the activity at *S. granarius* was determined as 83.51% in the same time zone. *A. millefolium* essential oil showed significant repellent activity in both stored product pests. The highest repellent activity for *S. granarius* was determined at 60% at the end of the 12th hour at 5% concentration. For *R. dominica*, the highest repellent activity was determined at 60% with a concentration of 2.5% at the end of the 2nd hour. These results indicated that plant essential oil have a significant potential in the control of *S. granarius* and *R. dominica*.

Keywords: *Essential oil, fumigant activity, contact activity, repellent activity, GC-MS, Stored product pest*

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Spatial Evaluation Of Soils Characterisitcs And Their Management To Support Sustainable Agriculture

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Abstract

Spatial evaluation of soil charaterisitis plays a central role at national and international levels in determining land suitability for various crops in order to prevent land degradation. The objective of this paper was to evaluate soil characteristics and associated environmental factors as a basis for soil management to protect soil resource from degradation and to promote land use for sustainable agriculture. Spatial distribution of soils and their characteristics could be extracted from results of soil mapping. The extent of Indonesian area is 190.1 Mha and is distributed in about 17,504 islands (IBS, 2016). Based on results of soil mapping and land evaluation of Indonesia, the remain potential areas for agricultural development occurred in peat, swampy areas and small upland area with a dry climate. The serious challenge is to reconcile the agricultural development and environmental aspects. The peat and mineral swampy soils are specifically fragile in response to land use change from natural conditions to agriculture. The selection and implementation of the appropriate technology is a prerequisite. In peat soils, the major limiting factors for agricultural development are waterlogging, deep up to 12 m, low decomposition rate, very high acidity (low pH), low concentration of macro- and micro-nutrients. The key success to overcome limiting factors for sustainable agricultural practices in peat land was (i) the appropriate water management by implementing a shallow drainage system (40 cm depth) to allow crop growth and keep a minimal peat oxidation, (ii) selection of suitable crops (tolerant crops), (iii) raised bed cultivation techniques, and (iv) applications of soil ameliorant and fertilizers. The more adaptive crops are oil palm, rubber, pine apple, and other horticultural and food crops. In mineral swampy land, the major limiting factors are waterlogging, tidal flooding, high salinity, the depth of pyrite position from soil surface, extreme low pH associated with pyrite oxidation, and low soil fertility status. The key success of sustainable agricultural practices in swampy areas was (i) water management zonation based on tidal amplitudes (A, B, C, and D types), where soil water table should not lower than pyrite position to avoid pyrite oxidation, (ii) application of soil ameliorants (lime) and compound fertilizers, and (iii) selection of adaptive crops. The more adaptive crops are food crops (e.g. rice and maize), and horticultural crops (e.g. orange and water melon). In the upland with dry climate, the major limiting factors for crop cultivation are water scarcity, low soil organic matter, and high soil temperature. The key success to overcome the severe limiting factors for crops are water harvesting, irrigation systems, fertilizer and biofertilizer applications, cover crop management, and cultivation techniques. Water resources consisted of ground water and harvesting of water surface land flow (e.g. constructions of canal reservoirs, long storage, Dam, reservoir, water river used by pumping); and ground water (using shallow and deep pumping wells). Ameliorants such as biochar (rice husk, corn cop, cacao husk, and oil palm empty fruit bunches), biofertilizers (*Agrimeth, nodulin*); conservation practices including mulch and compost application, cover crop practices, crop rotation, permanent pot planting point hole (sustaining soil moisture and organic C and N), and residual crop retentions. The most suitable and cultivated crops were mainly, but not limited to, maize, legumes and pumpkin. The reconciliation of agricultural development that satisfies the continued increase of food demand and of environmental aspects could be achieved by using the environmentally friendly technology to manage the limiting factors, thereby the optimum production could be achieved and at the same time preserved natural resource in a sustainable manner.

Keywords: *Soil charastristics, land suitability, sustanable agriculture, specific tecnology, peat soils, swampy soils*

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Assessing the impact of Ignalina nuclear power plant on ^{14}C concentration in Lake Drūkšiai

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Abstract

Radiocarbon (^{14}C) is a long-lived carbon isotope that has a half-life of 5730 ± 40 years. Nuclear power plants are one of the main producers of anthropogenic ^{14}C. In nuclear reactors, the formation of radiocarbon takes place in the coolant, the cooling system of the control and safety rod channels, fuel elements and graphite brickwork [1]. Anthropogenic radiocarbon can be released into the environment in gaseous forms, with liquid releases or with spent nuclear fuel. During photosynthesis radiocarbon can be easily assimilated into the plants. As a result, ^{14}C can be transported through the food chain and accumulate in a human body. Therefore, radiocarbon is considered a primary source of increased human radiation dose from industrial nuclear activities [2].

The aim of this research was to evaluate the impact of anthropogenic ^{14}C contamination from Ignalina NPP (INPP) on the Lake Drūkšiai (the Ignalina Nuclear Power Plant cooling pond) system. The lake sediment and vendace (*Coregonus albula*) scale samples were collected from the Drūkšiai Lake. The ages of sediment layers were estimated using ^{137}Cs and ^{210}Pb dating methods. ABA (acid-base-acid) chemical pretreatment procedure was used to extract humin (HM) and humic acid (HA) fractions from the sediments. Chemically pretreated samples were graphitized with the Automated Graphitization Equipment AGE 3 (IonPlus AG). Radiocarbon measurements in prepared samples were performed using the single stage accelerator mass spectrometer (SSAMS, NEC, USA).

^{14}C measurements in HM and HA fractions showed that after the start of the operation of the INPP in 1983, the radiocarbon concentration in these organic fractions increased by 3.86 pMC and 2.6 pMC, respectively.

In 1999s, there is a sharp increase of ^{14}C concentration (by 79.89 pMC) in HA fraction. In the same year, an increase of radiocarbon content in the Scots pine (*Pinus sylvestris*) near the INPP was also observed [3]. Since 2001, ^{14}C activities in vendace scales are similar to those in HA. The ^{14}C enriched organic matter that was released from the INPP in 1999s was incorporated into the food chain and then accumulated both in sediments and fish.

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Keywords: *Radiocarbon, Nuclear power plant, AMS, Lake sediments, Humin, Humic acid*
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Under Long Term Field Experiment, Effect of Different Organic and Inorganic Fertilizer on Soil Phosphorus Amount by Corn

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Abstract

Phosphorus (P) is one of the major plant nutrient. In most of the semi-arid soil conditions, P deficiency is so common and causes plant growth. For optimum growth, P fertilization is definitely required by majority of plant. Unfortunately, P fertilizer production is expensive and since apatite rock minerals are not a renewable resource, it is estimated that in the next 50 years P fertilizers sources is going to be limited. At the same time with P fertilization soil quality is depredated and soil microorganisms especially mycorrhizae effectiveness is restricted. In other to reduce the negative impact of high P fertilizer application on soil and plant quality it is better to use soil and plant natural mechanisms. Plant roots have several rhizosphere mechanisms such as reducing rhizosphere soil pH, carboxyl production and microorganism's effects on P mineralization such as mycorrhiza fungi. It is important to know an easy and suitable rhizosphere mechanisms can be used for less P fertilizer application and increase the P utilization. Also since organic fertilizers have a rich P concentration which are used as a fertilizer and amendment material. In this respect, organic fertilizers could be very important P source for eco-friendly and sustainable plant production. Also it is desired to use organic fertilize in agricultural production to increase plant health and quality of food

The aim of this study; under long term field experiment, to search the effects of different organic including mycorrhizal inoculation and inorganic fertilizers on soil phosphorus accumulation and P availability. The tested hypothesis was: organic fertilizers application increase soil P pool and P availability. The impact of several fertilizers effect was tested under a long term field experiment which was established in 1996. Since then regularly each year, 25 t ha^{-1} compost and animal manure and 10 t ha^{-1} for compost + mycorrhizal inoculum and NPK mineral fertilizers are applied. Under irrigated soil conditions corn (*Zea Mays L.*) seeds were sown in June 2017 and harvested in October 2017. After that, plants were harvested and rhizosphere and non-rhizosphere soil samples were taken from different soil depth (0-15 cm and 15-30 cm). Available soil P concentration was analyzed by Olsen method and plant P concentration and physiologic efficiency was calculated.

Obtained results showed that animal manure and compost application have the highest soil available P content compare to control and other treatments. In this respect, organic fertilizers can be used as P fertilizer source. Maize plant P concentration increased and plant agronomic efficacy is higher than the other treatments. Furthermore, if chemical fertilizers are considered harmful to the environment and is not a renewable resource. Organic fertilizers such as, animal manure, compost and mycorrhizae can be used for environment-friendly and sustainable plant production.

Key Words: Soil phosphorus, Organic fertilizers, Corn, Physiologic efficiency

Effect of Long Term Phosphorus Dose Applications on Wheat Plant Yield and Nutrient Concentration

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ABSTRACT

At present, increasing human population is caused for several problems on food security and soil productivity. The most important of these problem is impact of population on more food demand to be got from agriculture production. In order to produce sufficient agricultural production, the soil is exploited by taken out so much nutrient through harvesting. By adding several agricultural inputs such as chemical fertilizer and heavy tillage, soil fertility and quality is distorted. Soil and crop movement is getting very important subject for sustainability of agriculture and life. Agricultural management-based soil fertilizer use and optimization is getting very crucial for food security and human health. Therefore, fertilizers use in agriculture are required to be optimize for optimum plants growth. After the nitrogen, phosphorus (P) is the second most used fertilizer all over the world. Most of the soil are in semi-arid climate conditions are lese fertile in term of P nutrition. Most farmers are using excesses and some farmers are use insufficient P fertilizer. As well known that heavy P fertilizer application have negative impact on mycorrhizae development and consequence have on yield decreases. So it is sound and important to suggested an optimum P requirement for sufficient ecological plant production. The aim of research was to search their effects of different P fertilizer application on wheat growth and nutrient uptake. The tested hypothesis in this study was, prolonged phosphorus dose applications increases P accumulation in the soil and this caused limitation of plant growth and decreased the microelements intake.

The research was carried out under field conditions in Çukurova University Research and Application Farm, Adana-Turkey. The experiment was carried out by applying four different phosphorus doses 0, 50, 100 and 200 kg P_2O_5 per hectare and Adana-99 wheat varieties were used as a plant material. After the harvest, soil samples were taken from 0-20 and 20-40 cm depth and phosphorus, salt and pH were measured in the soil. Total yield was calculated in the plant and green parts of phosphorus, macro-element analysis was performed. Growth repsonse and agronomic effectiveness was calculated.

The results show that with increasing phosphorus doses application plant root colonization was significantly decreased from 32 % to 11 % respectively. The wheat yield increased with P level application from 2748 kg ha^{-1} to 4188 kg ha^{-1} respectively. And agronomic effectiveness was reduced with P level increases from 14.4 to 7.2. In 0-20 and 20-40 cm soil depth phosphorus accumulation was observed. Shot and grain P concentration were increased with P level application. Zinc and copper concentration of shoot decreased with P level application.

Keywords: phosphorus fertilizer, long term field condition, micro elements intake,

Citrus Feedstock Biochar Production, Its Physico-Chemical Characteristics and the Importins' for Sustainable Agriculture

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Abstract:

The research was conducted at Çukurova University Rhizosphere laboratory based research study, physico-chemical characterization of citrus feedstock made biochar was evaluated which was produced from citrus tree at 700 °C for time period of 2 hours in a muffle furnace having deficient oxygen. Biochar was crushed mechanically using a mortar and pestle, passed through 2mm mesh sieve. Different morphological characteristics and physico-chemical properties were analyzed by determining the pH and Electrical conductivity of biochar which was 7.2 and 2.4dS/m respectively, Scanning Electron Microscopy (SEM) analysis showed different pores in biochar surface indicating the internal water contents and volatile hydrocarbons which were evaporated/lost during carbonization. Inductively coupled plasma mass spectrometry (ICP-MS) was performed to quantitatively determine micro nutrients such as Cu, Mn, Zn, Fe as well as macro nutrients like Ca, K, Mg, P. Besides these, EDX showed the 72 % Carbon along with O, Au, K, Ca. The same 72/3.1 % age of C and N was also investigated by CN analyzer. TGA technique showed that water contents, hemicellulose, cellulose, and lignin were lost at different temperature as time increased.

Our results recommend that biochar produced from citrus tree having insoluble both trace and macro nutrients as well as CN make them plant-available and can be used as eco-friendly fertilizer for the plant growth and have the potential to remediate the contaminants naturally or artificially present in the soil. The produced biochar is porous in nature which can increase water holding capacity of the soil and act as refuge for the microorganisms.

Keywords: Biochar, Citrus, SEM, ICP-MS, characterization, XRD, contaminants.

Pistachio Production in The World and Turkey

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Abstract

The history of pistachios dates back to 6000 BC. It was cultured in southern Anatolia by the Eti, and entered the king's tables. Pistachio gene center is considered as the Near East region, which includes parts of Asia Minor, Caucasus, Iran and Turkmenistan. Pistachio is grown in the appropriate climate zones of the parallels 30-45 ° of the northern and southern hemispheres. In recent years it has been increasing interest in planting pistachios in the world and Turkey. Fruit characteristics of the pistachio, economic value, drought and high temperature resistance reasons such as the reasons for the garden plant is preferred.

Turkey ranks third in the production of pistachios in the world after the US and Iran. The majority of the production that the pistachios in Turkey is carried out in the following provinces: Sanliurfa, Gaziantep, Adıyaman, Kahramanmaraş and Siirt. Apart from these provinces, pistachio is grown in some suitable climates in the Mediterranean, Aegean, Marmara and Central Anatolia regions. Pistachio is one of the fruit species showing absolute periodicity. Therefore, production and market is fluctuating. The world pistachio market dominates the US and Iran.

Keywords: *Pistachio, Turkey, Production, Gazinantep, nut*

POSTER PRESENTATIONS ABSTRACTS

Fusarium Wilting Factor in Lentils *Fusarium Oxysporum* F. Sp. Lentis Biological Control of Lentis

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Abstract

Lentil (*Lens culinaris* Medikus subsp. *culinaris*) is cultivated in South and West Asia, North and East Africa, and is particularly important in developing countries for its high levels of nutrient protein and micronutrient source. Therefore, determination of biotic and abiotic factors affecting lentil production and taking the necessary precautions are important. In particular, Fusarium wilting caused by *F. oxysporum* f. sp. *lentis,* a global fungal pathogen in lentil cultivation, reduces lentil production and yiled. Many studies have reported that crop rotation and cultural agricultural activities are insufficient in the struggle of this disease, and it is emphasized that there should be alternative ways in this regard. In this study, bacterial isolates obtained from wild lentil nodules against Fusarium wilt are tested in vitro for their biocontrol activity. *In vitro* antagonistic activities of nodulating bacteria against three *F. oxysporum* f.sp. *lentis* isolates were determined at 30°C on PDA medium. Colony developments of *F. oxysporum* f.sp. *lentis* was calculated and the experiments were terminated after 15-21 days of incubation. Each experiment was set up in triplicate. Antagonist activity of bacterial isolates was evaluated as moderate and high level based on the control group. The data obtained were subjected to ANOVA and Tukey tests in SPSS 25 package program. The difference in the percentage of mycelium growth inhibition caused by bacterial strains against each isolate of *F. oxysporum* f.sp. *lentis* was found to be statistically significant ($P \leq 0.05$). Approximately 50% of the bacterial strains used in this study inhibited the *in vitro* growth of *F. oxysporum* f.sp. *lentis*. In addition, 53.33% of them exhibited moderate and 46.67% of them showed high antagonistic activity. The bacterial strains inside the lentil nolules inhibited the in vitro growth *F. oxysporum* f.sp. *lentis*. The effect was isolate specific in which the locations that the *F. oxysporum* f.sp. *lentis* isolates were obtained effected the antagonistic activity. Further studies on determination of biochemical characteristics of bacterial starins will enlarge our understanding of this antagonism.

Keywords: *F. oxysporum* f.sp. *lentis*, nodulating bacteria, antagonistic activity
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Microwave-related Drying of Fruits

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Abstract

Drying is one of the oldest conservation methods which is used for increasing the durability of foods. Drying or dehydration; is the process of removing water from the solid in order to retard or stop microbial degradation and chemical reactions. Microwave related drying (MW-hot air; MW-vacuum; MW-freeze; MW-osmotic) combination drying is a rapid dehydration technique that can be applied to specific foods, particularly to fruits. In microwave drying, high frequency waves pass quickly through the material, transform into thermal energy by absorption, thus the water inside the material is evaporated. In microwave drying, high frequency waves pass quickly through the material, transform into thermal energy by absorption, thus the water inside the material is evaporated. In this review, the advantages and disadvantages of microwave drying and its effect on the quality parameters of fruit and vegetables will be discussed. Furthermore, microwave drying will be 125 compared with other drying methods and effects of these methods on the drying time, drying rate and quality parameters of fruit and vegetables will be considered.

Keywords: *Microwave, hot air, vacuum drying, freeze drying, osmotic drying*

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GMO, Historical Evolution Process and Sociological Effects

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Abstract

Genetically modified organisms (GMO) are a biotechnological structure that involves the transmission of the genetic code of another organism to the organism in order to strengthen the defense mechanisms of the organism, to ensure efficient and continuous production, and to obtain the modifications of shape, color and size. Studies on genetically modified organisms were initially called the '2. Green Revolution' to meet the nutritional requirements of the growing population. However, in the narrow field, the use of pesticides, chemical fertilizers and excessive water to bring the highest level of product to the point of humanity brings to the point of facing a difficult time such as pollution of resources.The purpose of the laws written on this subject is to prevent the risks that may arise from genetically modified organisms and products, as well as to ensure the protection and sustainability of human, animal and plant health, environment and biodiversity.In the light of modern biotechnological developments, the search for the most suitable sources and solutions for the benefit of mankind and nutrition problems should be optimized and offered to the benefit of humanity.In this review, the evolutionary process and the sociological effects of foods, anti-genetically modified and anti-organism believes in the necessity of the views of the common reasons to reveal the common solution is aimed to illuminate.

Keywords: GMO, Historical process, Biosafety law, Green revolution

Effect of polyphenols on intestinal microbiota

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Abstract

In recent years, consumer awareness and the desire to benefit from food due to the continuous effects of people's welfare have led to the orientation of foods with functional characteristics. Foods are no longer just to meet the nutritional needs, but also with the components contained in the positive effects on health is also preferred. In addition, with the increase of food-related health problems, consumers have turned to healthy food alternatives. Therefore, interest and demand for functional foods have increased. Functional foods; In addition to the nutritional properties of foods, is defined as a food or food component that has the sustaining effects on consumer's physical and mental state. Phytochemicals, which have an important place in the diet with the consumption of herbal products, are secondary metabolites in the structure of many fruits and vegetables. Phytochemicals are classified as carotenoids, flavonoids, polyphenols, phytosterols, phytoestrogens, indoles and sulfides. The phytochemical notion has gained importance because of the researches which suggest that it reduces the risk of many diseases. The main components that enrich the intestinal microbiota are polyphenols, which are evaluated in the phytochemicals group. In particular, food groups that reach the intestine with high nutrient groups are converted into useful components by the activity of the microorganisms found here. Food groups with high polyphenol content reaching the column are converted into useful components by the activity of the microorganisms contained there in. The micronutrients, which are taken into our body with the consumption of foods, affect the metabolism and organ functions either through absorption or through intestinal microbiota. Besides, intestinal microbiota has functions such as making the toxic components taken with foods harmless, fermenting the nondigestible nutrients and synthesizing the micro-food components. As a result, the effects of polyphenol phytochemicals, an important functional food component, on the intestinal microbiota have become an issue to be investigated.

Keywords: Microbiota, fitochemical, functionalfoods, diet

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The Importance of Biosensors in Detection of Pathogens in Food Safety

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Abstract

Nowadays, the close relationship between food industry and biotechnology has led to the formation of new fields of activity. In recent years, the most important issue with the awareness of consumers has been to reach reliable food. In this context, all parameters of a product produced in the food industry are analyzed regularly by chemical and microbiological. Biosensors are defined as analytical devices that combine biospecific recognition systems with physical or electrochemical signals that provide different responses (signals) to different chemical components that are primarily required by biological analyzes. Biosensors are generally composed of bioreceptors and transducers. While the bioreceptor part is responsible for the identification of the substance to be analyzed, the transducer part enables the signal obtained from the material to be transmitted to the electrical field (6). Biosensors have been used for years to determine the data of fermentation and food processing process control (2,4). In addition to food safety, quality has gained a great importance with the green revolution in the last decade. When examined in this respect, microbial toxins constitute important sources of contamination. With the consumption of contaminated foods, a variety of diseases occur in humans and animals (5). Therefore, it is very important to prevent the risk of food-borne infections and intoxications and to provide rapid detection of pathogenic food. Existing methods are not very effective because they take a long time and require trained personnel. However, it is ensured that sensitive and selective results are obtained in a short period of time according to traditional methods with the dissemination of biosensors. However, with the use of biosensors, sensitive and selective results are obtained in a very short time compared to traditional methods. Since biosensors are low cost and high efficiency devices, they are expected to work in the future without requiring trained personnel (3).

Keywords: *Biosensors, Food pathogens, Food quality, Food microbiology*

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The Effect of *Trichoderma* Species on *Urtica dioica* Germination

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Abstract

Stinging nettle plant (*Urtica dioica*), which contains 48 genera and 1050 species in the world, has been used from old time until now in different fields; wounds, liver failures; evacuation of rheumatic edema, kidney disorders; slimming teas, making herbal medicines; used in fabrics to prevent tearing and bumps. Although it has lots of benefits, its cultivation in our country is low. The aim of this study was to determine the parameters that stimulate the germination of the *Urtica dioica* plant in order to let it contribute in studies to increase its cultivation in our country. The fungi *Trichoderma harzianum, T. virens, T. asperellum* and a nutrient solution were used to promote the plant growth. Potato Dextrose Agar (PDA), Water Agar and drying papers were used as germination media. The study was carried out *in-vitro* with 4 replications. As a result of the experiment, it was determined that species of Trichoderma cultivated in dry paper have promoted the germination of the Stinging nettle plant in 62.5% comparing to the control plant. However, *T. virens* in PDA and water agar media along with *T. asperellum* in PDA medium were observed to inhibit the plant germination. Thus, the use of these *Trichoderma* species with the nettle plant is expected to contribute positively in the improvement of this plant's health and productivity and in the enrichment of soil in the sustainable agriculture.

Keywords: *Urtica dioica*, *Trichoderma* spp.

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Determination of Optimum DNA Isolation Methods in Peach and Almond Trees

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Abstract

Peach (*Prunus persica* L.) has been thought to be originated from Iran, and was named "*Amygdalus persica*" by Linne. However, studies conducted within 19th century showed that it actually bases on 3000 BC and originated from China. Almond (Amygdalus communis L.) is a perennial plant grown in our region, mainly in Central Anatolia, Mediterranean and Marmara regions of Central and West Asia. The aim of this study is to transfer the properties such as vaccine adaptation, Product Efficiency, resistance to diseases to the hard-core of fruit trees by using classical improvement ways. In addition to the effects of both classical and modern improvement ways, molecular breeding studies also have created a new searching area, in which it is necessary to obtain a pure DNA from used organism. In our study, three different DNA isolation protocols were conducted to obtain pure DNA from both almond and peach carrying the parental and hybrid individuals. The concentration and the rate of purity of the gained DNA by applying DNA isolation protocols were determined by measuring them via a spectrophotometer. According to the obtained findings, the most effective method of DNA isolation for almond and peach plants was spotted.

Keywords: *Prunus persica, Amygdalus communis, DNA isolation, Hard core fruit, Almond, Peach*

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Outlook Of Carrot Production in Turkey

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Abstract

Turkey has approximately 24 million hectares of agricultural land, the fruit and vegetables farming is done on the part of 16.9%. Turkey, large agricultural areas, fertile soil and quality of fresh fruits and vegetables can be grown in the ecological wealth it is one of the rare countries in the world. Fresh fruits and vegetables are grown and consumed every year in the country. Carrot, which is one of the edible vegetable species, is produced and consumed in high amounts. Carrot is an important source of nutrients in terms of nutritious minerals, vitamin A and carotene. This work almost anywhere in the world and is widely grown carrots consumed in the production of the required Earth's surface, as well as a major producer countries will be examined production in Turkey. In this study, the carrot production, which is such an important and valuable product, will be carried out in the production structure, sales and consumption, and policy suggestions will be developed for the carrot production to continue successfully.

In this study, carrot planting areas, production amount, yield and developments in foreign trade in the world, EU and other countries were discussed together with important producer countries. The cultivation area used for carrots was analyzed with secondary data obtained from production, import, export, FAO and TUIK. Carrot response to the growth in almost all regions in Turkey, particularly concentrated in some areas. These regions also specialize in the production of carrots. In these regions, which are important in the production of carrots, it is beneficial to arrange the state subsidies accordingly. Another issue is the subject of seed production in carrot production. Carrot seeds are generally imported from outside. Turkey is incapable of carrot seeds to develop appropriate conditions to countries with their own genetic resources. Support and incentives are needed in this regard.

Keywords: carrot production, marketing of carrots, carrots in Turkey

Current Situation in The World And Turkey Production of Sour Cherry

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Abstract

This study was carried out in order to determine the general status of sour cherry production in hard-core fruits in agricultural production. This study was prepared based on official data and previous scientific studies. In addition to this, the production of sour cherry in the domestic and foreign market in terms of competitive system; important factor for the overall marketing problems from the beginning of the current situation and Turkey, SWOT analysis aimed at developing solutions. According to 2016 FAO data, sour cherry production is carried out on approximately 214,396 hectares of land on Earth. Russia ranks first with an area of 22,324 hectares and production of 192,500 tons. Sour cherry main producing countries in the world, Turkey, Poland, Iran, Ukraine and Russia. Although it is one of the leading countries in the production of cherry in the hard-core fruits, it is not very effective in exports, it should be encouraged that farmers should be encouraged to promote the sour cherry varieties in terms of taste and aroma and to give importance to the planting of cherries in order to increase the exportation by increasing the awareness of producers in order to increase the world market share.

Keywords: sour cherry production, sour cherry foreign trade, sour cherry production problems, sour cherry marketing

Association of HLA-G Gene Polymorphisms with Obesity

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Abstract

With respect to the World Health Organization (WHO), obesity is seen as one of the most dangerous 10 illness. Obesity is a global problem that can affect people of all ages. According to the WHO's records; obesity is one of the most important factors which leads diabetes, heart disease and hypertension and especially alarming in children and adults.

Obesity accompanies a lot of diseases. Immune system diseases are one of the the most important disease which accompanies to obesity. Inflammation and immune changes in obese individuals have an important role in the formation of cell functions an the pathophysiological effects of obesity. The formation of antigens which is located in HLA genes are regulated by MHC gene region. The HLA-G gene seems to present functional polymorphisms mainly in the regulatory regions. There are various studies about HLA-G gene polymorhisms. HLA-G gene has an important role about inhibition of immune resistance. HLA-G gene rs66554220, rs41557518 and rs1063320 polymorphisms hasn't been studied yet in the individuals with obese. In this study, peripheral blood samples were collected from 50 individiuals BMI≥30 obese and non-obese 50 individiuals. DNA isolation was performed from blood samples. Three polymorphisms [14 bp insertion/ deletion 3' UTR (rs66554220), rs41557518 and rs1063320] were analyzed by using PCR and RFLP methods and the association of genotypes with the risk of obesity was evaluated.

Keywords: Obesity, HLA-G, polymorphism

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Association of KIR2DL4 Gene Polymorphisms with Obesity

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Abstract

Obesity; is an important public health problem that affects to all of the world. Obesity influences all systems of the body, and causes a lot of health problem. The prevalence of obesity is increasing day by day. Obesity accompanies a lot of diseases. Immune system diseases are one of the the most important disease which accompanies to obesity. Natural killer Ig-like receptors are natural killer cells or killer T lymphocytes; that expressed in the cell membrane and have an important role about regulation of innate immune system. Killer-cell immunoglobulin-like receptor (KIR) molecules help natural killer cells to separate infected cell and healthy cells. KIR2DL4 gene is the member of the KIR gene family. Several polymophisms are linked with KIR2DL4 gene. KIR2DL4 gene rs660773 –9797G>A (intron 7), rs660437 –9769 C>A (intron 7) and rs649216 – 9571 C>T (762) polymorphisms ha vent been studied yet in the individuals with obese. In this study, peripheral blood samples were collected from 50 individiuals BMI≥30 obese and non-obese 50 individiuals. DNA isolation was performed from blood samples. DNA samples were analyzed by PCR-RFLP method and polymorphisms rs660773 –9797G>A (intron 7), rs660437 –9769 C>A (intron 7) and rs649216 – 9571 C>T (762) were genotyped. Data derived from project could be useful to understand the relationship between immune system and obesity.

Keywords: Obesity, KIR2DL4, polymorphism

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Thermal Properties of Milk and Cheese

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Abstract

Most of dairy products are heated and cooled in their thermal treatments, such as pasteurization, concentration, drying and refrigeration. In order to analyze accurately the rate and amount of heat transfer involved, thermal properties of the products being processed must be known. There are many factors which may aspect the thermal conductivity of foods and food products, e.g., composition, density, porosity, product temperature, heat treatment and other details of the particular substance. However, it was reported that thermal conductivity values of milk are linearly dependent on the moisture content and inversely dependent on the fat content. Further that the applied processes influenced the thermal properties of milk, for example the enthalpy change (ΔH of denaturation) of whey proteins decreased in the pulsed electric field treatedbovine milk, and denaturation increased with the treatment intensity. Cheese is a generic term for a diverse group of milk-based food products. Cheese is produced throughout the world in wide ranging flavors, textures, and forms. During the cheese processing, they are thermally and mechanically treated and therefore thermal properties are one of the most important parameters. The information about the thermal properties of cheeses can be used to design the production techniques and process conditions. Knowledge about thermal parameters of cheeses could be used in the process of quality evaluation. The thermo physical parameters of milk and some selected cheeses were presented in the article. It was reported that differential scanning calorimeter (DSC) was used to determine the ratio of solid to liquid fat; that is, the amount of fat that is crystallized, by dividing the partial enthalpy of melting of the fat for ripening temperature by the total enthalpy of melting of the same fat extracted from cheese.

Keywords: Thermal, milk, cheese, DSC.

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Lime Content of Soil in Gaziantep Province

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Abstract

Plant nutrient is vital for the growth and yielding. The nutrients in the soil play a key role for plant to enhance their resistance against pests and diseases, especially Calcium, which is major element among others, is accepted for this function. This study has been carried out to determine lime content of the agricultural fields in Gaziantep province between the years of 2012 and 2015. Totally, 605 soil samples were collected and lime contents of them were analysed by volumetric Schiebler calcimeter. Consequently, of 43,9% were marn (>30% lime content), of 25,9% were excessive limy (15-30% lime content), of 7,93% were limy (8-15% lime content), of 5,62% were medium limy (4-8% lime content), of 7,88% low limy (2-4% lime content) and of 8,76% were either without lime or very low amount of lime (0-2%). Most of regional soils were limy, so pH is also above 7. For this reason, acid-based fertilizers are recommended in general.

Keywords: Lime, Soil, Calcium

Identification of Boron Content in The District of Gaziantep

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Abstract

To enhance agricultural production, conscious and balanced fertilization is key. The use of fertilizers seasonably will contribute significantly to the improvement of physical and chemical health of the soils, protection of human health, efficient use of our resources and thus, prevention of environmental pollution, besides productivity enhancement. The study material is composed of 410 soil samples taken from the soils of Gaziantep between years 2012 and 2015. The boron content in those soils have been defined with hot water extraction method suggested by Gupta (1967), Gestring and Soltanpour (1981) (Kacar,1982). The measurements were taken with spectrophotometer. At the end of the study, the following boron contents were found: 51% of the soils had very low levels of boron (less than 0,4 ppm); 30% had low levels (0,5-0,9 ppm) and 19% had sufficiently (more than 2,4 ppm). In the soils with low boron content, improvement in productivity and quality will be assured through addition of boron fertilizer.

Keywords: Bor, Soil, Fertilizer

Causes of Soil Compaction

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Abstract

Soil compaction is a physical factor that prevents the development of the plant in plant production. The most important soil feature affecting soil compaction is soil moisture content. Soil structure, soil structure and soil organic matter amount are important soil properties affecting the compression. Soil compaction, mainly due to the increasing weight of the tractor and tool-machine compresses soil all over the world has become the most important factor. Volumetric changes in soil wetting-drying the resulting internal forces during events such as natural or by mechanical tillage and external forces such as occurs with the use of heavy machinery. The natural state of the soil structural system of the building, rain or under the influence of external mechanical forces of corruption and re-sequencing of soil particles more tightly defined as soil compaction. Soil compaction is a degradation process is common in gardens as well as in other pistachio orchards. The purpose of this study, the causes of ground pistachio jam problem in the garden, introducing a general outline, the alternative methods used to reduce jams are evaluated

Keywords: *Soil compaction, soil, pistachios*

Variation Of Stable Carbon İsotope Ratio (Δ13c) İn Automotive Particulate Matter Emissions

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Abstract

It is well known that excessive automotive engine exhaust emissions of gases (carbon monoxide, hydrocarbons, nitrogen oxide) and particulate matter (PM) pose a threat to public health and urban air quality. Human exposure to polluted air containing PM can cause numerous health problems, such as cardiovascular, cerebrovascular and respiratory diseases [1]. In an effort to reduce automotive emissions modern cars use a variety of engine modifications, catalytic systems and filters which in turn alter the isotopic ratio of carbonaceous particles (isotopic fractionation effect). Diesel engines are of particular interest due to higher production of particulates (soot) in comparison to gasoline engines [2]. The aim of this work was to examine particulate matter fractionation in automotive emissions using $\delta^{13}C$ and ^{14}C measurements. Experiments were performed in a specialized dynamometer laboratory to ensure reproducibility and accuracy of the results. Four light passenger vehicles with different fuels (diesel, 95 RON gasoline, 98 RON gasoline) were tested using simulated transient cycles in urban and rural areas. Additionally, driving modes of 30, 60, 90 km/h and at maximum power were tested. Engine exhaust particulate matter was collected on quartz filters. Later, isotopic ratio $\delta^{13}C$ values of fuel and exhaust carbonaceous particulates were measured using stable isotope ratio mass spectrometer. $\delta^{13}C$ values were then compared and level of isotopic fractionation determined, as shown in Fig 1. Finally, biofuel fraction was evaluated using accelerator mass spectrometer which required additional intermediate sample graphitization step.

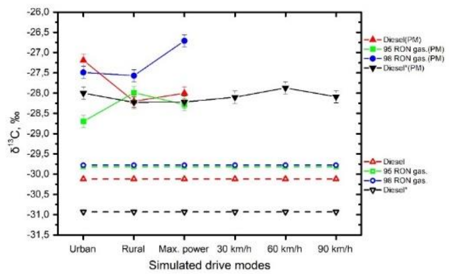

Fig. 1. $\delta^{13}C$ values of particulate matter and fuel during separate simulated drive modes.

The obtained results show particulate matter $\delta^{13}C$ values ranging from -28.7 ‰ to -26.7 ‰ during separate driving modes. Most significant fractionation was observed when using diesel fuel. Average $\delta^{13}C$ value was found to be equal to -27.9 ‰ in automotive emissions and fractionation $\Delta^{13}C$ (particulates-fuel) equal to 2.1 ‰. Finally, it was determined that biofuel fraction in fuels differed considerably and ranged from 6.1 % to 13.5 %.

Keywords: *Particulate matter, Automotive Emissions, Stable Isotope Fractionation, Gasoline, Diesel.*

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Applying mycorrhiza biotechnology to horticulture and relations in tree for protection against plant pathogens

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Abstract

The aim of this study is to search effectiveness of mycorrhizal inoculation on citrus trees, role in nutrient cycling in the ecosystem and also protect against plant pathogen. The tested hypothesis was mycorrhizal inoculation application to enhance citrus trees growth effectiveness and protection from disease. Mycotrhiza are symbiotic associations between plant and soil borne fungi and associating with about 80% of plant families worldwide, which play a key role in nutrient cycling in the ecosystem and also protect plants against environmental, cultural stress. The occurrence of the two major classes of mycorrhizas is indicated as are the soil, plant and fungus factors affecting the size of the response. Arbuscular mycorrhizal (AM) fungi can protect plants against some pathogens. Most of the major plant families are able to form mycorrhiza, the arbuscular mycorrhizal association being the most common mycorrhizal type involved in agricultural systems. AM biotechnology is feasible for crops using a transplant stage, as in the case with horticultural systems. Recent developments and insights regarding the potentials of AM symbiosis in horticultural practices are discussed. Given the effects of AM inoculation on plant growth and health, as bio fertilizers and bio protectors, it is accepted that an appropriate management of this symbiosis would permit a satisfactory reduction of chemical fertilizer and pesticide inputs, key aspects for sustainable horticultural plant production approaches. Maximum benefits will only be obtained from inoculation with efficient AM fungi and a careful selection of compatible host/fungus/substrate combinations. The mycorrhizal stimulation of citrus trees by increasing the efficiency of nutrient uptake from soil is discussed with special reference to citrus tree species used in agroforestry. The low intensity of rooting of many tree species and the prevalence of low fertility soils suggests maximum responses may be obtained frequently by inoculating with mycorrhizal fungi selected for high efficiency or by management to increase populations of indigenous fungi where these are highly effective but low in number. Citrus plants are mycorrhizal dependent plant and inoculation protect plant against biotic and abiotic stress factors. Effective mycorrhiza function also ameliorates deleterious soil conditions other than nutrient deficiency and is important to maximize symbiotic nitrogen fixation and protect against plant pathogen. Inoculation of tree species in the nursery is logistically feasible.

Keywords: Mycorrhiza inoculation effectiveness, citrus trees, plant pathogens, stress factors

A Case Study of Different Soil and Crop Management Effects on Soil Parameters and Relationship with Mycorrhiza Spore Development and Root Colonization

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Abstract

The aim of this work is to determine the relationship between mycorrhizal development and soil and crop management was done under two different agriculture department located on the same Menzilat soil Series. In Çukurova University Research and Implication Farm, each department have their own Departmental Research Sites. Since the department have their own soil and crop management system it was an interest to see the effect of agriculture inputs on soil parameters and mycorrhizal development. The research was conducted on the same Menzilat soil series. During 2009 in both department research area's soil and plant roots were collected and soil and root colonization was done. Soil samples were collected at 0-20 and 20-40 cm depth. Mycorrhizal spores number, watermelon root colonization, soil pH, organic matter, salt and available P, Zn, Fe, Mn and Cu concentration were analysed.

Since research farm established in 1970 soil P levels are differed in between horticulture and department of soil science and plant nutrition. In 0-20 cm soil depth soil science and Plant nutrition have 36 kg P2O5 ha-1 and in the Department of Horticulture this was reach up to 190. This is depending on the excess P fertilization and crop managements. Number of mycorrhizae spores were counted and in the department of soil science have higher spore number than Horticultural departments. At sampling time there was watermelon plant in the both research sites. Root colonization was determined and it was found that plant growth in Horticulture department have less root colonization. In generally there is a relation between soil P level and mycorrhiza spore abundance and root colonization. It was once more determined that soil and crop management have significant effects on soil and plant health and it is very important for sustainability of agriculture and agricultural technology application.

Keywords: Mycorrhiza spores, Phosphorus, Soil and Plant Management, watermelon, sustainable agriculture

Effect of Different Nitrogen Doses and Mycorrhiza Application on Mycorrhizal Inoculation Effectiveness at Alfalfa Plant

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Cukurova University, Agriculture Faculty, Department of Soil Science and Plant Nutrition, Adana

Abstract

Clover is an important fodder plant of the family of legumes which is a perennial plant species that can be evaluated as both green grass and dry grass. At the same time, it knows that improves the soil fertility as a pasture breeding plant. The alfalfa plant is expected to provide high yield and feed quality when infected by rhizobia bacteria and mycorrhizal fungi for sustainable, quality and high yield production. With mycorrhizal inoculation clover cultivation could be important strategy for environmental-friend and sustainable production system. The aim of this study to search different level of nitrogen fertilizer and mycorrhizal inoculation on clover plant yield and effectiveness. The tested hypothesis was mycorrhizal inoculation and N level application increase clover growth effectiveness.

The experiment was established under greenhouse conditions by using with mycorrhiza (G. Mosseae) inoculation and four nitrogen doses (control, 50, 100 and 200 mg N (as NH_4NO_3) kg^{-1}) with three replications as a randomized block. At harvest, plant shoot and root was separated and dry weight were determined. Also mycorrhiza colonization and effectiveness was calculated with using total biomass dry weight. Obtained data are showed that mycorrhizae inoculated plant produce nearly twice dry weight than non-inoculated plants. İncreased N fertilizer decreased shoot and root DRW. Root colonization was determined and mycorrhizal inoculation level was significant. Mycorrhizal effectiveness was calculated and it has been found that mycorrhizal inoculation significantly increased the alfalfa growth effectiveness.

Keywords: Mycorrhiza inoculation effectiveness, alfalfa, nitrogen doses and dry weight.

Under Long Term Field Conditions Effect of Different Phosphorus Doses on Agronomic Efficacy and Nutrient Uptake by Wheat (*Triticum aestivum* L.)

F. Öztürk[1,*], M. Işık[1], V. Akşahin[1], S. U. Jan[1,2] and İ. Ortaş[1]

[1]*Cukurova University, Agriculture Faculty, Department of Soil Science and Plant Nutrition, Adana, Turkey, ozturk2421@gmail.com*
[2]*Department of Microbiology, Faculty of Biological Sciences, Quaid-i-Azam University, Islamabad, Pakistan*

Abstract

After the green revolution, crop productivity significantly increased by using heavy tillage, irrigating and fertilizers. Using agricultural inputs over natural capacity of soils caused in decreases in soil quality and productivity. Chemical fertilizers use especially phosphorus is one of the less mobile elements and negatively interactive with several elements such as zinc and iron. Excess phosphorus fertilization does not decrease only micro nutrition uptake however also decreases the efficiency of mycorrhizal fungi. Mycorrhiza fungi are one of the rhizosphere mechanisms increased mineral nutrient and water uptake. Farmers are using heavy P fertilizer and, in most cases, they do not get the yield they desire. So that's why there is a need to use optimum phosphorus fertilizer for sustainable plant production. The aim of this study was to search the effect of different phosphorus doses on plant nutrition and agronomic activity. Hypotheses of this study, increased doses of phosphorus decrease the plant micro element nutrition.

A long term field experiment was established in 1998 and since then regularly each year 0, 50, 100 and 200 kg P_2O_5 ha^{-1} as triple super phosphate fertilizer is applied. Wheat seeds were sown in November 2017 and harvested at May 2018. When harvested, plant shoots were prepared for nutrient analyses by using ICP-OES. Also by using yield date agronomic efficiency was calculated both biomass and seed yield. With increasing P fertilizer, yield increased and agronomic efficiency significantly increased. Data showed that increasing doses of phosphorus fertilizer do not change plant macro and micro nutrition concentrations.

Keywords: *Phosphorus, plant nutrient, agronomic efficiency, long term experiment and wheat,*

Effect of Organic and inorganic Fertilizer on Maize (Zea Mays L.) Root Growth

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Abstract

Maize is one of the important cereal crop for the world and our country's food security. Soil high pH and lime content have an effect on plant nutrient uptake (especially P, Zn, Fe and Cu). Since under less nutrient uptake conditions, plant root growth and root parameters are very important plant mechanisms for better nutrients and water uptake. If plant can't reach the sufficient nutrients, the plants will be under the abiotic stress conditions. Plant root growth is one of the important power for pushing down abiotic stress factors to get sufficient nutrients. Root growth is directly influenced by soil-crop managements such as fertilizer application and soil tillage. Organic fertilizer has significant effects on root growth. In order to make more root, plant is allocated nearly 20-50% of photosynthesis production (carbohydrates) to down for square plant growth. More carbohydrates to root mean more root growth which is necessary for plant security. Organic carbon allocation is also vital for healthy plant growth and yield. Also, plant growth is very important for soil organic carbon pool. In this respect, it is important to know factors are affecting plant root growth and other parameters. This area has not been investigated extensively. Effect of organic and inorganic fertilizers on root growth is significantly important for healthy and eco-friendly production. The aim of the study is to understand the impact of organic fertilizers on maize plant root growth. The tested hypotheses of the study were organic fertilizers increases the maize root growth.

The experiment was conducted at Cukurova University Research and implementation Station under long term field experiment in 1996 and since then regularly each year, 25 t ha-1 compost and animal manure and 10 t ha-1 for compost + mycorrhiza inoculum and NPK mineral fertilizers were applied. Under irrigated soil conditions maize seeds were sown in June 2017 and harvested in October 2017. At harvesting time, for each treatment and plot unit, at 0-40 cm soil depth in one square meter area all roots were collected with three replicates. All the collected roots were washed under tap water and then with di-ionized water. and fresh root was recorded, roots growth parameters such as root diameter, length, volume and surface were analyzed by WinRhizo. Also, plant root specific surface area was calculated data showed that organic and mineral fertilizers increased root length and volume as compared to control treatments. It appeared that compost application produced highest root parameters than the other treatments.

Keywords: *Root growth, Organic fertilizer, Maize and Fresh weight,*

Acknowledgement: *This work was supported by TAGEM. All authors would like to thank TAGEM.*

Use of CRISPR-Cas system in Agriculture

C. Yıldız[1], F. Özbaş Gerçeker[2]

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[2]*Gaziantep University, Dept. Biology, Gaziantep, Turkey, gerceker@gantep.edu.tr*

Abstract

Plants with a wide range of chemical diversity are the “green chemical factories” that can support food, feed, medicines, and biomaterial industries. Plant domestication which is a dynamic evolutionary process creates new and valuable forms of plants from wild species through genetic modification. CRISPR/Cas is an RNA-guided system and can be easily engineered to bind to the DNA target. This technology evolved from modified type II immune system of bacteria and archaea. Exploitation of this system in plants may lead to site-specific targeted genome engineering which can be objectively utilized to express/silence a trait harbouring gene in the genome. CRISPR/Cas9 system requires only Cas9 endonuclease and single guide RNA, which are directly delivered into plant cells via either vector-mediated stable transformation or transient delivery of ribonucleoproteins (RNPs) and generate double-strand breaks (DSBs) at target site. The major advantage of CRISPR/Cas9 system is that engineered plants are considered Non-GM; can be achieved using in vitro expressed RNPs transient delivery.

CRISPR/Cas9 system started to be used in medicine, molecular biology and plant breeding. The most commonly used system is CRISPR/Cas9 discovered from *Streptococcus pyogenes*. In August 2013, three independent groups demonstrated that this system could be efficiently used in plants such as *Arabidopsis thaliana*, *Nicotiana benthamiana*, rice and wheat. Up to now, genomes of many other agriculturally important plant species including corn, sorghum, tomato, potato, cucumber, grape, apple, orange, lemon, poplar, soybean, clover and tobacco were also successfully modified by using this system.

Keywords: CRISPR-Cas, aggriculture, plant

Detection of Genetically Modified Organisms (GMOs) in Food

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[2]*Gaziantep University, Dept. Biology, Gaziantep, Turkey, gerceker@gantep.edu.tr*

Abstract

Genetically modified organisms (GMOs) are organisms (i.e. plants, animals or microorganisms) in which the genetic material has been modified by using genetic engineering or transgenic technology. The most common and commercially available GMO products are corn, canola, cotton, potatoes, soybeans and sugar beets. In recent years, concerns about GMO have been increasing. For this reason, GMO in food must be determined to protect health, as well as for ethical and cultural concerns. Commission of the European Communities suggested that food products containing DNA or proteins, provided by using GMO have to be tagged. In this instance; detection and quantification of genetic modification is important. Therefore; safe, sensitive, accurate and fast methods are needed for qualitative and quantitative analysis of GMO.

In this review, qualitative and quantitative GMO detection methods and developing new technologies were investigated. Protein and DNA based methods such as western blots, enzyme-linked immunosorbant assay (ELISA), lateral flow strips, southern blots and real- time polymerase chain reaction (RT-PCR) methods are discussed. Protein or DNA of interest can be detected by conventional Western and Southern blot techniques. Disadvantage of these techniques is that they can give false positive results. ELISA as a protein based method is useful but it does not work well in processed foods as temperature damages the protein. DNA sequences of the coding genes, marker genes and promoter or terminator DNA sequences are target for PCR studies. The lack of the PCR product indicates that the transgenic sequence is absent. Frequently studied target sequences are T-Nos in *Agrobacterium tumefaciens*, P-35S in *Cauliflower mosaic viruse*, pBR322 and pUC19 cloning vectors. RT-PCR is a rapid and cheap quantitative method to detect the presence of targeted DNA-segments in samples. Genetically modified organisms, can be identified by RT-PCR even at very low concentrations.

Keywords: *Genetically modified organisms, GMO, food, RT-PCR*

Analysis of the Association of LMP2 anf LMP7 Genes with Obesity

H. Bayazıd[1], M.A. Bayazıd[2], A. Tekin[3], F. Özbaş Gerçeker[4]

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Abstract

Obesity is a situation resulting from excess body fat accumulation and increasing the risk of diseases such as cardiovascular disorders, type 2 diabetes and cancer. It is known that as well as environmental factors (70%), genetics (40%) also has an effect in the development of obesity. By means of technological and analytical advances, more than 20 obesity susceptibility loci have been determined. These genes generally have role in key metabolic processes such as; regulation of food intake and adipocyte function. Although many genes related to obesity have been reported, the genetic basis has not been clearly understood yet. In the present study, it was aimed to investigate the role of polymorphisms in the LMP2 and LMP7 genes on the development of obesity. LMP2-60 and LMP7 145 polymorphisms were analysed by polymerase chain reaction restriction fragment length polymorphism technique in 100 morbid obese patients and 100 control individuals having normal body mass index. As a result of the study, LMP2 60 and LMP7-145 polymorphisms were not found to be associated with morbid obesity ($p>0.05$).

Keywords: *Obesity, LMP2, LMP7, Polymorphism*

Acknowledgement: *This work was supported by Gaziantep University Scientific Research Projects Coordination Unit (Project no: FEF.YLT.17.02).*

Detection of Genetically Modified Organisms (GMOs) in Food

D. Polat[1], F. Özbaş Gerçeker[2]

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Abstract

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1st INTERNATIONAL CONGRESS ON SUSTAINABLE AGRICULTURE AND TECHNOLOGY 2019 | 01-03 APRIL, GAZIANTEP		
INCSAT-1 Congress Programme		
DAY 1	***01.04.2019 Monday***	
09.00 to 17.00	Registration	
09.00 to 10.00	**Coffee Break**	
10.00 to 12.00	Official Opening	**Assoc.Prof. Dr. Erdihan TUNÇ (Congress Chairman)**
		Mehmet YAŞAR (GAPcert)
		Mehmet KARAYILAN (Gaziantep Provincial Agriculture And Forestry Directorate)
		Burhan AKYILMAZ (Silkroad Development Agency)
		İbrahim YILMAZ (Gaziantep Metropolitan Municipality)
		Prof. Dr. Ali GÜR (Gaziantep University Rector)
		Plaque Presentation
12.00 to 13. 00	**LUNCH**	
Chairman: ***Prof. Dr. İbrahim Ortaş***		***SALON TURUNCU***
13.00 to 13.30	**Plenary Session**	**Prof.Dr. Sören Thiele-Bruhn, Trier University** *Manure affects the fate of antibiotic pharmaceuticals in soil*
13.30 to 14.00	**Plenary Session**	***Prof. Dr. Nazım ŞEKEROĞLU, Kilis 7 Aralık University*** *Production and technologies of medicinal and aromatic plants in Turkey*
14.00 to 14.15		**Coffee Break**
Chairman: ***Prof. Dr. Nazım ŞEKEROĞLU***		***SALON TURUNCU***
14.15 to 14.45	**Plenary Session**	***Prof. Dr. İbrahim Ortaş, Çukurova University*** *Soil-Mycorrhizae and Carbon Relationship to Climate Change and Mitigation of Atmospheric CO2 Under Long Term Field Experiments*
14.45 to 15.15	**Plenary Session**	***Dr. Raimund Schneider,*** **Trier University** *Impact of heavy machinery in agriculture and forestry – Harmful soil compaction*
15.15 to 15.45		**Coffee Break**

DAY 1	**01.04.2019**	***1st INTERNATIONAL CONGRESS ON SUSTAINABLE AGRICULTURE AND TECHNOLOGY 2019***	
15.45 to 17.30	**Oral Session-1**	**Chairman: Prof.Dr. Sören Thiele-Bruhn**	**SALON TURKUAZ**
15.45 to16.00	**Mahmut Esat KIYAK**		
	The effects of increasing Vermicompost applications on some biological properties of Radish (Raphanus Sativus L.) cv. 'Cherry Belle' Plant		
16.00 to16.15	**Elif YÜZBAŞIOĞLU**		
	Effect of some commonly used fungicides on photosynthetic pigment in tomato (Lycopersicon esculentum)		
16.15 to16.30	**Ayşen AKAY**		
	Effect of Vermicompost, Mycorrhiza and NPK fertilizer on growth and yield in Piment Mme Jeannette Pepper		
16.30 to 16.45	**Veysi AKŞAHİN**		
	Effect of long term phosphorus dose applications on wheat plant yield and nutrient concentration		
16.45 to 17.00	**Hasret GÜNEŞ**		
	The effects some bio-agents and organic substances to Verticillium dahlia		
17.00 to 17.15	**Derya KILIÇ**		
	Situation of organic fruit growing in Turkey and the World		
17.15 to 17.30	**Celal KAYA**		
	GAP TEYAP		

DAY 1	01.04.2019	*1st INTERNATIONAL CONGRESS ON SUSTAINABLE AGRICULTURE AND TECHNOLOGY 2019*	
15.45 to 17.30	**Oral Session-2**	**Chairman: Assist. Prof. Dr. Elif PALA**	**SALON TURUNCU**
15.45 to16.00	**Alexandra Bykova**		
	Impact of phosphorus fertilizer on soil organic carbon sequestration and CO2 flux		
16.00 to16.15	**Mehmet IŞIK**		
	Under long term field experiment, effect of different organic and inorganic fertilizer on soil phosphorus amount by Corn		
16.15 to 16.30	**Behmen Fazil oğlu Aliyev**		
	Traditional agricultural systems of Azerbaijan		
16.30 to 16.45	**Samet Eray YALNIZ**		
	Crabronidae (Hymenoptera: Aculeata) fauna of Adana province, Turkey		
16.45 to 17.00	**Akide ÖZCAN**		
	The production, adequacy level, World trade and competition power of Almonds in Turkey		
17.00 to 17.15	**Samet Eray YALNIZ**		
	Studies on Vespidae (Hymenoptera: Vespoidea) of Giresun province, Turkey		
17.15 to 17.30	**Fadime TOSİK DİNÇ**		
	Agricultural policies in Turkey in the period of democratic party		

DAY 1	01.04.2019	*1st INTERNATIONAL CONGRESS ON SUSTAINABLE AGRICULTURE AND TECHNOLOGY 2019*	
15.45 to 17.30	**Oral Session-3**	**Chairman: Dr. Nusret MUTLU**	**SALON MAVİ**
15.45 to16.00	**Laurynas Butkus**		
	Assessing the impact of Ignalina nuclear power plant on 14C concentration in Lake Drūkšiai		
16.00 to16.15	**Nusret MUTLU**		
	Widespread application of sustainable precision agriculture practices in GAP region		
16.15 to16.30	**Ünal YILMAZ**		
	Supportability of energy with agricultural products: Example of Gaziantep		
16.30 to 16.45	**Saeed Ullah JAN**		
	Citrus feedstock biochar production, its Physico-Chemical characteristics and the importins' for sustainable agriculture		
16.45 to 17.00	**Hasan YILDIZ**		
	Use of diatoms as biological indicator		
17.00 to 17.15	**Ünal YILMAZ**		
	Simulation analysis of wind energy powered electrical energy production for Gümüşhane province		
17.15 to 17.30	**Sevgi GEZİCİ**		
	Cholinesterase Inhibitory Activities and Phytochemical Composition of Pods of Senna (*Cassia angustifolia* Vahl.) as Potential Neuroprotective Agent		

18.00 to 20.00	**CONGRESS OPENING COCKTAIL** ***GAÜN SEYİRTEPE SOSYAL TESİSLERİ***

DAY 2	**02.04.2019**	***1st INTERNATIONAL CONGRESS ON SUSTAINABLE AGRICULTURE AND TECHNOLOGY 2019***	
09.30 to 11.00	**Oral Session-4**	**Chairman: Dr. Raimund Schneider**	**SALON TURKUAZ**
09.30 to 09.45	**Ayça AKÇA UÇKUN**		
	The way of local products to geographical indications		
09.45 to 10.00	**Ezgi Okan Arıkan**		
	A sustainable agricultural approach: The philosophy of permaculture		
10.00 to10.15	**Cevher İlhan CEVHERİ**		
	Agriculture systems and sustainability applied in Turkey		
10.15 to 10.30	**Şükran Çakır Arıca**		
	Genotoxic interventions in agriculture		
10.30 to 11.00	**Coffee Break**		

DAY 2	02.04.2019	*1st INTERNATIONAL CONGRESS ON SUSTAINABLE AGRICULTURE AND TECHNOLOGY 2019*	
09.30 to 11.00	**Oral Session-5**	**Chairman: Prof. Dr. Abuzer ÇELEKLİ**	**SALON TURUNCU**
09.30 to 09.45	**Awet Tekeste Tsegai**		
	Agricultural water retention for sustainable protection against floods and heavy rains		
09.45 to 10.00	**Toudjani A. Anabi**		
	Environmental mitigation through soil and water conservation in Sub Saharan Africa		
10.00 to 10.15	**Markus ANDA**		
	Spatial evaluation of soils characteristics and their management to support sustainable agriculture		
10.15 to 10.30	**Rukiye DOĞANYİĞİT**		
	Evaluation of animal wastes in Gaziantep city		
10.30 to 10.45	**Mahir Emre YALÇIN**		
	Gaziantep solid waste management: The effects of the zero waste project		
10.45 to 11.00	**Coffee Break**		

DAY 2	02.04.2019	*1st INTERNATIONAL CONGRESS ON SUSTAINABLE AGRICULTURE AND TECHNOLOGY 2019*	
09.30 to 11.00	**Oral Session-6**	**Chairman: Assist. Prof. Dr. Fadime TOSİK**	**SALON MAVİ**
09.30 to 09.45	**Halide Bilge SARIGÜL**		
	A study on the expansion of the usage areas of Pistachio: An example of Pistachio jam		
09.45 to 10.00	**Didem AKDOĞAN**		
	Fermentetion, prebiotic covering and producing ornamentation material of Stevia plant		
10.00 to 10.15	**Ayça AKÇA UÇKUN**		
	Alternate bearing of olive varieties		
10.15 to 10.30	**Berna ÖZTÜRK**		
	Hypericum perforatum L. as natural antioxidant and antimicrobial agents		
10.30 to 10.45	**Kıvanç ATLAMA**		
	Using Urtica dioica L. as functional ingredients in foods		
10.45 to 11.00	**Coffee Break**		

DAY 2	**02.04.2019**	***1st INTERNATIONAL CONGRESS ON SUSTAINABLE AGRICULTURE AND TECHNOLOGY 2019***	
11.00 to 12.15	**Oral Session-7**	**Chairman: Assist. Prof. Dr. Demet DOĞAN**	**SALON TURKUAZ**
11.00 to 11.15	**Gülden KILIÇ**		
	Probiotic fruit and vegetable based beverages		
11.15 to 11.30	**Kadir Can ASLANPAY**		
	Investigation of the use of resistant starch in the production of gluten-free biscuits		
11.30 to11.45	**Ceren SERİNKOZ**		
	Fermented coffee production		
11.45 to 12.00	**Mohamed Cherifou Dine ABOUDOULAYE**		
	Dairy sector ın Republic of Benın: perspective for Wagashi cheese		
12.00 to 12.15	**Sevilay Gül**		
	The effects of lactic acid bacteria and inoculants mixture enzyme on fermentation and feed value of Vetch (Vicia narbonensis L.) silage		
12.15 to 13.30	**LUNCH**		

DAY 2	02.04.2019	*1st INTERNATIONAL CONGRESS ON SUSTAINABLE AGRICULTURE AND TECHNOLOGY 2019*	
11.00 to 12.15	**Oral Session-8**	**Chairman: Dr. Kamil SARPKAYA**	**SALON TURKUAZ**
11.00 to 11.15	**Uğur UĞURLU**		
	Physical and biochemical changes of Kashar cheese during ripening		
11.15 to 11.30	**Seydi YIKMIŞ**		
	Optimization of ultrasound treated traditional apple vinegar by surface response method		
11.30 to 11.45	**Mehmet Murat Han Altın**		
	Applications of ultrasound in fruit juices		
11.45 to 12.00	**Dietmar Schröder**		
	Starkregenabfluss		
12.00 to 12.15	**Şelale YALÇINÖZ**		
	Blackberry concentrate: Physicochemical properties and thermal degradation kinetics of anthocyanin and colour		
12.15 to 13.30	**LUNCH**		

DAY 2	**02.04.2019**	***1st INTERNATIONAL CONGRESS ON SUSTAINABLE AGRICULTURE AND TECHNOLOGY 2019***	
11.00 to 12.15	**Oral Session-9**	**Chairman: Dr. Nevzat ASLAN**	**SALON MAVİ**
11.00 to 11.15	**Büşra BELTEKİN**		
	Effect of Calcium Chloride application on some physical and sensorial properties of pumpkin dessert		
11.15 to 11.30	**Omar Adil Zainel**		
	Design and analysis of date picking elevator scissor type		
11.30 to 11.45	**Hatice GÖZEL**		
	Incorrect applications on olive cultivation in south eastern Anatolian region		
11.45 to 12.00	**Aydın ATAKAN**		
	Evaluation of plant protection practices of Garlic growers in Gaziantep province		
12.00 to 12.15	**Mithat DİREK**		
	The gross profit analysis of corn production farms in Karatay district of Konya province		
12.15 to 13.30	**LUNCH**		

DAY 2	**02.04.2019**	***1st INTERNATIONAL CONGRESS ON SUSTAINABLE AGRICULTURE AND TECHNOLOGY 2019***	
13.30 to 15.15	**Oral Session-10**	**Chairman: Assist. Prof. Dr. Ali ÖZKAN**	**SALON TURKUAZ**
13.30 to 13.45	**Hatice GÖZEL**		
	Evaluation of efficiency relationship of fertilizer use in olive growing in plain and mountain villages in Kilis		
13.45 to 14.00	**Cevher İlhan CEVHERİ**		
	A Study on determination of the dorrelation between the variety of vegetable and fiber quality characteristics of Candia Cotton (G. Hirsutum L.) variety produced in organic and conventional conditions		
14.00 to 14.15	**Yeşim AYTOP**		
	Profile of Thyme producers and determination of production-marketing opportunities in Altınözü district of Hatay province		
14.15 to 14.30	**Şükran Çakır Arıca**		
	The effects of monocultural agriculture on the sustainability of local agricultural biodiversity		
14.30 to 14.45	**Mustafa Demir**		
	Enzymes and heavy metal pollution in soil		
14.45 to 15.15	**Coffee Break**		

DAY 2	02.04.2019	*1st INTERNATIONAL CONGRESS ON SUSTAINABLE AGRICULTURE AND TECHNOLOGY 2019*	
13.30 to 15.15	**Oral Session-11**	**Chairman: Assist. Prof. Dr. Deniz MIHÇIOĞLU**	**SALON TURUNCU**
13.30 to 13.45	**Gülseren ŞAHİN**		
	Usage of microalges in wastewater treatment		
13.45 to 14.00	**Melek DEMİR**		
	Functions of Dunaliella salina		
14.00 to 14.15	**Alihan ÇOKKIZGIN**		
	Determination of pods properties and yield levels pea varieties and lines (Pisum sativum L.)		
14.15 to 14.30	**Mahir Emre YALÇIN**		
	Bisphenol-A Residues in foods and agricultural environments in terms of sustainable agriculture		
14.30 to 14.45	**Mustafa ALKAN**		
	Insecticidal and behavioural effects of Achillea millefolium L. (Asteraceae) essential oil against Sitophilus granarius (Coleoptera: Curculionidae) and Rhyzopertha dominica (Coleoptera: Bostrichidae)		
14.45 to 15.15	**Coffee Break**		

DAY 2	02.04.2019	*1st INTERNATIONAL CONGRESS ON SUSTAINABLE AGRICULTURE AND TECHNOLOGY 2019*	
13.30 to 15.15	**Oral Session-12**	**Chairman: Assoc.Prof. Dr. Zafer ÇETİN**	**SALON MAVİ**
13.30 to 13.45	**Nevzat ASLAN**		
	Pistachio production in the World and Turkey		
13.45 to 14.00	**Miray Gizem BİNGÖL**		
	Antimicrobial effects of lactic acid bacteria isolated from fermented plant based products		
14.00 to 14.15	**Ali ÖZKAN**		
	Converting the Maraş pepper industrially to high value added products		
14.15 to 14.30	**Hasan GÜNDOĞAR**		
	Relationship between animal trials design in periodontology and ecologic environment: Mini review		
14.30 to 14.45	**Levent GÜLÜM**		
	An important mineral in nutrition: Selenium		
14.45 to 15.15	**Coffee Break**		

DAY 2	**02.04.2019**	***1st INTERNATIONAL CONGRESS ON SUSTAINABLE AGRICULTURE AND TECHNOLOGY 2019***	
15.15 to 16.45	**Oral Session-13**	**Chairman: Assoc Prof. Dr. Vural Emir KAFADAR**	**SALON TURKUAZ**
15.15 to 15.30	**Buket ÖZBAL**		
	Spectacular functions of Spirulina platensis		
15.30 to 15.45	**Gülümser ÖZPINAR**		
	Phytoplankton in the lentic ecosystems		
15.45 to 16.00	**Şerif KAHRAMAN**		
	Determination of some Soyabean genotypes yield and technological properties grown as a main crop in Diyarbakır conditions		
16.00 to 16.15	**Alihan ÇOKKIZGIN**		
	A research conducted on yield and yield characteristics of chickpea genotypes (Cicer arietinum L.) under Bayburt conditions		
16.15 to 16.30	**Kürşat Alp ASLAN**		
	Genetic characterizations of vitis genetic resources belonging Mardin, Şırnak, Siirt by using simple sequence repeats (SSR)		
16.30 to 16.45	**Eda DALYAN**		
	Changes in the antioxidative enzyme activities and lipid peroxidation in Maize roots exposed to lead stress		

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15.15 to 16.30	**Oral Session-14**	**Chairman: Assist. Dr. Feyza Nur KAFADAR**	**SALON TURUNCU**
15.15 to 15.30	**Demet YILMAZKAYA**		
	A fungal spore calendar for the atmosphere of Yalova, Turkey (2005)		
15.30 to 15.45	**Engin Zafer ŞAHİN**		
	Determination of urease enzyme activity in different agricultural soils in Araban district of Gaziantep (Southeast Turkey)		
15.45 to16.00	**Sevgi ARSLAN**		
	Comparison of aggregate stability of Pistachio, Grain and Pasture soils in Gaziantep		
16.00 to16.15	**Mehmet Sait TEKİN**		
	Investigation of halophytic plants in secondary vegetation due to global warming in Araban (Gaziantep, Turkey)		
16.15 to 16.30	**Engin Zafer ŞAHİN**		
	Investigation of factors affecting catalase enzyme activity in different agricultural soils		

DAY 2	**02.04.2019**	***1st INTERNATIONAL CONGRESS ON SUSTAINABLE AGRICULTURE AND TECHNOLOGY 2019***	
15.15 to 16.45	**Oral Session-15**	**Chairman: Assist. Prof. Dr. Türkan GÜRER**	**SALON MAVİ**
15.15 to 15.30	**Duygu ŞİŞEK**		
	Effects of Ozone, Sulfuric Acid and Potassium Nitrate treatments on the germination of some weeds		
15.30 to 15.45	**Yeşim AYTOP**		
	Determination of producer satisfaction: The Case of Maras Pepper		
15.45 to 16.00	**Özge DEMİREL**		
	Pathogenic variaitons of Fusarium oxysporum f. Sp. Ciceris		
16.00 to 16.15	**Nazlı BOZMAN**		
	Biological filtration by using Mammalian DNA		
16.15 to 16.30	**Sevil ÇELİK**		
	Determination of suitable areas for solar power plant (GES) using GIS and remote sensing methodology in Araban district (Gaziantep)		
16.30 to 16.45	**Erkan ÖZDEMİR**		
	Journals published in agricultural field in the last five years bibliometric analysis		
19.00 to 22.00	***CONFERENCE GALA DINNER GAÜN SEYİRTEPE SOSYAL TESİSLERİ***		
DAY 3 03.04.2019	***SOCIAL EVENT: GAZİANTEP CITY TOUR (ALL DAY)***		

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INCSAT-1 Poster Presentations

DAY 1	**01.04.2019**	***1st INTERNATIONAL CONGRESS ON SUSTAINABLE AGRICULTURE AND TECHNOLOGY 2019***
13.30-17.30	**POSTER Session-1**	
INCSAT_P-001	“Fusarium wilting factor in lentils Fusarium oxysporum f. sp. lentis biological control of lentis” **Derya İŞLER CEYHAN**	
INCSAT_P-005	“Effect of polyphenols on intestinal microbiota” **Selen AKÇAY**	
INCSAT_P-006	The importance of biosensors in detection of pathogens in food safety **Selen AKÇAY**	
INCSAT_P-007	“The effect of Trichoderma species on Urtica dioica germination” **Hasret GÜNEŞ**	
INCSAT_P-008	“Determination of optimum DNA isolation methods in peach and almond trees” **Selçuk BAŞBUĞA**	
INCSAT_P-011	“A current approach to organic agriculture: Biodynamic Agriculture” **Derya KILIÇ**	
INCSAT_P-019	Applying mycorrhiza biotechnology to horticulture and relations in tree for protection against plant pathogens **Waleed Khalid AHMED**	
INCSAT_P-020	A case study of different soil and crop management effects on soil parameters and relationship with Mycorrhiza spore development and root colonization **Berna ÇEVİK**	
INCSAT_P-021	Effect of different Nitrogen doses and Mycorrhiza application on Mycorrhizal inoculation effectiveness at Alfalfa plant **Hatice ALICI**	
INCSAT_P-022	Under long term field conditions effect of different phosphorus doses on agronomic efficiency and nutrient uptake by wheat (Triticum aestivum L.) **Feyzullah ÖZTÜRK**	
INCSAT_P-023	Effect of organic and inorganic fertilizer on Maize (Zea Mays L.) root growth **Şeyma KARADERE**	
DAY 2	**02.04.2019**	***1st INTERNATIONAL CONGRESS ON SUSTAINABLE AGRICULTURE AND TECHNOLOGY 2019***
09.30-12.00	**POSTER Session-2**	

INCSAT_P-012	Association of HLA-G gene polymorphisms with obesity **A. Amer Mohammad**	
INCSAT_P-013	Association of KIR2DL4 gene polymorphisms with obesity **Huda Sherzad Ahmed**	
INCSAT_P-014	“Thermal properties of milk and cheese” **Sani GÖKSULAR**	
INCSAT_P-015	“Lime content of soil in Gaziantep province” **Tuğba Semercioğlu Şimşek**	
INCSAT_P-016	“Identification of Boron content in the district of Gaziantep” **Tuğba Semercioğlu Şimşek**	
INCSAT_P-002	“Microwave-related Drying of Fruits” **Hasan Cem BİLİM**	
INCSAT_P-003	Determining the biological performance of air-assisted orchard sprayer against Pistachio psillid Agonoscena pistaciae Burck. and Laut in pistachio orchards **Hasan Cem BİLİM**	
DAY 2	**02.04.2019**	***1st INTERNATIONAL CONGRESS ON SUSTAINABLE AGRICULTURE AND TECHNOLOGY 2019***
13.30-17.30	**POSTER Session-3**	
INCSAT_P-004	“GMO, historical evolution process and sociological effects” **Esra ÖZMAYA**	
INCSAT_P-009	“outlook of carrot production in Turkey” **Mithat DİREK**	
INCSAT_P-010	Current situation in the world and Turkey production of sour cherry **Mithat DİREK**	
INCSAT_P-018	Variation of stable carbon isotope ratio (δ13C) in automotive particulate matter emissions **Laurynas Bučinskas**	
INCSAT_P-024	“Use of CRISPR-Cas system in Aggriculture” **Ceren YILDIZ**	
INCSAT_P-025	“Analysis of the association of LMP2 anf LMP7 genes with obesity” **Husam BAYAZID**	
INCSAT_P-026	Detection of genetically modified organisms (GMOs) in food **Derya POLAT**	
INCSAT_P-027	A research on the effects of the transportation simulation to different distance of broilers to meat quality properties **Bedri Bora ERTEM**	

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INCSAT-I

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REPUBLIC OF TURKEY
MINISTRY OF INDUSTRY AND TECHNOLOGY
SOUTHEASTERN ANATOLIA PROJECT
REGIONAL DEVELOPMENT ADMINISTRATION

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