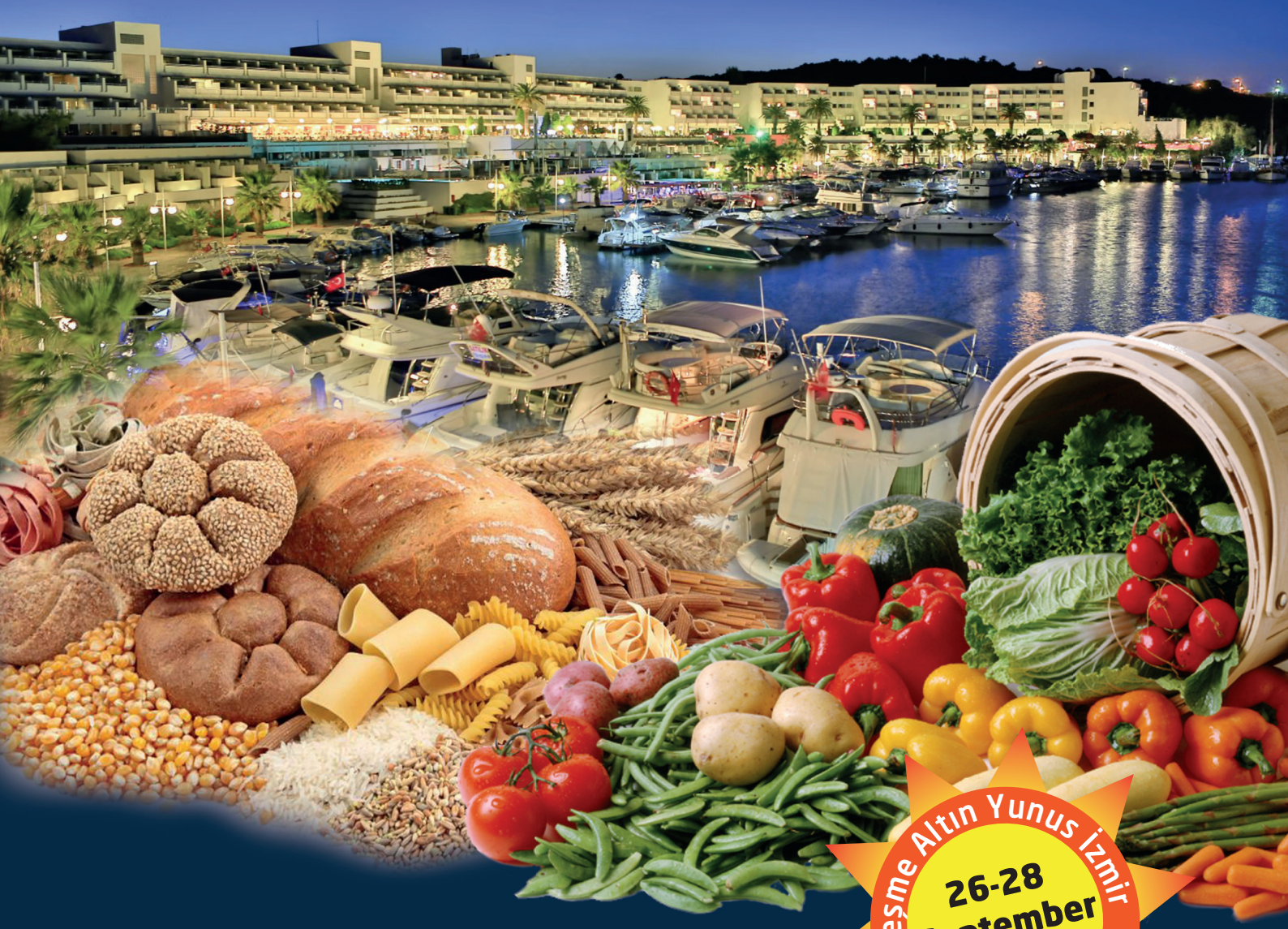

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DETERMINATION OF YIELD AND SOME YIELD CHARACTERISTICS OF SOME SOYBEAN GENOTYPES SELECTED FROM TWO POPULATIONS UNDER DOUBLE CROPPING IN MEDITERRANEAN REGION

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ABSTRACT

The aim of this study was to determine promising soybean genotypes suitable for double crop conditions in Mediterranean climate zone. Two soybean populations (Kunitz x SS201 and Kunitz x Bert), which were harvested bulk in the Karadeniz Agricultural Research Institute (F_5 generation, in 2013) were used as seed material in the study. The field trials on the basis of Augmented Design were conducted at the experimental field of the Ege University, Faculty of Agriculture, Department of Field Crops in 2014, 2015 and 2017. Each population was planted in 6 rows and 50 plants were selected from each population in 2014. In 2015, 100 single plants (F_6) selected from both populations were planted with Arisoy, Bravo, Nova, Umut-2002, SA-88 and Ataem-7 with five replications in augmented design. Seven soybean genotypes (2, 10, 11, 12, 14, 39 and 67), according to the results of augmented design experiment, with Arisoy, Bravo and Nova registered varieties were tested in a RCBD with four replications in 2017. According to the test results, the highest first pod height obtained from genotype 14 and grain yield varied between 3126 kg ha^{-1} and 4172 kg ha^{-1} and the highest grain yield obtained from promising genotype 39.

Keywords: Double cropping, soybean lines, earliness, yield

INTRODUCTION

Soybean is a leguminous plant with great importance for food, feeding animals and soil. Soybean grains contain 18-24% fat, 8% mineral matter, 26% carbohydrates and 36-45% protein (Arioglu, 2014). Soy protein is the closest protein to the animal protein, and its biological value is very high. Soybean is used almost 400 fields in the industry such as; infant formula production, poultry feed, antibiotics production, cosmetics production and etc. Soybean is also an important plant in the production of biofuels. Because of these properties soybean is called as "boneless meat", "food pill", "holy plant", "miraculous plant" and "yellow gold"(Karacaoglu,1984).

Soybean accounted for 50% of the world's total oilseed production while it constitutes only 4% of Turkey's oilseed production (Anonymous, 2017). In the production season of 2018-2019, 355.240 thousand tons of soybean production was realized according to the data of June. During this production season, Brazil has become the leading producer country with production of 118.000 thousand tons. The US ranks second after Brazil with 116.483 thousand tons of production. Argentina, China, India, Paraguay and Canada are other countries with significant share in soybean production. Turkey soybean production cannot meet consumption and imports covered by this vulnerability. During the 2018-2019 production season, 2.500 thousand tons of soybeans and 730 thousand tons of soybean meals were imported (Anonymous, 2018). Turkey should produce more soybean to reduce soybean imports. Although not a major share of Turkey in world soybean production is ahead of many countries in terms of soybean yield. Soybean has an important place in the Mediterranean Region in terms of planting area and production. In the 2015/16 season, approximately 61% of soybean production was in Adana, 21% in Mersin and 9% in Samsun. At the same time,

Mersin province has the highest yield of 4690 kg ha^{-1}, with an average yield of 4380 kg ha^{-1} in the country.

The aim of this research was to determine soybean genotypes that high yielding for double cropping and suitable for machine harvesting under Mediterranean climate zone.

MATERIALS AND METHODS

Two soybean F_5 populations (Kunitz x SS201 and Kunitz x Bert), were used as seed material in the study. The field trials on the basis of Augmented Design were conducted at the experimental field of the Ege University, Faculty of Agriculture, Department of Field Crops in 2014, 2015 and 2017. Each population was planted in 6 rows (5 m length, 70 cm row spacing, 45 plants per m^2) and 50 single plants were selected from each population according to grain yield, plant height, first pod height, number of pods per plant, number of seed per pod, 100-seed weight, number of flowering days and number of maturity day parameters in 2014. In 2015, 100 single plants (F_6) selected from both populations were planted with registered species Arisoy, Bravo, Nova, Umut-2002, SA-88 and Ataem-7 with five replications in augmented design. In 2017, seven soybean genotypes (Table 1), which were selected in terms of yield and earliness according to the results of augmented design experiment, with Arisoy, Bravo and Nova registered varieties were tested in a Randomized Complete Block Design (RCBD) with four replications at Bornova-İzmir. Bornova is located (Latitude 38°28' and Longitude 27°13') in the western part of Turkey at Aegean Sea with altitude of 27 m and dominated by the Mediterranean climatical conditions. The experimental area has a heavy soil structure with clay-silt soil at 0-20 cm depth and clay-loamy structure at 20-40 cm depth. The soil test indicated a pH of 7.63 with 1688 kg ha^{-1} of K_2O and 7.40 kg ha-1 of P_2O_5. In addition, the organic matter content of the soil was very low (1.52%) and the lime content was 7.60% (Ilker, 2011). Before planting, 200 kg ha^{-1} of DAP (36 kg ha^{-1} N, 92 kg ha^{-1} P) fertilizers were applied and Sprinkler irrigation was performed 6 times starting with sowing time.

Table 1: Selected Soybean Lines and Registered Varieties.

Line Codes	Pedigree
2	Kunitz x SS201
10	Kunitz x SS201
11	Kunitz x SS201
12	Kunitz x SS201
14	Kunitz x SS201
39	Kunitz x SS201
67	Kunitz x Bert
Registered Varieties: Arısoy, Bravo, Nova	

RESULTS AND DISCUSSIONS

The difference between the genotypes found statistically significant in terms of all characteristics and LSD test results were presented in Table 2.

Table 2: Mean values of the genotypes and varieties and the LSD grouping

Genotypes	Plant height (cm)	First pod height (cm)	Pod number (plant $^{-1}$)	Number of seed (pod^{-1})	Grain yield (kg ha^{-1})	100 seed weight (g)
Bravo	74,90^{e}	13,30^{bcd}	107,80^{abc}	2,20^{c}	3408,82^{cdef}	15,55^{def}
Nova	78,40^{de}	10,48^{e}	105,66^{abc}	2,55^{ab}	3602,24^{bcd}	16,27^{cde}
Arısoy	86,50^{bcd}	12,66^{cd}	89,04^{cd}	2,67^{a}	3495,29^{bcd}	14,57^{f}

67	83,45^{cde}	12,46^{cde}	112,00^{ab}	2,22^{c}	3184,93^{ef}	12,00^{g}
39	82,10^{cde}	12,90^{cd}	117,53^{a}	2,42^{bc}	4172,67^{a}	16,62^{bcd}
14	90,00^{abc}	17,13^{a}	93,06^{bcd}	2,55^{ab}	3126,42^{f}	19,20^{a}
12	78,40^{de}	12,53^{cde}	99,40^{abc}	2,37^{bc}	3442,08^{cde}	17,15^{bc}
11	95,06^{ab}	11,82^{de}	104,66^{abc}	2,57^{ab}	3781,12^{b}	17,70^{b}
10	97,10^{a}	14,00^{bc}	77,85^{d}	2,60^{ab}	3316,63^{def}	15,55^{def}
2	80,53^{de}	15,00^{b}	96,45^{bcd}	2,52^{ab}	3661,36^{bc}	15,27^{ef}
Mean	84,64	13,23	100,35	2,47	3519,16	15,99
LSD(0,01)	9,233	2,051	20,15	0,23	29,957	1,086

The highest plant height was obtained from line 10 with 97.10 cm length (Table 2). It has been understood that the soybean lines in this study perform better than the control varieties for plant height. In this study average plant height obtained 84.64 and this value coincides with the plant height (83.8 cm) obtained under similar conditions in 2014 and 2015 (Ilker, 2017). The growing period in main crop was between May and September, but in double crop it was between June and October. When the main value of plant height and first pod height in the soybean grown as double crop is shorter than that grown in the main crop conditions due to the effects of high temperature and day length (Arioglu, 2014).

Genotypes with high first pod height should be determined in order to reduce the loss of seeds in machine harvest. In this study first pod height was changed between 10.48 cm and 17.13 cm. The highest first pod height obtained from line 14. Short day effectives in double crop growing season in Mediterranean region. Flowering occurs when the day length becomes shorter than the critical value for the cultivar. Therefore, the plants were started to flowering very soon after emergence in double crop growing season and the pods were formed closer to soil surface. (Bakal et al., 2017). The results are corresponded with the findings of Gulluoglu et al. (2016), Ilker et al. (2018) and Bakal et al. (2017) for double cropping conditions.

Pod number per plant is one of the most important seed yield components in soybean. The highest pod number per plant obtained from line 39 with 117.53 pods plant^{-1}. The average pod number per plant found 100.35 pod plant^{-1} and this value higher than the findings of Bakal et al. (2017), Ilker et al. (2018), Ilker, (2017), Onat et al. (2017) and Yildirim (2017).

Generally, the number of seeds per pod is 2.5 and for soybeans under stress, the seeds per pod could drop to 2, 1.5, or even less under high stress situations (Lee and Herbek, 2005). In this study number of seed per pod value changed between 2.20 and 2.67 seed pod^{-1}. The highest number of seeds per pod obtained from Arisoy registered variety.

Grain yields of genotypes ranged from 3126,42 to 4172,67 kg ha^{-1} and the highest grain yield was obtained from line 39. This genotype had also the highest pod number per plant. Generally, soybean seed yield depends mostly on pod number per unit area and seed weight (Onat et al., 2017; Ohyama et al., 2013). In this study the mean grain yield found 3519.16 kg ha^{-1}. This result is similar to findings of Ilker (2017) and Onat et al. (2017) when found to be higher than other studies conducted under similar conditions (Ilker et al., 2018, Bakal et al., 2017).

The mean 100 seed weight of soybean varieties and lines found 15,99 g and the highest 100 seed weight obtained from line 14. This result is corresponded with the findings of Ilker et al. (2018), Onat et al. (2017), Bakal et al. (2017) for similar conditions.

According to the results of this research conducted for the determination of suitable genotypes as the double cropping in the Mediterranean climate zone, it has been understood that the selected line number 39 is a promising genotype in terms of grain yield and line 14 in terms of first pod height. In order to compare the trial findings and reduce the error, this study

should be carried out at least one year in the same way and the results should be evaluated together.

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HYPERACCUMULATOR PLANT SELECTION FOR MAXIMUM EFFICIENCY IN WASTEWATER TREATMENT ON ARTIFICIAL WETLANDS

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ABSTRACT

Water is the most important and indispensable element for existence of all living creatures. But nowadays, because of the wide environmental pollution, forest and green area losses, rapidly growth human population and finally wild and uncontrolled consumption of drinkable water resources, make an extremely dangerous lack of water. Therefore, cleaning and recycling technologies for reuse of waste waters is the one of the most important systems for much more water procuration. The chemical, physical and biological processes uses for their recycling and reclamation on waste water treatments plants. Nowadays, green technologies are highly preferred systems for all possible treatment solutions. Artificial wetlands, is the one of these green technologies, which use natural cycles for waste water reclamation. With their low construction costs, rare maintenance needs and no energy demand makes them more eco friendly application. Artificial wetlands, use natural phytoremediation ability of plants. Phytoremediation is the uptake of some unwanted elements -like heavy metals from different mediums by hyperaccumulator plants. These mediums can be water, air or soil. Different plants can uptake different unwanted elements by different quantity. In this research, the selection options of the hyperaccumulator plants for reaching maximum reclamation capacity of an artificial wetlands in different seasons will be discussed and show with specifying their accumulation capacity in different seasons.

Keywords: Hyperaccumulator plants, phytoremediation, artificial wetlands, wastewater purification.

INTRODUCTION

Life begins with water. All kind of living creatures needs water for living, nourishing and breeding. Water is a vital element in determining our life limits. It also has a capability to effects and alter the living kind's physiological and morphological structure. On the other hand, the increasing demands of human beings and his high consumption passion, uncontrolled population growth and low environmental protection consciousness create a heavy pressure and high consumption levels on to all water resources, especially those that are drinkables. Nowadays in many countries, problems such as water scarcity and famine due to this scarcity increase and spread. During the days, access to clean and potable water becomes more and more difficult and expensive and this situation affects all sectors, especially agriculture and food industry in a negative way. This situation affects all societies in economic and vital terms and causes negative consequences especially in disadvantaged groups such as children and the elderly. On the other hand, the global warming further increases the severity of this situation by making these conditions difficult. Under these conditions, duties of all, is to be more sensitive to environmental problems and to ensure that all-natural resources, especially water, are properly used, protected and recycled.

Various wastes, as a domestic or industrial usage results are undesirable substances in the process of mixing with water, quality and quality of water disrupt create water pollution. The primer reasons of polluted water are:

- Animal wastes
- Soil erosion
- Chemical impurities
- Biological impurities
- Physiological impurities
- Endustrial impurities
- Contamination in the environment
- Pollution in the settlements
- Environmental pollution
- Pollution of streams
- Contaminants caused by transportation vehicles to leave to the creeks.

Over the last three decades the European Union and its member states have successively implemented measures to ensure a sustainable water management process. A Bulk of the water reuse schemes are distributed along coastlines and in the highly urbanized areas of Northern and Central Europe (Bixio, 2008; Maryam and Büyükgüngör, 2017). This because, cleaning and recycling technologies for reuse of waste waters is the one of the most important systems for much more water procuration.

Phytoremediation and Hyperaccumulator plants

Wastewater treatment/reclamation can be explained as the up taking of undesirable, water quality deteriorating substances from the aquatic mediums. Nowadays, various physical, chemical and biological treatment methods are used for the treatment of wastewater. However, many of these systems have high energy requirements with costly manufacturing and maintenance costs. Apart from these three methods, green reclamation-phytoremediation techniques, based on the principle of using plants in the treatment by imitating natural processes are also used for many years.

Phytoremediation is a bioremediation process that uses various types of plants to remove, transfer, stabilize, and/or destroy contaminants in the soil and groundwater. There are several different types of phytoremediation mechanisms. These are:

1. Rhizosphere biodegradation. In this process, the plant releases natural substances through its roots, supplying nutrients to microorganisms in the soil. The microorganisms enhance biological degradation.

2. Phyto-stabilization. In this process, chemical compounds produced by the plant immobilize contaminants, rather than degrade them.

3. Phyto-accumulation (also called Phyto-extraction). In this process, plant roots sorb the contaminants along with other nutrients and water. The contaminant mass is not destroyed but ends up in the plant shoots and leaves. This method is used primarily for wastes containing metals. At one demonstration site, water-soluble metals are taken up by plant species selected for their ability to take up large quantities of lead (Pb). The metals are stored in the plant Is aerial shoots, which are harvested and either smelted for potential metal recycling/recovery or are disposed of as a hazardous waste. As a rule, readily bioavailable metals for plant uptake include cadmium, nickel, zinc, arsenic, selenium, and copper. Moderately bioavailable metals are cobalt, manganese, and iron. Lead, chromium, and uranium are not very bioavailable. Lead can be made much more bioavailable by the addition

of chelating agents to soils. Similarly, the availability of uranium and radio-caesium 137 can be enhanced using citric acid and ammonium nitrate, respectively.

4. Hydroponic Systems for Treating Water Streams (Rhizofiltration). Rhizofiltration is like Phyto-accumulation, but the plants used for clean-up are raised in greenhouses with their roots in water. This system can be used for ex-situ groundwater treatment. That is, groundwater is pumped to the surface to irrigate these plants. Typically, hydroponic systems utilize an artificial soil medium, such as sand mixed with perlite or vermiculite. As the roots become saturated with contaminants, they are harvested and disposed of.

5. Phyto-volatilization. In this process, plants take up water containing organic contaminants and release the contaminants into the air through their leaves.

6. Phyto-degradation. In this process, plants actually metabolize and destroy contaminants within plant tissues.

7. Hydraulic Control. In this process, trees indirectly remediate by controlling groundwater movement. Trees act as natural pumps when their roots reach down towards the water table and establish a dense root mass that takes up large quantities of water. A poplar tree, for example, pulls out of the ground 30 gallons of water per day, and a cottonwood can absorb up to 350 gallons per day (Fig. 1.) (Anonymous, 2018).

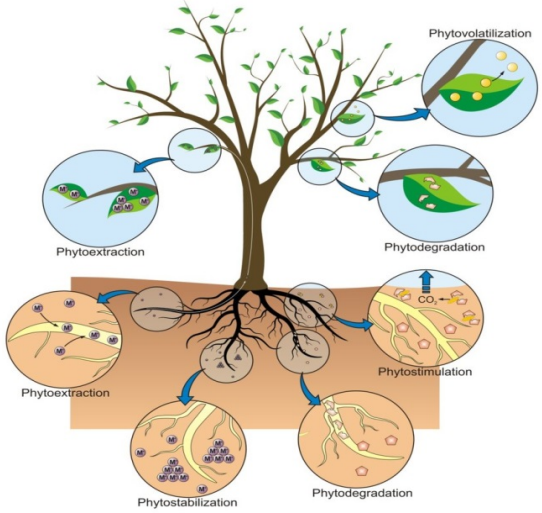

Figure 1. Schematic representation of phytoremediation strategies (Favas et all, 2014).

High tolerance to trace elements (including metals or metalloids) has evolved in a number of plant species. Tolerant plants are often excluders, limiting the entry and root-to-shoot translocation of trace metals. However, a class of rare plants called hyperaccumulators combines extremely high tolerance to, and foliar accumulation of, trace elements. Hyperaccumulators have recently gained considerable interest because of their potential use in phytoremediation (Chaney et al., 1997, 2005; Pilon-Smits, 2005; Verbruggen et al, 2009),

Over 450 plant species (0.2% of angiosperms) have been identified as hyperaccumulators of trace metals (Zn, Ni, Mn, Cu, Co and Cd), metalloids (As) and non-metals (Se), the majority of them being Ni hyperaccumulators (75%) (Brooks et al., 1974, 1977; Baker & Brooks, 1989; Reeves & Baker, 2000; Ellis & Salt, 2003; Reeves, 2003, 2006; Sors et al., 2005; Milner & Kochian, 2008; Verbruggen et al, 2009).

Hyperaccumulators occur in over 34 different families. The *Brassicaceae* family is relatively rich in them, in particular the genera *Alyssum* and *Thlaspi.* Since Ni

hyperaccumulation occurs in a broad range of unrelated families, it is certainly of polyphyletic origin (Macnair, 2003). A relatively large fraction of the Ni hyperaccumulators described so far belongs to the *Odontarrhena* section in the genus *Alyssum (Brassicaceae)*. Within that section, Mengoni et al. (2003) established that the no hyperaccumulators are distributed over different clades and that the trait might have been lost or, less likely, acquired more than once. With few exceptions, among them *Sedum alfredii (Crassulaceae),* Zn and Cd hyperaccumulation is confined to the *Brassicaceae*, to the genus *Thlaspi* and the species *Arabidopsis halleri*. Within the *Thlaspi* genus, hyperaccumulation is confined to the *Noccaea* section, and all the members of this section are hyperaccumulators, suggesting that hyperaccumulation is monophyletic within this genus (Macnair, 2003; Verbruggen et al, 2009).

As can be seen in the examples mentioned above, plants, to meet their own vital needs and to sustain their lives by taking the metal and non-metal elements in the environment and they can continue their lives. These abilities of the hyperaccumulator plants can be used to clean the different mediums and the environment. For wastewater purification they can also been used in artificial/constructed wetlands in, near or on the water.

Artificial/Constructed Wetlands for Wastewater Treatment

Natural wetlands perform many functions that are beneficial to both humans and wildlife. One of their most important functions is water filtration. As water flows through a wetland, it slows down and many of the suspended solids become trapped by vegetation and settle out. Other pollutants are transformed to less soluble forms taken up by plants or become inactive. Wetland plants also foster the necessary conditions for microorganisms to live there. Through a series of complex processes, these microorganisms also transform and remove pollutants from the water. Nutrients, such as nitrogen and phosphorous, are deposited into wetlands from storm water runoff, from areas where fertilizers or manure have been applied and from leaking septic fields. These excess nutrients are often absorbed by wetland soils and taken up by plants and microorganisms. For example, wetland microbes can convert organic nitrogen into useable, inorganic forms (NO3 and NH4) that are necessary for plant growth and into gasses that escape to the atmosphere (EPA,2004).

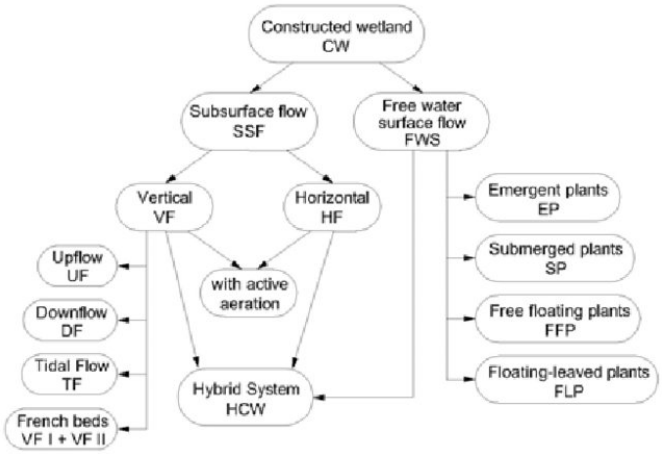

Fig. 2. Classification of constructed wetlands for wastewater treatment (Stefanakis et al. 2014, modified by Skrzypiec and Gajewska, 2017).

Wastewater treatment in wetland systems is the result of physical, chemical and biological processes in the soil and water environment with the usage of wetland plants (macrophytes). Unlike conventional biological reactors, wetland systems do not produce secondary sludge. They are also characterized by resistance to uneven and variable flow of sewage. The operational costs of these facilities are very low mainly because of minor energy supply requirements. For the treatment of industrial wastewaters both subsurface and surface flow constructed wetlands have been used. (Fig. 3) Within subsurface flow constructed wetlands both horizontal and vertical flow systems have been designed. Also, the use of various hybrid constructed wetlands for industrial effluent treatment has been reported recently (Jawecki et al., 2017; Kadlec and Knight, 1996; Kadlec and Wallace, 2009; Skrzypiec et al., 2017; Stefanakis et al., 2014; Vymazal, 2014; Skrzypiec and Gajewska, 2017).

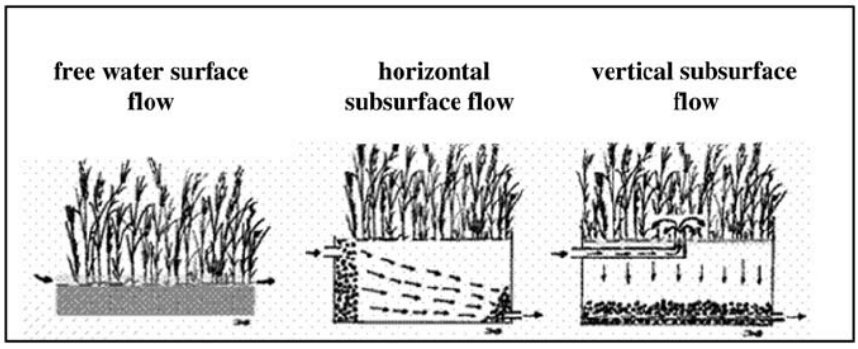

Fig. 3. Types of constructed wetlands based on the water flow type (Ghermandi, 2007).

Wetlands are some of the most biologically diverse and productive natural ecosystems in the world. While not all constructed wetlands replicate natural ones, it makes sense to construct wetlands that improve water quality and support wildlife habitat. Constructed wetlands can also be a cost-effective and technically feasible approach to treating wastewater. Wetlands are often less expensive to build than traditional wastewater treatment options, have low operating and maintenance expenses and can handle fluctuating water levels. Additionally, they are aesthetically pleasing and can reduce or eliminate odours associated with wastewater (EPA,2004).

Hyperaccumulator Plant Selections on Artificial Wetlands for Wastewater Reclamation

Wetland ecosystems, including constructed wetlands for wastewater treatment, are vegetated by wetland plants. The ability of wetlands to transform and store organic matter and nutrients has resulted in a widespread use of wetland for wastewater treatment worldwide. Wetland plants are an important component of wetlands, and the plants have several roles in relation to the wastewater treatment processes (Brix, 2003).

The wetland sediment zone provides reducing condition conducive to metal removal pathway. Constructed wetlands proved effective in abatement of heavy metal pollution. Physico-chemical properties of wetlands provide many positive attributes for remediating heavy metals. *Typha, Phragmites, Eichhornia, Azolla, Lemna* (Fig.4) and other aquatic macrophytes are some potent wetland plants for heavy metals removal (Rai,2008a).

Fig. 4. Some of most known aquatic hyperaccumulator plants; *Lemna minor, Eichhornia crassipes, Pistia stratiodes, Typha latifolia.*

Different hyperaccumulator plants have different heavy metal uptake capacity. But some of them can be used on aquatic mediums as wetlands. On the figure 5 some of the hyperaccumulator aquatic plants which can be used on artificial/constructed wetlands have been shown. Each other, they have different uptake capacity of different heavy metal types. They must be selected according the wastewater contaminant type and content quantity.

Common name	Scientific name	Source
Reed	*Phragmites australis*, *Phragmites karka*	Rai 2009a
Water fern, water velvet	*Azolla caroliniana*,*Azolla pinnata*	Rai 2007b, 2008c, 2010a, b
Water bloom/algal bloom	*Microcystis* sp.	Rai and Tripathi 2007a
Balrush/cattail	*Typha latifolia*, *Typha angustata*, *Typha domingensis*	Rai 2008a, 2009a
Poplar trees	*Populus deltoids*	Rai 2008a
Pond weed/curly leaf pond weed	*Potamogeton natans*, *Potamogeton crispus*	Rai 2008a
Parrot's feather	*Myriophyllum spicatum*	Rai 2008a
Umbrella plant	*Cyperus alternifolius*	Rai 2009b
Duckweed	*Lemna minor*	Rai 2007a
Water hyacinth	*Eichhornia crassipes*	Rai 2008a
Smart weed	*Polygonum hydropiper*	Rai 2008a
Smooth cordgrass	*Spartina alterniflora*	Rai 2008a
Water zinnia	*Wedelia trilobata*	Rai 2008a
Water lettuce	*Pistia stratiotes*	Rai 2008a
Irish-leaved rush	*Juncus xihoides*	Rai 2009a
Fuzzy water clover	*Marsilea dromondii*	Rai 2009a
Reed canarygrass	*Phalaris arundinacea*	Rai 2009a
Salt marsh bulrush	*Scirpus robustus*	Rai 2009a
Rabbitfoot grass	*Polypogon monspeliensis*	Rai 2008a
Zebra rush	*Scirpus tabernaemontani*	Rai 2009a

Fig. 5. List of wetland plants used for heavy metal phytoremediation with their common names (Rai, 2012)

CONCLUSION

Constructed/artificial wetlands are the wastewater procuration centres which support the natural resources, wild life and the ecosystem. Whit the global warming oppression, the regaining processes which have low energy consumption and low maintenance and construction costs will be more popular, like artificial wetlands. On the other hand, they must be well designed, constructed and sustainable. Sustainability of an artificial wetland depends

also right and appropriate plant selection for effectiveness. The plant selections must be realized by concerning, the wastewater's type, flow rate, content; climatic conditions, soil type, geomorphological structure and expected water quality for reuse. Therefore, plant species to be used to ensure continuity and sustainability in the systems should be selected by experts who understand and know the plant life, ecological requirements and their phytoremediation capacities. Landscape architects are the most appropriate professionals for these abilities. They know the construction and the design of these structures and also plant life and their requirements.

Therefore, teams of multidisciplinary experts should be formed under the leadership of landscape architects to ensure sustainability in the design, construction and after of the artificial wetlands, which are expected to become popular by the day. The plant selection must be done according the contents, quality and flow capacity of wastewater. The right plant selection should be made, with the correct amounts of hyperaccumulator plants suitable for seasonal changes should be selected in heavy metal contaminated waters. However, the impact and sustainability of artificial wetland systems can be increased by these right selections.

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PROFILE OF THE DAIRY FARMS THAT MEMBERS OF CATTLE BREEDERS' SOCIETY IN BALIKESİR SINDIRGI DISTRICT

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ABSTRACT

A significant part of milk production is obtained from mostly small and medium-sized dairy farmers in Turkey and Balıkesir is one of the most productive cities in dairy farming and milk production, furthermore Sındırgı, a district of Balıkesir, is responsible for a big part of this production. In this study, a survey was conducted to 40 farmers registered with Balikesir Sındırgı district directorate of agriculture and foresty; to determine the structure of these dairy farms, demographic and socio-economic conditions of farmers and their families, their opinions about animal breeding, care-feeding and breeding conditions. While the experience of 50% of respondents is between 10-20 years, it is more than 20 years for the other 45%. Only 5% has less than 10 year experiences. These study findings indicate that 55% of the farmers had at least one training in breeding field, and the other 45% had no training. Regarding the milk yield; the majority (52,5%) of them produce 25 liters (per day per head), 25% produces 30 liters, 15% produces 20 liters, 5% produces 35 liters and only 2,5% produces 15 liters. Furthermore it is stated that general cleaning periods of these barns are every three months for 47,5%, every month for 45% and every day for 7,5%. Consequently, despite their higher experience and size of businesses cleaning periods are inadequate.

Keywords: Dairy Farms, Social and Cultural Situation, Balıkesir-Sındırgı

INTRODUCTION

Milk produced by the mammary glands of female mammals to feed their infants is a complex food containing numerous nutrients. Also, milk is an essential food material for mammals' growth and development. Beside growth and development, milk has a unique function for life cycle because it contains protein and peptide structural parts such as immunoglobulins, enzymes, enzyme inhibitors, growth hormones, other hormones, growth factors, antibacterial agents and fatty acids, vitamins and minerals. Raw milk's quality, especially hygienic quality is as important as it is very essential raw material for dairy products industry (Metin, 2005, Besler, 2008; Fagundes et al., 2011).

Since milk and dairy products are raw materials for the industry, it is necessary to increase the production of animal products both in terms of quality and quantity in parallel with the increase in population in Turkey. However, nowadays, due to environmental and economic reasons, it is important to increase the number of animals and to increase the yield per animal. Quality of raw milk, especially hygienic quality is of great importance in this point (Soyak et al., 2007; Demir et al., 2014). In order to increase animal production, not only nutritional and genetic improvements, but also equipment and equipment used and environment conditions must be improved and optimized (Turgay et al., 2006, Demir et al., 2014).

In Turkey, milk is produced mostly in traditional small sized family dairy farms and it is known that people who are responsible of milking have inadequate information about how to perform udder cleaning before milking (Diler and Baran, 2014). According to FAO's predictions, above 500 million family farmers carry out approximately 80% of food production and they contribute to rural development at most (Chamber, 2002).

Agricultural production splits up to plant production and animal production in itself. In developed countries, animal production has 2/3 of total production however in Turkey this portion is only 1/3. In Turkey, about all in 78 million hectares land, plant can be performed in 28 million hectares part which brings Turkey to first place in all European countries (Anon., 2013). If we evaluate European countries for milk yield, it can be seen Finland has the most production with 8.5 tons milk per year and Sweden follows with 8.4 tons, in sequence, Danimarka with 8.1 tons, Holland with 7.8 tons, Germany with 7.3 tons, Esthonia with 7.1 tons and England with 7 tons. In consideration of information above, in developed countries higher milk yield shows us that advanced modern and technological production and breeding systems are more effective on milk yield than business size itself. In Turkey, milk production of Trakya Region with 6.4 tons is under European average, but it is also higher than Poland, Romania, Bulgaria, Slovenia and Lithuania milk productions (Aydın et al., 2010). According to TUİK (Turkish Statistical Institute), it is indicated that milk production of Turkey in 2017 is 20.672.894 tons, it is 971.204 tons for Balıkesir and also 98.669 tons for Sındırgı (Anon., 2017).

For development of milk and milk products sector in Turkey, the situation of dairy farms and milk production are crucial factors. The major parts of dairy farms in Turkey, consist of small and medium sized family businesses. In Turkey regarding dairy farming and milk production, province of Balıkesir comes in the first places, also milk production of district of Sındırgı reachs significant amounts. In this study, a survey was conducted to 40 farmers registered with Balikesir Sındırgı district directorate of agriculture and foresty; to determine and evaluate the structure of these dairy farms, demographic and socio-economic conditions of farmers and their families, their opinions about animal breeding, care-feeding and breeding conditions.

MATERIAL AND METHODS

Material

Material of this study was comprised by 40 farm owners who have at least 10 animals selected from random sampling method from 255 producers who make dairy cattle in Balıkesir's Sındırgı district.

Methods

Within the study, survey questions were asked and their answers were evaluated for these 40 farmers to determine the structure of these dairy farms, demographic and socio-economic conditions of farmers and their families, their opinions about animal breeding, care-feeding and breeding conditions.

DISCUSSION

In Turkey, the major of dairy farming businesses are small or medium sized ones and they are especially run by family members. But lately there can be seen fundamental changes in business structures. While dairy farming draws more interest respect to other sectors, the investments also reach higher numbers. To evaluate and determine the situation of Sındırgı -a district of province Balıkesir- in this conjuncture; a survey was conducted to 40 farmers registered with Balikesir Sındırgı district directorate of agriculture and foresty; to determine the structure of these dairy farms, demographic and socio-economic conditions of farmers and their families, their opinions about animal breeding, care-feeding and breeding conditions.

To begin with farm owners' educational backgrounds and family structures, first of all family size of farms; 62,5% of them have 5 or less than 5 members and 37,5% of them have between 5 to 10 members. Also, 62,5% of farm owners are between 30-50 years old, 27,5% of

them are between 51-60 years old. On the other hand, the ones above 60 years old are 7,5% and under 30 years old are only 2,5%. Thus, the majority of farm owners are between 30-50 years old, namely middle aged (Figure 1).

Cattle breeding experience of the majority of the respondents (50%) is between 10 to 20 years, other 45% is above 20 years. Only 5% has fewer than 10 year experiences. Looking at their educational backgrounds; 72.5% of the respondents are primary and 2% of them are secondary school graduates, also 22.5% are identified as a graduate of high school. There were not any illiterate farm owner and also none of them has bachelor's degree. However, this high level (%72.5) of primary school graduates indicates low education level of farm owners. These study findings indicate that 55% of the farmers had at least one training in husbandry field, and the other 45 percent had none. Looking cattle breeding experience and training data together, we can say training percentage is much lower than their business experience. Kayişoğlu (1997) found that farmers who produce milk in the Trakya region have a mean age of over 40 and most of them (90%) are primary school.

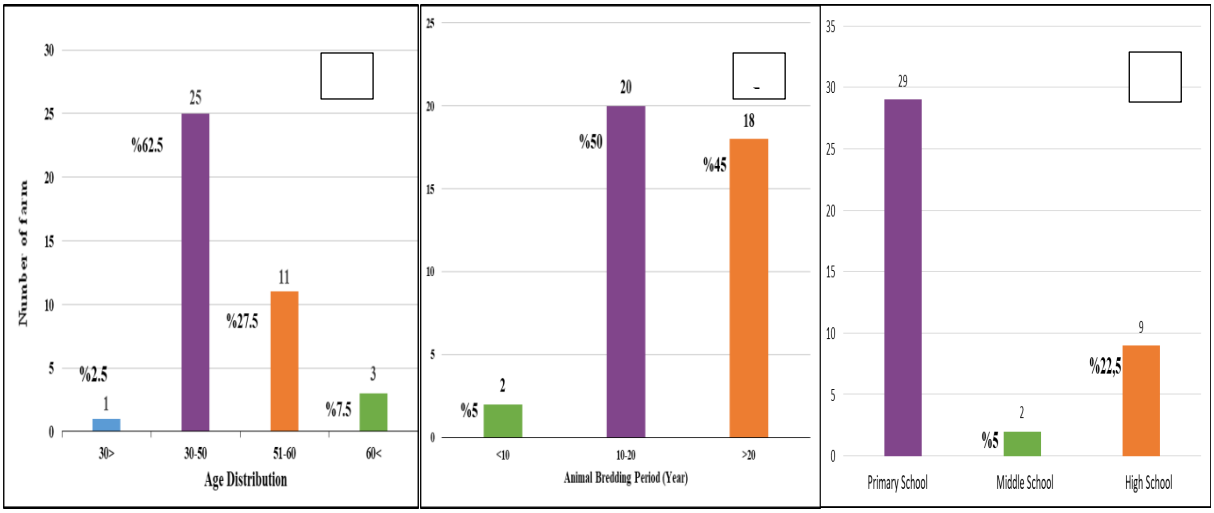

Figure1. Age Distribution of farmers (a), animal breeding period (b) and Education status (c)

Regarding animal existence and the condition of animal barns; it can be concluded as below. 70% of studied farms have above 30 head of cattle, 20% of them have 20 to 30 heads and 10% of them have 10 to 19 heads. On the other hand, regarding dairy cattle existence of farms; 27,5% of them have above 30 heads, 35% of them have 10 to 19 heads and 37,5% of them have 20 to 30 head of dairy cattle. Answers of this part shows that in studied farms there are at least 10 dairy cattle and the major part of these farms (65%) have above 20 dairy cattle (Figure 2). In studied farms, about 45% of the barns are open, 55% are semi open and none of them is closed. In studies conducted in Kars and Central Anatolia regions, 95.1% of dairy cattle companies are closed and 4.9% are in semi-open barn. In the region, animals are affected by cold, and because of their habits, closed (stagnant) stable system is widespread (Özdemir and Karaman, 2008; Demir et al., 2014). Most of the farmers (75%) reported that there is no bedplate in their barns and only 25% of them have bedplates made of chaff. Demir et al., (2014) found that 64.2% of the barn base structure was concrete bedding and 71.6% of the barn was used base and 67.3% was preferred chaff in Kars.

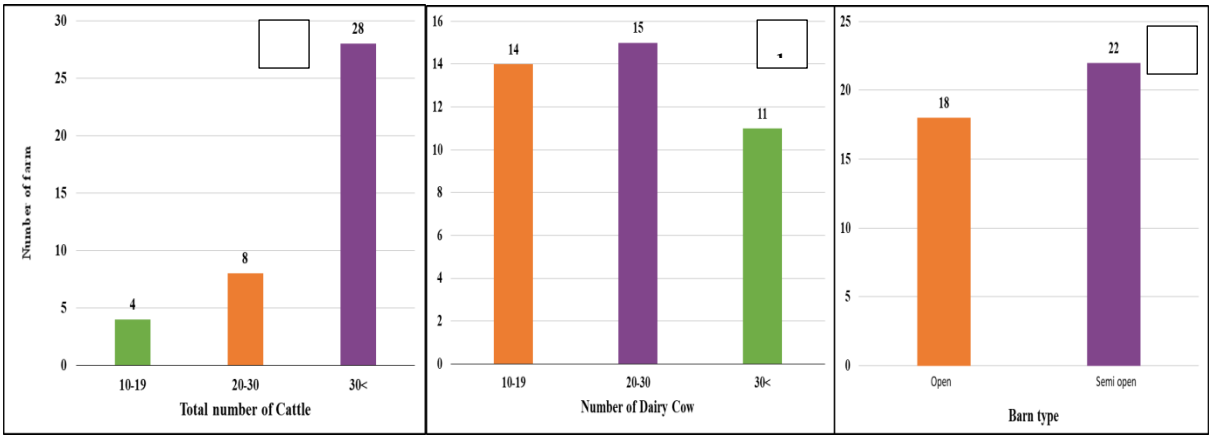

Figure2. Total number of cattle (a), dairy cow (b) and barn type of farm (c)

General hygiene and milking hygiene performance of studied farms are summarized as below. The general cleaning periods of these barns are every three months for 47,5%, every month for 45% and every day for 7,5%. In addition, in 12,5% of them there is twice a day bedplate cleaning, in 42,5% of them there is once a day bedplate cleaning and in 45% of them there is bedplate cleaning on every other day. Analyzing the answers given in the cleaning periods of milking equipment section it is seen that the milking equipment are cleaned once a month in 5% of them, once a week in 7,5% of them, every other day in 10% of them, daily in 42,5% of them and after every milking session in 35% of them (Figure 3).

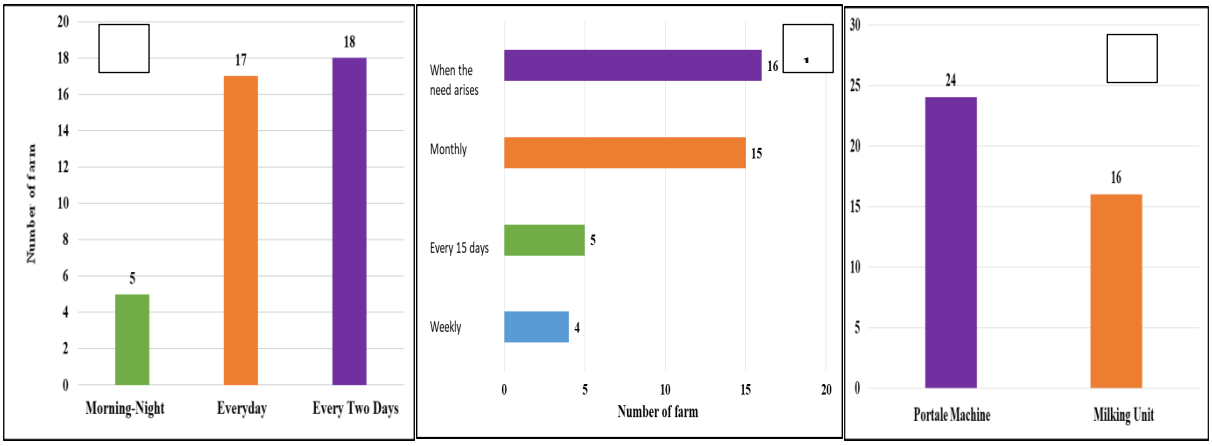

Figure3. Cleaning periods of barn (a), milking machine (b) and milking type (c)

Given answers about milking practices, milk yield and awareness can be summarized as below. In milking practices section; 40% of studied farms use stable milking units and 60% of them use portable milking units (Figure 3). As seen from the answers none of the farm members practice milking by hand. In study conducted by Elmaz et al., (2010) in Burdur, it was determined that 92.8% of the enterprises milked with mobile machine. Kayişoğlu (1997) reported that the use of milking machines is very common, although the milking in the region is usually carried out in small enterprises in Trakya region. Demir et al. (2014) stated that a significant portion of the animals were milked manually and twice a day in Kars. Despite the fact that there is a milking machine, it has been determined that the milking machine remains unproductive in many plants.

Regarding the milk yield; the majority (52,5%) of them produce 25 liters (per day per head), 25% produces 30 liters, 15% produces 20 liters, 5% produces 35 liters and only 2,5% produces 15 liters. These data show us that in the majority of farms (82,5%) milk yield per day is above 25 liters per head. Furthermore, they were asked whether or not they are aware of the effect of milk quality on milk prices; 30% of them gave positive answer to this question and the rest of them (70%) gave negative answer. Also this 70 percent thinks that there is no direct effect of milk quality on milk prices. Another question was if they take milk samples for microbiological analysis by themselves; only 22,5% of them said that they had microbiological analysis and the majority of them (77,5%) said that they have never had any kind of analysis for their milks before. Lastly, period of veterinary controls; 10% of studied farms once a week, 12,5% of them twice a month, 37,5% once a month and the major part of them (40%) call for veterinary services just in need, for example sickness, labour, artificial insemination etc. (Figure 4)

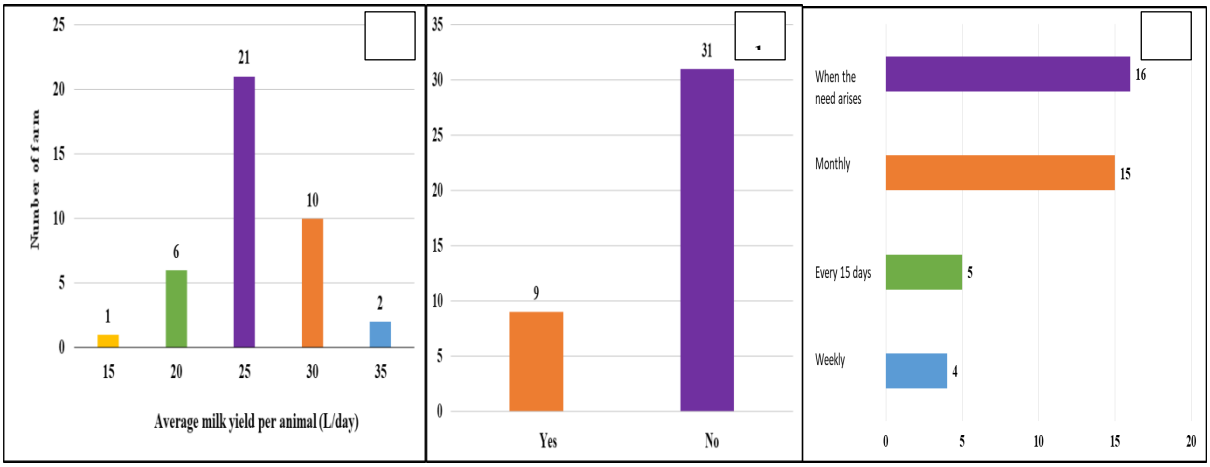

Figure 4. Average milk yield per animal (L/day) (a), Frequency of microbiological analysis (b) and Veterinary Control (c)

CONCLUSION

As a result, it was determined that although the farmers were enthusiastic in food hygiene and sanitation area, their practices did not reflect this situation. Insufficient cleaning periods and also their responds suggested that they did not need to use bedplates. But it is known that using suitable bedplates in barns is crucial for animal health and milking hygiene. Although the farms are in the same neighborhood, given answers in this survey are very differently. It is difficult to assure a standard in milk quality with those kinds of differences. It can be recommended that farmers should be encouraged to found modern facilities and they should be supported financially. Also, training programs must be conducted regularly by responsible institutions.

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ADAPTATION OF LACTIC ACID BACTERIA AND YEASTS IN TRADITIONAL FERMENTED MILK BEVERAGES: KEFIR AND KOUMISS

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ABSTRACT

In almost every region of the world, there are many fermented dairy products. The most known fermented dairy products are yoghurt, ayran, acidophilus milk, kefir, kımız and yakult. Kefir and Koumiss are traditional dairy products for the nomadic people of central Asia and has been known and highly appreciated by consumers for centuries. The both product are formed as a result of metabolic activities that occur during both lactic acid and ethyl alcohol fermentations. Similar to kefir, both lactic acid and alcohol fermentations occur in koumiss. However, unlike kefir, there is no grain structure of the koumiss starter. The microorganisms contained within the kefir grains and koumiss typically produce lactic acid and antibiotics, such products inhibit the proliferation of both spoilage and pathogenic microorganisms in fermented products. The yeast community in Koumiss and kefir grain is complex and rich in different species. Bacterial growth may also be stimulated by the amino acids and vitamins produced by the yeast. Some yeast strains even produce inhibitory substances against undesirable and pathogenic microorganisms. Most yeast strains from Koumiss and kefir have moderate to strong proteolytic and lipolytic activities, which might allow them to contribute to the final sensorial profiles of the product.

Keywords: Lactic acid bacteria, yeast, traditional fermented product, commensalism, fermentation mechanism

INTRODUCTION

Milk and milk derived products are a significant part of the diet of western countries and some ethic groups. Fermented dairy products are important in milk technology in terms of human health and nutrition. Fermented dairy products first appeared to provide longer shelf life of the milk and to provide the desired sensory properties. Most regions of the world have more than 500 fermented dairy products produced by different microbiological fermentations and produced using different milk types. Fermented dairy products produced using mesophilic starter cultures such as acidophilus milk, bifidus milk, villi are widely consumed in Scandinavian countries. Fermented dairy products produced by yeast and lactic acid fermentation such as kefir, koumiss are widely consumed in Central Asian Turkic Republics and Eastern European Countries, Russian Federation and Mongolia (Danova et al., 2005; Akın, 2006). In fermentation of these products which are higher nutritional value, lactic acid bacteria are used alone, as are yeasts and molds. Fermented milk products, which are made with certain strains of lactic acid bacteria and yeasts, are classified as yeast-lactic fermentations, and some typical examples are kefir and the related products, koumiss and acidophilus-yeast milk (Wszolek et al., 2006; Lv and Wang, 2009).

The acidification and enzymatic processes associated with the growth of lactic acid bacteria and yeasts affect the taste, odor and texture properties of various fermented dairy products. Although fermentation by lactic acid bacteria is dominant in the production of most of the fermented dairy products, there are also products in which both yeasts and lactic acid bacterial cultures are used. These products are produced by the interactions of these two groups and these interactions provide the characteristic flavor and quality of these products

(Nyambane et al., 2014). In this review, adaptation processes of yeast with lactic acid bacteria in fermented dairy products will be evaluated. The interactions between lactic acid bacteria and yeast in the adaptation process will be considered.

KEFIR

Chemical Properties

One of the most popular fermented milk drink; kefir is a traditional fermented dairy product originating from the tribes of the Northern Caucasus mountain region in Russia, located between the Black Sea and the Caspian Sea. For many decades, the longevity of the Caucasian people has been attributed to the high consumption of fermented dairy products, especially kefir. There is no known record concerning the time of origin of the first kefir grains or first kefir product. Historically, kefir was made in sheep skin bags by continuous fermentation under uncontrolled conditions (Guzel-Seydim et al., 2010). Kefir grains are gelatinous, yellowish, irregular shaped, and vary in size, from 0.3 to 3.5 cm in diameter. The matrix is composed of casein (30–34%), polysaccharides (45–60%), fat (3–4 %) together with both living and lysed microorganisms. The polysaccharide matrix, water-soluble substance known as "kefiran," is composed in equal parts by glucose and galactose. The exopolysaccharides produced by the kefir starter culture contained glucose and galactose in a 1.0:0.94 ratio.

The chemical composition of kefir depends greatly on the type of milk that was fermented and using producing methods (traditional or industrial). However, during the fermentation, changes in composition of ingredients and nutrients have also been shown to occur. The major end products of fermentation are lactic acid, acetaldehyde, acetoin, diacetyl, ethanol, and carbon dioxide. Moreover, during the fermentation, vitamins such as B_1 and B_{12}, soluble calcium, amino acids, folic acid and vitamin K may increase in the kefir (Lv and Wang, 2009).

Microbiological Properties

The microorganisms present in the kefir grains influence the microbiological characteristics of kefir drink. Kefir is the product of the fermentation of milk with kefir grains and 'mother culture' prepared from grains. These grains contain lactic acid bacteria (lactobacilli, lactococci, leuconostocs), acetic acid bacteria and yeast mixture (Iriyogen et al., 2005; Kabak and Dobson, 2011). Researchers were identified bacterial cultures that included species of *Lactobacillus delbrueckii* subsp. *delbrueckii*, *Lactobacillus kefir*, *Lactococcus lactis* subsp. *cremoris*, *Enterococcus faecalis*, *E. faecium, Lactobacillus brevis, Lactobacillus casei, Enterococcus faecium, Lactobacillus acidophilus, L. helveticus; Streptococcus thermophilus, L. fermentum, L. kefiranofaciens, Leuconostoc and Lactococcus and Lactobacillus delbrueckii subsp. bulgaricus. Identified yeasts were Kluyveromyces, Zygosaccharomyces, Pichia, Torula, candida, and Saccharomyces, Klyveromyces lactis,Klyveromyces matxianus and Saccharomyces cerevesiae as the leading yeast microflora and Torulaspora delbrueckii, Zygosaccharomyces rouxii, Saccharomyces unisporus, Zygosaccharomyces rouxii, Debaryomyces hansenii* and *Torulaspora delbrus* in kefir drink and kefir grain microflora (Simova et al. 2002; Santos et al., 2003; Kesmen and Kacmaz, 2011).

KOUMISS

Chemical Properties

Koumiss is one of the traditional dairy products for the nomadic people of central Asia and has been known and highly appreciated by consumers for centuries (Ozer, 2000).

Koumiss is a very popular fermented dairy product in Mongolia, Kazakhstan, Kirgizstan and some regions of Russia. Koumiss generally contains about 2% alcohol, 0.5–1.5% lactic acid, 2–4% milk sugar and 2% fat (Wang et al., 2008). The composition of mare's milk is significantly different from that of bovine milk. It is similar to human milk, in particular regarding its low nitrogen content, low casein-to-whey protein ratio, and high content of lactose (Yaygin, 1992; Kücükcetin et al., 2003). For centuries, koumiss has been considered not only as an essential food, but also as a nutriment and medicinal remedy (Ishii, 1999). It is made from fresh mare's milk as a result of lactic acid bacteria (LAB) and yeasts fermentation. Similar to kefir, both lactic acid and alcohol fermentations occur in koumiss. However, unlike kefir, there is no grain structure of the koumiss starter (Guzel-Seydim et al., 2010).

Microbiological Properties

The biodiversity of Koumiss is not well-defined. The fermentation is symbiotic nature and depends on the action of two distinct types of microorganisms which mainly consists of *Lactobacillus* ssp., lactose-fermenting (*Saccharomyces lactis, Torula koumiss*) and non-lactose-fermenting (*Saccharomyces cartilaginosus*) yeasts, and the non-carbohydrate-fermenting yeast (Mycoderma spp.) (Koroleva, 1991; Tamime and Marshall, 1997). However, *Lactococcus* spp. have been found in Mongolian Koumiss, but their presence in the starter culture in some countries may not be desirable because the fast acid development inhibits the growth of yeasts (Koroleva, 1991). Moreover, several studies show that lactic acid bacteria (LAB) were predominant on the bacterial biodiversity in koumiss. Especially *Lactobacillus* ssp. are reported to play a major fermentation role affecting the aroma, texture and acidity of the product as well as being of some benefit to human health (Montanari, 1996; Wu et al., 2009). The yeast community in Koumiss is complex and rich in different species Yeast species are essential for the typical characteristics of koumiss. Bacterial growth may also be stimulated by the amino acids and vitamins produced by the yeast. Some yeast strains even produce inhibitory substances against undesirable and pathogenic microorganisms (Nielsen et al., 1998). Most yeast strains from Koumiss have moderate to strong proteolytic and lipolytic activities, which might allow them to contribute to the final sensorial profiles of the product (Jakobsen and Narvhus, 1996; Spinnler et al., 2001, Mu et al., 2012).

The main LAB strains in koumiss are usually Lactobacilli, such as *Lactobacillus plantarum, Lactobacillus helveticus, Lactobacillus casei*, and *Lactobacillus kefiri* due to their higher acid tolerance (Wu et al., 2009; Wang et al., 2008). Three types of koumiss exist- 'strong', 'moderate' and 'light'- depending on the lactic acid content.

ADAPTATION OF LACTIC ACID BACTERIA AND YEAST IN FERMENTED DAIRY PRODUCT

Since lactic acid bacteria do not have a cytochrome enzyme system, they supply energy requirements by fermentation. Lactic acid bacteria (LAB) use lactose, which is found in the milk as the main energy source. Lactose is fermented by the lactic acid bacteria by two different mechanisms, homofermantative or heterofermantative. Lactose cannot be used directly in metabolism by lactic acid bacteria (Özden, 2007). Lactose breaks down glucose and galactose through the cell's lactase or "□-galactosidase" enzyme. Glucose, either by glycolytic pathway (*Streptococcus thermophilus* and *Lactobacillus* species) or by phosphoketolase (*Leuconostoc* spp.), depending on microorganism; galactose is metabolized via Leloir. Homofermentative LAB produces 90% lactic acid from a molecule glucose by following the metabolic pathway of Embden-Meyerhoff-Parnas (EMP). Heterofermentative lactic acid bacteria produce glucose 50% lactic acid by fermentation by Hegsos Mono Phosphate (HMF) while producing ethanol, acetic acid, glycerol, mannitol and fructose at high concentration. Lactic streptococci can lower the pH to 4.5-4.3 with lactic acid and the

lactobacilli to 3.5-3.2. Lactobacilli are more resistant to acidity because they produce more acid. Lactic acid bacteria form lactic acid as well as antimicrobial substances such as hydrogen peroxide, hydrogen sulfide, bacteriocin (Kılıç, 2001; Liu, 2003; Metin, 2005).

Formation of alcohol from carbohydrates is usually called alcohol fermentation by means of yeast. The sequence of reactions in which glucose is formed by ethyl alcohol and which is energized is called ethyl alcohol fermentation. Few yeast species are useful for milk technology. Yeasts provide a suitable base for lactic acid bacteria, especially those that are effective in matured some products, by providing pH elevation using lactic acid in the medium. It also provides a microaerophilic environment for the lactic bacteria used together and plays an important role in the formation of the aroma (Templer and Jakobsen, 2000, Kılıç, 2010). Alcohol fermentation occurs in anaerobic conditions. In ethyl alcohol fermentation, glucose first breaks down with pyruvate in glycolysis reactions. Acetaldehyde occurs from pyruvate. Hydrogen is added to NAD^+ in each of the acetaldehydes formed during glycolysis to form 2 molecules of ethyl alcohol. The reaction results in CO_2 emissions. The CO_2 output is a condition specific to ethyl alcohol fermentation. Yeasts, which also play a role in kefir and koumis fermentation, play an important role for lactic bacteria by creating microaerophilic environment, realizing alcohol fermentation and contributing to the formation of flavor and aroma (Güzel-Seydim ve ark., 2000; Beshkova et al. 2003).

The acidification and enzymatic processes that occur with the growth of lactic acid bacteria and yeasts affect the taste, odor, texture properties of various fermented foods (Gürsoy ve Kınık, 2002). Yeast and lactic acid bacteria in kefir and koumiss microflora enhances the LAB viability, with high production of lactic acid and ethanol, as a consequence of adaptation to the environment and substrate exploitation. Lactic acid, ethanol and amino acids are an adaptive response to the environment (Chaves-Lopez et al., 2017).

The Interaction Between Lactic Acid Bacteria and Yeast in Kefir and Koumiss

Although the exact mechanisms are unknown, there are positive and negative interactions between lactic acid bacteria and yeasts. Interactions between lactic acid bacteria and yeast can emerge in different ways. Symbiosis in the forms of mutualism or commensalism is wide-spread in fermented foods, for example in yogurt, kefir and koumiss. Symbiotic relationships based on acid or alcohol fermentation occur when lactic acid bacteria are responsible for the lowering of the pH due to the secretion of organic acids allowing the yeast population to become competitive in the immediate environment, followed by yeast fermentation, like in various milk-based fermentations such as Koumiss (Roostita & Fleet, 1996; Geredeli ve Anıl, 2005; Kesenkaş ve Akbulut, 2006; Stadie et al., 2013).

The interaction between yeasts and bacteria involves stimulation or inhibition and the specific mode of interaction is dependent on yeasts as well as bacteria. One of the positive interactions between yeasts and lactic acid bacteria is to contribute to the formation of a characteristic taste and flavor of the fermented products. In addition, yeasts promote the growth of lactic acid bacteria by producing CO_2, pyruvate, propionate and succinate. Also, the synthesis of amino acids and vitamins by yeasts promotes the growth of lactic acid bacteria. Some lactic acid bacteria species promote the development of non-lactose utilizing yeasts by hydrolyzing lactose to galactose (Narvhus and Gadaga, 2003). Mutualism occurs between yeasts and lactic acid bacteria during the fermentation of milky kefir. Yeasts, on the other hand, lowers the pH and inhibits the development of unwanted microorganisms by forming alcohols and CO_2 together with bacteria, thus making the products safe and extending their shelf life. The negative interactions recorded mainly concern the mutual inhibition of growth. Yeasts are inhibited by lactic acid bacteria-produced compounds such as phenyl-lactic acid, 4-hydroxy-phenyl-lactic and cyclic peptides, conversely, the growth of LAB is inhibited by

fatty acids produced by the metabolism of lipolytic yeasts (Vilojen, 2001; Ferreira ve Viljoen, 2003; Stadie et al., 2013).

Utilizing positive or negative interactions between the yeast and lactic acid bacteria, it is possible to maintain the essential aroma in fermented dairy products or to make changes during the ripening period. Thus, while unwanted conditions can be minimized in the formation of products, improvements in the desired properties in production will be provided. In addition, antimicrobial compounds produced by LAB have provided which activate procarcinogens; these organisms with a competitive advantage over other microorganisms. Exploitation of antibiosis of LAB is the best. In addition many LAB produce metabolic end products choice for not only improving the microbial safety of the food (butyrate/ butyric acid) that have antitumorigenic activities in products but as a probiotic preparation because of their vitro Lactobacillus casei shirota strain when natural adaptation to the gut environment (Roostita & Fleet, 1996; Soomro et al., 2002; Stadie et al., 2013; Nymbane et al., 2014).

CONCLUSION

In order to provide adaptation of lactic acid bacteria and yeast to milk, it is necessary to contain sufficient amounts of nutritional ingredients in milk. To have any effect on fermented dairy products, yeasts need to reach high cell densities and must compete and interact with other microorganisms present, but especially with the dominant lactic acid bacteria. Positive and negative interactions influencing the growth and metabolism of either LAB or yeasts may modify ripening time and/or the production of essential odors. Sufficient knowledge about the interactions between yeasts and bacteria in dairy products remains incomplete. More comprehensive studies are needed to determine the role of yeasts during interactions in dairy products.

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ASSURANCE OF HEALTHY AND SUSTAINABLE PRODUCTION IN BEE PRODUCTS "GOOD MANUFACTURING PRACTISES (GMP)"

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ABSTRACT

Bee products (honey, beeswax, pollen, bee bread, royal jelly, propolis, bee venom, apilarnil, bee hive air etc.) getting from beekeeping practices are ancient recipe of nature used as food, food supplier, medicine and cosmetic directly used without adding any additive or components inside. Protection of natural, effective and healthy structure of bee products possible only if with quality production. Quality production could be feasible with "Good Manufacturing Practises"; though protect or reduce technical application of possible pollution from internal and external weldings from production to consumption in every single case. Bee products face many risk factors affect quality from getting from hive to till consumers. Good manufacturing practises (GMP) sustain quality and standardization in persistance and assurance of bee products from hive, environmental conditions, hive managements, equipments and materials, quality of package, delivery to consumers. Thus, assurance utilization of bee products could be sustained with high food security, standardization and health declaration.

Key words: Bee products, quality, good manufacturing practises, standardization, sustainability.

INTRODUCTION

The importance of bee products in human, animal and plant life is a doubtless truth. Protecting the natural, healthy and efficient structure of nature's ancient recipe bee products that is used as food dietary supplement, medicine and cosmetics and directly edible without adding any other additives, is only possible with quality production (Sunay, 2011).

In recent years, food safety emphasis in agriculture become more important by the raising consciousness of natural and healthy nutrition. Bee products qualified as important nutritional source with its natural contents and healthy features, are being faced with many risks from hive to table because of beekeeping activities are made in field conditions. In other words, many important factors that are effecting on bee products quality are appearing on production stages at field conditions. Nowadays, bee products are under threat of heavy metal, antibiotics, pesticides and microbiological contamination directly or indirectly. Can 'Good Manufacturing Practices' be the solution for this serious problems on quality of bee product productions?

Good Manufacturing Practices (GMP) in Beekeeping

'Practical beekeeping' is defined as beekeeping practices that using all potential of modern technology and as a result of this, gaining profit above its economical yield level.

First of all, for having a good manufacturing in beekeeping, it is very important that beekeeper is educated and have enough knowledge and experience on beekeeping. Beekeeper must be innovative, self-developer and visionary to collate information that learnt with developing technologies. Besides, the beekeeper needs to determine his/her aim of production well. That is to say, which bee product or products the beekeeper targets to produce, the beekeeper needs to plan an accordingly colony management system.

It must be studied on the bee colonies that are compatible ecotypes to the region. Working with improper bee races and ecotypes to the region is an important factor that can reduce the success of production. Attention should be paid to keep young queen bees in colonies, to change queen bee after two production season and after one winter period, to avoid breeding queen bees from swarm colonies. Queen bees should be bred subjected to productivity based selection in the way beekeeper wants. Queen bees should not be given to the production colonies without controlled by progeny tasting (Doğaroğlu, 2012).

Because of colony productivity depends on the convenience of pollen and nectar resources, success in beekeeping related majorly on these factors. Beekeeping is a production line that natural resources turn into products by honey bees and quantity and activity of production is only depends on sufficient nectar and pollen amount in nature. It is necessary to have plenty of water resources close to colonies, to consider number of colonies in significant area according to environmental flora and to transmit colonies to water resources at the beginning of flowering. Also, on the purpose of benefiting from surrounding sources at flowering period in maximum levels, attention should be paid to keep foragers in maximum population by colony arrangement. The area where the apiary situated must have clean environment and air conditions, there shouldn't be plant production areas which are using conventional agriculture pesticides around apiary. The distances between apiaries are important for spreading and controlling of diseases and pests. Generally, areas that are windless, far from human and animal activities, noise free, contains clean water resources must be selected. It must pay attention to feeding of bees and not using anything except syrup, honey-powdered sugar cake or fresh pollen while feeding (Doğaroğlu,2012).

Beekeeper should attach importance to hygiene and cleanliness of the hands before practices and mask that is using at the apiary. Regular cleaning of used hives, other tools-equipment and specially disinfection of hive tool by sodium hypochlorite and caustic soda mixture after every use can prevent infection of diseases pretty well. It is very important that beekeepers use materials and methods that is convenient for good manufacturing practices at fighting with disease and pests for preventing medicine and pesticide residues in bee productions. Strategy for fight against Varroa must be using of regionally simultaneous, ordinate, alternate and non-residual practices. Correct diagnosis at diseases prevents unnecessary usage of medicines at beehives and provides the manufacture of non-residue products. Antibiotics shouldn't be used for American foul brood and remove the possible disease causing factors for Nosema. Using good beekeeping techniques develops the efficiency and health of the colony. Hygienic apiculture practices has long lasting protective effects for continuity of colony health. Bee welfare is under pressure of viruses, microorganisms and parasites. Sanitation and hygiene helps honey bees to be healthy and to prevent the transmission of diseases like Nosema, American foul brood and European foul brood. (GTHB,2008).

Bee products can easily effect from heat and light, that is why there can be variations on nutrition facts and microbiological reproduction. Features that peculiar to every product must be known from producers and proper storage conditions must provide by having necessary precautions.

Significant principal points can be summarized for consideration of bee products in 'Good Manufacturing Practices':

- Standardization; is the most important criterion that increases marketability, continuity and value of the product and providing convenience of finding mouth-pleasing product for consumers.
- Additive, residue and hygiene: It should be avoided from every practice that can left residues for consumer welfare. Besides, to follow the rules of hygiene would make this products preferably and improve food safety.
- Colony population levels: It is important to keep colony population in optimal levels for manufacturing good quality bee products.
- Harvest time: It must be known in when, how often and which conditions honey harvest will be made and during this practice, product quality needs to be protected in maximum level GTHB,2008).

Food Safety Applications for GMP of Bee Products

Monitoring after sales in bee products makes the component part of 'Good Manufacturing Practices' and have an important place in food safety. If product preserves under improper conditions at sales point, product structure and feature can deteriorate and this situation can reflect to consumers. In that case, it needs to specially pay attention to protect the product guarantee line at the sales point to prevent from negative results, it needs to be specified the conservation, handling and storage conditions at product labels, it must not be forgotten that sales point is also responsible for product safety. All information, document and samples for that lot needs to be kept till the end of product expire date (Çukur *et al.,* 2017).

CONCLUSION

'Good manufacturing practices', in other words; environmental conditions of bee products that importance for health is unquestionable, colony maintenance management and production applications, materials and equipment at production, storage conditions, packaging quality, bee products, reliable and continuous distribution to consumer brings standardization and quality to bee products. In attempt to provide standardization and quality; it needs to increase the frequency of bee products food controls, conduct effective inspections and controls, conduct disincentive penal sanctions to plants that are improper to regulations and rules, in Turkey. Consumers needs to be informed by public service announcements, awareness needs to provide by social consciousness about the subject, EU harmonization studies and programs needs to accelerate, researches about bee products at universities and research institutions must be supported.

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USING OPPORTUNITIES OF PROPOLIS IN FARM ANIMALS

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ABSTRACT

Worker bees create biochemical changes in plants, enzymes and plant secretions from plant shoots and buds by enzymes secreted by the gut at the beginning. Propolis protects the colony for against bacterial and viral infections.

Propolis is known to have protective and therapeutic properties in farm animals. Propolis has been shown to prevent and treat newborn calf diarrhea, which causes significant economic loss, to significantly increase the iron content and ruminal butyrate production in the blood, while reducing the number of ruminal bacteria. In addition, the application of propolis gives positive results against mastitis, which is an important problem in dairy farming.

The addition of propolis to quail and poultry feeds positively affected the parameters such as egg weight, shell quality, and fertile egg ratio. Mixed feeding increases the viability, feed utilization, fattening performance and carcass yield of the propolis ethanolic extruded broiler chickens at different concentrations.

In parallel with the development of healthy living consciousness, more attention has been given to the use of bee products. More scientific research on the subject needs to be undertaken to disseminate propolis awareness and use in order to determine the effects of propolis, a "natural antibiotic," in the field of animal production.

Keywords: Propolis, animal production, beekeeping, bee products.

INTRODUCTION

Propolis is a product of the honey bees used to protect hive, larvae and themselves from the various microorganisms like virus, bacteria and fungi. Propolis has an intensive and fine odour and a somewhat bitter taste. The colour varies according to the geographical area and plant sources from light yellow up to dark brown (Topal *et al.,* 2015).

The use of propolis becomes widespread in medical science, apitherapy and bio-cosmetics fields owing to its anti-viral, anti-bacterial, anti-fungal, anti-inflamatory, anti-ulceric, local anesthetic, anti-tumoric, immunity stimulative and functional properties (Şahinler and Yücel, 2016). Propolis, too, forms part of traditional medicine, and chemical analysis has pointed to the presence of at least 300 compounds in its composition. It is mainly composed of resin (50%), wax (30%), essential oils (10%), pollen (5%) and other organic compounds (5%). Among these organic compounds, we may find phenolic compounds and esters, flavonoids in all their forms (flavonoles, flavones, flavonones, dihydroflavonoles and chalcones), terpenes, beta-steroids, aromatic aldehydes and alcohols, sesquiterpenes and stilbene terpenes. Caffeic acid phenethyl ester (CAPE) is a biologically active ingredient of propolis with several interesting biological properties, including apoptosis, metastasis and radiation sensitivity of cancer cells (Yücel *et al*., 2017).

Propolis and its derivates have the capacity to inhibit virus propagation. Several *in vitro* studies have shown the effect of propolis on the DNA and RNA of different viruses, among them Herpes simplex type 1, Herpes simplex type 2, adenovirus type 2, vesicular stomatitis virus and poliovirus type 2. The effects observed involve a reduction in viral multiplication and even a virucidal action (Viuda-Martos *et al.,* 2008). The antiseptic, antibiotic, antibacterial, antifungal and antiviral features of propolis come from its galangin, caffeic and ferulic acid content. In converted researches, propolis is used in branches and diseases such as dentistry, oto-rhinolaryngology, ophthalmology, gynaecology, dermatology, digestive system diseases and pulmonary diseases besides its cancer and radiation treatment (Stangaciu, 1999).

Using Propolis in Farm Animals

Poultry: Its healing effects have proven successful in combating avian diseases, viruses, *S. epidermidis*, paratyphoid fever, diarrhea, digestion issues, inflammation, skin ailments and wounds, and as a preventative immunity booster. Hens fed a propolis supplement improved egg production, blood constituency, and haematological parameters (Viruda-Martos *et al.,* 2008).

Propolis has also been used in the treatment of bacterial and viral originated diseases in poultry breeding. Muscular injection of propolis for the strengthening of immunity has increased the broilers live weight by gradual weight increases in thymus, spleen and cecal tonsil. Supplementation of propolis to diet improved egg production, egg weight and feed conversion ratio in layers. In addition, supplementation of propolis to broiler diets could increase body weight gain, defensive system and cortical parameters in tibia whereas decrease oxidative stress and liver-renal lesions. Propolis supplementation to the starter diet improved the digestibility of ether extract. However, supplementation of propolis to the starter diet had an adverse effect on digestibility of crude protein during the grower phase. Also, adding of ethanolic extract of propolis in quails diet increases egg shell weight, shell quality, carcass characteristics and livability (Bonomi *et al*, 1976; Teterrev and Ushakov., 1992; Acikgoz *et al.,* 2005).

Ruminants: Because of its high antimicrobial and antioxidant properties it is used in the animal nutrition sector in last decades, intensively. The effect of propolis administration was important on the growth of calves, increase the ferrum capacity in blood and expectant for preventing neonatal diarrhea that causes a serious economic loss. Besides that, propolis has diminished ammonium production and decreased the number of ruminal bacteria in the rumen. Due to high antibacterial effect, propolis was found effective for against mastitis pathogens in dairy cows (Topal *et al*., 2013).

The use of solutions of propolis as the antibiotic was studied in ruminants in the treatment of endometritis and clinical mastitis and sorne effects in restoring milk yield as well as a drop in bacterial counts in mammary secretion was demonstrated. In helminths infections, the effect of propolis has been tested *in vitro* on *Ascaris suum,* in combination with medicinal plants such as *Hirundu metkdnalis, Lumbriscus terrestris, Herba thymi, Vacdnum myrtillis,* and *Hiradum pilasella*. lt demonstrated a relatively lasting anthelmintic activity of the propolis and plants combinations due to a neu-rogenous-holinergic effect (Ambrosini *et al*., 2002)

Daily weight gain of female calves increased by using propolis. Neonatal diarrhea did not observe in calves. Propolis is highly antiseptic. It can be applied to skin ailments like; cuts, wounds, burns, bites, stings, hot spots, and lick granulomas (its bitterness deters licking). Recently, propolis has gained popularity as a veterinary application to treat young cattle

dermatophytosis. A propolis liniment has also been used to treat mastitis, a potentially fatal disease of the mammary glands, successfully (Şahinler and Yücel, 2016).

The study was carried out to determine the effects of propolis on growth performance and neonatal diarrhea of calves. Five females and five male calves from both control and propolis treatment groups, 20 Holstein calves, had been used, totally. Calves in both control and treatment groups were fed with the same amount of milk once in a day Propolis tincture was given to calves 2cc in a day after milk feeding. The research was prosectioned for 35 days. Daily weight gain of females in control and propolis treatment groups was found 312.8 g/day and 392.83 g/day. Daily weight gain of males in both groups was found 458.31 g/day and 470.50 g/day. Daily weight gain was found significant *($P < 0.05$)* in females. Significant differences had been obtained in both body and shoulder length parameters between control and treatment groups of females *($P < 0.05$)*. The only statistically important difference had appeared between two groups of males for withers height. Neonatal diarrhea did not observe in propolis administration group. The results of the research showed that the effect of propolis administration was important on the growth of calves and is very expectant for preventing neonatal diarrhea that causes a serious economic loss (Yücel *et al*., 2015).

Others (Hamster, rat and fish): Effective healing was determined in external ear diseases and mouth lesion of hamsters with propolis ethanol extract application. Especially in rats, poplar propolis extract has increased beneficial bacteria in the intestine and creative synergic effects on antioxidant enzyme activity. The anti-oxidative activity of propolis was evaluated in vivo based on ameliorative effects on the oxidative stress induced by vitamin E deficiency in rats (Sun *et. al*, 2000). Propolis was found to have an effect on the plasma vitamin C concentration, as well as on tissue concentrations of vitamin C in the kidney, stomach, small intestine and large intestine. These findings suggested that some components of propolis are absorbed to circulate in the blood and behave as a hydrophilic anti-oxidant that saves vitamin C. Besides of rats and hamsters, it also recover reproductive and blood lipid system in Salmon fish as well. All these scientific data indicated that propolis could be assessable as natural feed additive (Topal *et al*., 2013).

CONCLUSION

The improving technology and changing living conditions of life effect also animal health prevention facilities. Feeds enriched with natural preservatives and substances that protect the animal health become extremely popular. More studies are needed on the contribution of the magnificent propolis has on farm animals health and nourishment in order to create more awareness and influence the production of qualified propolis and increase the conscious selection and consumption of it. Making multidisciplinary scientific researches about the protective effects of the propolis on farm animals that meet with the common trend of ‘not getting sick’ will significantly contribute to spreading the results of the researches all around the world and improving the sector.

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EFFECTS OF APILARNIL ON GROWTH, BODY MEASUREMENTS AND TESTES CHARACTERISTICS FOR SAANEN MALE KIDS

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ABSTRACT

In this study, the drone bee larvae (Apilarnil), a bee product, were examined for the effect on body measurements and testicular properties of Saanen male kids. Two groups (13 head control, 13 head treatment group) were separated from the weaned male kids at 75 days old. For the control group, water was administered only with 2 cc injector twice a day, while the treatment group was given 5 days of drone bee larvae (apilarnil) homogenate orally by plastic syringe obtained from 1.25 ml "good beekeeping practises" in a day for three times per week.

The effect of treatment on live weight was insignificant statistically. Scrotum length, left and right testes length, left and right testes diameter were determined at higher values than the control group for the treatment group. The mean height of the withers for treatment group was 63.52 cm. whereas the average body length was 67.72cm. respectively. In order to demonstrate the androgenic effect of apilarnil in this study, it is necessary to investigate the effects of using apilarnil for growth and performance in male kids and bucks of different ages.

Keywords: Apilarnil, Saanen kid, growth, body measurements, testes characteristic

INTRODUCTION

Apilarnil is an important bee product used in apitherapy (Hellner *et al.,* 2008; Praveenya *et al.,* 2012). The extract obtained from the larvae of male bees is called "apilarnil" and is a bioactive product. It was first produced in Romania by Nicolae V. Iliescu (1980, 1987) at the beginning of the 1980s that the chemical synthesis of the human medicines in Romania. Apilarnil; is a "biodynamic" bee product that allows unwanted drone bee larvae to participate in the reproductive cycle with its high nutritional value. It is widely used in human and animal nutrition especially in the far east and eastern Europe countries (Krell, 1996). Apilarnil has received considerable interest from both the scientific and academic circles, as well as from consumers, for its biological effects (Aoşan, 2015; Artık and Konar, 2015). In the period of three to seven days old larvae, drone bee larvae are removed from the honeycomb before homogenization, filtration and lyophilisation processes (Stangaciu, 1999). Apilarnil, which has a very strong biological activity, contains all essential amino acids. Apilarnil has homogeneous, milky, with a yellowish gray color and a bitter taste, easily adulterated and requires cold chain preservation in crude form. Some physicochemical properties are similar to royal jelly but are different in contents (Barnutiu *et al.,* 2013). Apilarnil has strong anabolic and androgenic effects. The purpose of this study is to detect the effects of drone larvae on body measurements and testicular characteristics of Saanen male kids.

MATERIAL AND METHODS

The study constructed in Ege University Faculty of Agriculture, Department of Animal Science, Small Animal Husbandry Unit. Twenty-six male kids were used in the treatment. From these animals, 13 heads were in control, while the remaining 13 heads kids were in the treatment group. The study began at 75.days age and finished at 135.days age of Saanen male kids. The trial lasted 60 days. All male kids were nourished milk at least 20 % of their live weight and weaned from the milk after about 75 days. Two groups (13 head control, 13 head treatment) were separated randomly after weaning. For the control group, water was given only 2 times a day with 2 cc injector, while the treatment group was given 5 days' apilarnil oral gavage (apilarnil) obtained from 13 head kids two days a week and 1.25 ml "good beekeeping practises per animal" given by plastic injector.

The following characteristics of the Saanen male kids were examined individually during the trial period (Ceyhan and Karadağ, 2009; Atay *et al.,* 2010; Gök *et al.,* 2015).

a. **Growth traits**: As the developmental characteristics in the kids, weaned weights, as well as live weight changes with individual weighting, were observed every 14 days. Sensitivity was determined as 0.1 kg on the scale.

b. **Testes characteristics**: Testes characteristics were taken individually in 14-days intervals. The testes length was determined individually with a digital caliper, the circumference of the scrotum was 0.1 centemetre with the scrotum circumference, and the scrotum volume was 10 ml with individual sensitivity.

c. **Body measurements**: Some body measurements, such as height at withers, body length and chest circumference in Saanen male kids, were individually measured with a measurement tape at 0.5 cm per day every 14 days.

In the evaluation of the characteristics examined in the study, the development of SPSS 15 (1999) package statistical program, the testes characteristics and some body measurements were individually determined and the effect of live weight per experiment was accepted as covariance. In order to determine the treatment effect-test was also performed for group comparison as well as variance analysis (Düzgüneş *et al*., 1991).

RESULTS

In the study, growth and testicular characteristics and body measurements were individually determined in Saanen kids.

Live Weight

Live weight of male kids at the beginning of trial was same as 21.77 kg for both control and experiment groups whereas mean live weight of control group was reached up 29.25 and of experiment group was 28.66 kg at the end of trial. In terms of live weight, the distinction statistic between the groups is insignificant (P>0.05) (Table 1).

Table 1. Least square means and standard errors for live weight by days/age and group in Saanen kids

Group	Days/Ages	N	Mean	Standard error
Control	75	13	21,77	1.05
	90	13	26,87	0.77
	105	13	30,43	1.09

	120	13	33,23	1.17
	135	13	33,94	0.96
	Overall	**65**	**29,25**	**0.71**
Treatment	75	13	21,17	0.85
	90	13	25,79	1.07
	105	13	30,10	1.38
	120	13	33,18	1.49
	135	13	33,05	1.52
	Overall	**65**	**28,66**	**0.80**
Significant level		**130**	**0.583**	
General	75	26	21,47	0.67
	90	26	26,33	0.65
	105	26	30,26	0.86
	120	26	33,21	0.93
	135	26	33,49	0.88
	Overall	**130**	**28,95**	**0.79**

Daily Gain

The average live weight gain between weaning weight age (75 days) and 90 days was 298 g. The difference between the groups is in favour of the treatment group. Between the nineteenth and one hundred fifth days of the study, there is a difference of 9 grams in favour of control group kids. The daily gain is about 155 g on the average for one hundred fifth and one hundred twenty fifth days. In other words, there is a decrease in daily gain (Table 2).

Table 2. Least square means and standard errors for daily gain in Saanen male kids

Ages	Group	N	Min	Max	Mean	Standard Error	Significant level(P)
75-90	Control	13	140	473	288.15	28.121	0.623
	Treatment	13	127	547	308.15	28.600	
	Overall	26	127	547	298.15	19.751	
	Control	13	123	510	289.08	30.427	

90-105	Treatment	13	43	567	286.85	36.916	0.963
	Overall	26	43	567	287.96	23.437	
105-120	Control	13	30	470	145.92	41.292	0.833
	Treatment	13	-25	64	164.39	75.993	
	Overall	26	-25	26	155.15	42.410	
120-135	Control	13	-29	270	98.31	37.723	0.370
	Treatment	13	-490	250	32.31	61.567	
	Overall	26	-490	270	65.31	35.983	
75-135	Control	13	136	284	205.38	13.262	0.740
	Treatment	13	107	331	198.08	17.265	
	Overall	26	107	331	201.17	10.690	

The decrease in daily gain is 120-135. days and continued to decline to an average of 65 grams. Overall, the average daily gain was 201 g (between 75 and 135 days), with a higher value in the control group (205 g). There was no significant difference in terms of age (age) in terms of daily gain in Saanen male kids.

Testes Characteristics

The effect of the treatment on the testicular characteristics examined was not significant. In the treatment group, the characteristics such as the length of the scrotum, the length of the left and right testes and the diameter of the left and right testes are relatively higher than those of the control group. Saanen male kids had a mean scrotum length of 10.19 cm, a left testes length of 9.16 cm, a right testes length of 9.17 cm, a left and right testes diameter are 4.15 and 4.14 cm, respectively. The circumference and volume of the scrotum were 19.58 cm, and 188.85 cm^3, respectively (Table 3).

Table 3.Least square means and standard errors of some testicular traits for male Saanen kids

Traits	Group	N	Min	Max	Mean	Standard error	Significant Level(P)
SICLEN	Control	65*	5.00	14.00	10.15	0.215	0.792
	Treatment	65	5.50	15.00	10.24	0.283	
	Overall	130	5.00	15.00	10.19	0.171	
LETELE	Control	65	4.00	13.00	9.14	0.212	0.898
	Treatment	65	4.50	14.00	9.19	0.279	

	Overall	130	4.00	14.00	9.16	0.169	
RITELE	Control	65	4.00	13.00	9.15	0.213	
	Treatment	65	4.50	14.00	9.19	0.279	0.921
	Overall	130	4.00	14.00	9.17	0.169	
LETEDI	Control	65	2.00	6.00	4.14	0.116	
	Treatment	65	2.00	6.50	4.17	0.140	0.863
	Overall	130	2.00	6.50	4.15	0.089	
RITEDI	Control	65	2.00	6.00	4.13	0.116	
	Treatment	65	2.00	6.50	4.16	0.141	0.896
	Overall	130	2.00	6.50	4.14	0.089	
SCRCIR	Control	65	10.50	27.00	19.87	0.386	
	Treatment	65	12.00	27.00	19.13	0.463	0.220
	Overall	130	10.50	27.00	19.58	0.297	
SCRVOL	Control	65	25.00	450.00	193.05	10.526	
	Treatment	65	25.00	420.00	182.50	12.816	0.527
	Overall	130	25.00	450.00	188.85	8.12054	

*: Every group 13 observation and it was made 5 times observation (13 x 5=65)

SICLEN:Scrotum lenghth LETELE:Left testes length RITELE:Right testes length

LETEDI:Left testes diameter RITELE:Right testes diameter SCRCIR:Scrotum circumferences

SCRVOL:Scrotum volume

Body Measurements

The height at withers outside the chest circumference from the examined the body length average are grouped into the treatment group. The difference between the groups in terms of body measurements is not significant, statistically. While the average height at withers was 63.5 cm in the Saanen male kids, the body length and average of the chest circumference were; 67.39 and 66.90 cm, respectively (Table 4). The change in body measurements according to age group was significant ($P < 0.01$). The general mean values for height at withers and chest circumference are 63.50, 67.39 and 66.90 cm, respectively (Table 5).

Table 4. Least square means and standard errors for some body measurements in Saanen male kids

Traits	Group	N	Min	Max	Mean	Standard Error	Significant level (P)
HW	Control	65*	54	71	63.47	0.432	
	Treatment	65	55	72	63.52	0.449	0.931

	Overall	130	54	72	63.50	0.310	
BL	Control	65	59	74	67.06	0.455	
	Treatment	65	56	77	67.72	0.500	0.330
	Overall	130	56	77	67.39	0.338	
CHCR	Control	65	57	74	66.90	0.519	
	Treatment	65	54	87	66.89	0.787	0.994
	Overall	130	54	87	66.90	0.470	

::*: Every group 13 observation and it was made 5 times observation (13 x 5=65)

HW: Height at withers BL:Body length CHCR: Chest circumferences

Table 5. Least square means and standard errors for change of body measurements in age in Saanen male kids(cm)

Traits	Days	N	Min	Max	Mean	Standard error	Significant level (P)
HW	75	26	54	66	60.42	0.509	0.001
	90	26	57	67	61.25	0.527	
	105	26	58	70	63.96	0.536	
	120	26	60	70	65.38	0.555	
	135	26	62	72	66.46	0.518	
	General	130	54	72	63.50	0.310	
BL	75	26	56	68	63.46	0.595	0.001
	90	26	61	71	66.04	0.562	
	105	26	60	77	68.27	0.701	
	120	26	62	74	69.12	0.608	
	135	26	64	74	70.08	0.538	
	General	130	56	77	67.39	0.338	
CHCR	75	26	54	68	61.37	0.647	0.001
	90	26	55	75	65.96	0.990	
	105	26	57	87	68.63	1.181	
	120	26	59	75	68.38	0.715	
	135	26	63	78	70.13	0.707	
	General	130	54	87	66.90	0.470	

HW:Height at wither BL: Body length CHCR: Chest circumference

DISCUSSION

In this trial, we implied that the apilarnil preparation contributes to stabilization of the metabolism in Saanen male kids and has a regulating effect on their central nervous system. Being a stimulant of the central mechanisms of regulating androgens formation, the preparation increases aqua-motor activity of the animals, promotes rehabilitation of disturbed sexual function and testes characteristics in male goats. All these positive manifestations of growth and development in male goats were due to the physicochemical characteristics of drone-brood homogenate, the presence of several biologically active components for groups.

In several experimental studies, Goloshchapov (2004), Krylov and Sokolsky (2006) and Hismatullina (2010) observed the therapeutic efficiency of drone larvae for restoring the function of the actoprotector system and the sexual function of males (Yücel *et al.,*2011).

It should be expected that apilarnil administration in the pre-pubertal period would cause an increase in semen production, sexual behaviour and fertility in adult male goats. Since androgen production in males coincides with testicular growth, the growth of secondary sexual characteristics, increase in testes characteristics of treatment group, receiving apilarnil implied that it might be possible to stimulate sexual development and androgen hormone production with apilarnil administration at an early age. As a result, testes growth and androgen hormones production by apilarnil administration may provide an opportunity for extension of reproductive lifespan and decreased generation time in male kids, thereby reducing costs in the male goat husbandry. It can be said that apilarnil has positive effects on the reproductive activities of farm animals (Bolatovna *et al*., 2015). There is a limited number of studies on the mechanism of action of apilarnil and its use in veterinary and animal science fields in particular. In fact, this bee product, which has wide use in high nutritional, medicine, pharmacy, animal science and veterinary medicine fields, needs more coordinated studies, cooperation, more research and more research by multidisciplinary science branches. In addition, the canvas will contribute to the national economy by recycling an important bee product, which is regarded as a "waste", into the production cycle.

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RELATIONSHIP BETWEEN PRODUCTION AND PRICE OF POTATOES IN TURKEY: A DISTRIBUTED LAG MODEL ANALYSIS

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ABSTRACT

Global food price volatility became more remarkable especially after the effects of serious food crisis of 2008 and 2011. However, in Turkey food prices started to fall after 2011 and 2016. Shortly after, the food prices in Turkey reached its peak value in January 2017. In this respect, the aim of this study was to investigate the relationship between the potatoes production and its prices in Turkey in the period 1985-2017. The Koyck model was used to analyze the data. The potatoes production was considered as dependent variable and its price and lag value of price series are considered as explanatory variables. According to the results, potatoes production in Turkey has been influenced by the prices of potatoes formed in the market. The time required for the changes in the potatoes prices to affect potatoes production was 2.69 years. Furthermore, 10% increase in price of potatoes increases the production of potatoes by 1.38%. On the other hand, 10% increase in production in the previous period increases the production of potatoes by 7.29%. In conclusion, economic measures such as making of production planning, constituting of efficient marketing opportunities, price policies and giving a place to stable production can be taken against to fluctutations in the price increases.

Keywords: Price analysis, Koyck Model, Distributed Lag Model, Cobweb, Potatoes

INTRODUCTION

Recent developments in the world economy have contributed to the fluctuations in the food prices. The changes in the global climate, the strengthening of demand in parallel with the welfare increase in large populations such as China and India, the weakening of public policies to stabilize prices of agricultural products in some countries, and the shift of large-scale institutional investors to agricultural product markets with speculative purposes leading to a more volatile course (OECD-FAO, 2010). Therefore, food price volatility has become one of the hot topics for researchers and policy makers within the last decade due to its detrimental effect on macroeconomic stability, productivity of food prices and general well-being of consumers. Global food price volatility became more remarkable especially after the effects of serious food crisis of 2008 and 2011.

Volatility in unprocessed food prices in Turkey are quite high compared to other countries (Öğünç, 2010). Indeed, according to comparisons performed on monthly inflation rate, monthly food price changes in Turkey during the period 2006-2009 is about 4 times more volatile than in the EU-27. This difference in unprocessed food prices are up to 6 times and Turkey has a higher monthly-unprocessed food price volatility than all of the countries concerned. This volatility can put pressure on the inflation outlook, especially when fresh fruit and vegetable prices are contributing to the annual consumer price index inflation. The

volatility observed in fresh fruit and vegetable prices is closely related to the strong seasonality in this group of products. Rapid changes in climate conditions and seasonal variations in prices are the main causes of price volatility. Factors such as lack of production planning, problems in product support system, losses in transportation of products, high dependency on natural conditions in production, limited production of alternative production areas and lack of competition in price increase the price volatility. The average food inflation has declined in the period after 2010, in the EU-27, while in Turkey it was observed that the rate of this decline is quite limited. Average consumer price inflation, which is significantly higher than other countries in Turkey, for the period after 2010, when experiencing a recovery, as in other countries but is observed that a relatively high level. Comparing averages of 2006-2009 and 2010-2015 periods, relative prices of oils; fruit, vegetable, especially potatoes, milk, cheese and egg have significantly increased compared to the EU-27 countries, which suggests that these items are decisive in the current trend.

Potato is the most produced plant species after corn, wheat and rice in the world. Averagely 4.5 million tons of potatoes are produced per year between 2010 and 2017. In 2012 production amounted to 4.7 million tons. The price of potatoes became cheaper (0,70 TL/kg in 2011 and 0,47 TL/kg in 2012) as production increased. In 2013, production decreased from 4.7 million tons to 3.9 million tons. In 2014, 4.1 million tons were produced. As the prices increase, producers increased their production by 19 percent and reached to 4 million 760 thousand tons in 2015. Potato prices decreased to 0.64 TL/ kg with the increase in production. Production for 2017 is 4.8 million tons (TUİK, 2018). On the other hand, domestic demand is 4.1 million tons resulting a decrease in potatoes prices. However, the situation has changed in 2018. Potato become more expensive both monthly and annually. The gap between demand and supply, along with bad weather conditions, caused a drastic increase in potato prices in Turkey from May to June 2018. The increase in prices is too high compared to the decrease of 1% in production.

Consumer prices of essential commodities of daily use are a very sensitive issue. The consumer suffers in case prices of consumable items are high. On the other hand, producer suffers when prices are too low to recover the cost of production. The price of consumable items is determined by the demand and supply of that particular commodity. The supply of agricultural products depends mainly on nature so there is a great element of uncertainty. If supply is in short of demand then price will increase. The other main influencing factor is supply of that commodity. Such large fluctuations in the prices is a matter of concern so there is need to identify the influencing factors of these fluctuations. Therefore, in this study it is aimed to analyze the sensitivity of potato producers to prices via a distributed lag model, Koyck model. If a model uses not only the present values but also the lag values of the defining variable, this model defined as distributed lag model in which time series data is used (Gujarati, 2009). Two major problems arise in distributed lag models. One is the multicolinearity and the other is the increasingly lower degrees of freedom as lag length increases. In order to overcome these problems, Almon and Koyck models have been developed for the estimation of parameters in distributed lag models. Koyck Model has been used for modeling the relationship between agricultural product and price in a number of studies, e.g., potatoes (Erdal et al, 2009, Doğan, et al, 2014), wheat (Özçelik, Özer, 2006; Akgül, Yıldız, 2016), maize (Mbise, 2016), dried onion (Erdal, Erdal, 2008), garlic (Hasan, Khalequazzaman, 2015), tomatoes (Erdal, 2006), watermelon (Abdikoğlu, Unakıtan), hazelnut (Çelik, 2014), cow milk (Özsayın, 2017). Some studies applied Almon model to analyze relationship between agricultural product and price, e.g. dries onion (Doğan, Gürler, 2013), paddy (Doğan et al, 2014), watermelon (Özbay, Çelik, 2016), tomatoes (Doğan, Onurlubaş, 2016). On the other hand some studies used Almon and Koyck models together

for tobacco (Dikmen, 2006), strawberry (Çobanoğlu, 2010), wheat (Çetinkaya, 2012), sheep milk (Çelik, 2015) and buffalo milk (Çelik, 2015). This study is important in terms of analyzing the sensitivity of potato producers to these price changes during periods of large price fluctuations. The remainder of this paper is organized as follows: Section 2 presents the data and the method used in this paper. Section 3 discusses the results of the Koyck Model analysis. Section 4 concludes.

MATERIAL AND METHOD

Material

In order to examine the production and price relation of the potatoes, potato production is accepted as a dependent variable and potato price as an independent variable in the study. The annual data of potato production and potato prices were obtained from official websites of TUIK for the years 1985-2017. Potatoes have been regarded as a suitable product due to its price formation in free market conditions and the existence of theoretical conditions. The prices received by farmers are converted to real prices via the wholesale price index. Various forms of production and price series have been tested and transformed into the most appropriate form so that the analysis phase can produce healthy results. As a result, natural logarithms have been taken since they provide stability over the variables.

Method

Since economic events are related to previous events in a significant way, past values used in econometric models play an important role as explanatory variables. There are many reasons for including the past values. These can be listed as follows:

- Psychological reasons: due to habit or inertia nature, people will not react fully to changing factors, e.g. income, price level, money supply etc.
- Information reasons: because imperfect information makes people hesitate on their full response to changing factors.
- Institutional reasons: people cannot react to change because of contractual obligation.

For these reasons, the distributed lag models take into account not only the current values of a dependent variable based on both the current values of an explanatory variable and the lagged (past period) values of this explanatory variable. Models can allow the analyzing the behaviors of economical units such as consumer and producer based on appropriate dynamic models (Erdal, 2006; Hasan and Khalequzzaman, 2015). The starting point for a distributed lag model is an assumed structure of the form

$$Y_t = \alpha + \beta_0 X_t + \beta_1 X_{t-1} + \beta_2 X_{t-2} + \ldots\ldots\ldots\ldots + u_t \quad (1)$$

or the form

$$Y_t = \alpha + \beta_0 X_t + \beta_1 X_{t-1} + \beta_2 X_{t-2} + \ldots + \beta_k X_{t-k} + u_t \quad (2)$$

Where Y_t is the value at time period t of the dependent variable Y, α is the intercept term to be estimated, and β_i is called the lag weight (also to be estimated) placed on the value *i* periods previously of the explanatory variable X. In the first equation, the dependent variable is assumed to be affected by values of the independent variable arbitrarily far in the past, so the number of lag weights is infinite and the model is called an *infinite distributed lag model*. In the alternative, second equation, there are only a finite number of lag weights, indicating an assumption that there is a maximum lag beyond which values of the independent

variable do not affect the dependent variable; a model based on this assumption is called a *finite distributed lag model*.

In an infinite distributed lag model, an infinite number of lag weights need to be estimated; clearly this can be done only if some structure is assumed for the relation between the various lag weights, with the entire infinitude of them expressible in terms of a finite number of assumed underlying parameters. In a finite distributed lag model, the parameters could be directly estimated by ordinary least squares (assuming the number of data points sufficiently exceeds the number of lag weights); nevertheless, such estimation may give very imprecise results due to extreme multicollinearity among the various lagged values of the independent variable. The most common type of infinite distributed lag model is the geometric lag, also known as the Koyck model. In this lag structure, the weights (magnitudes of influence) of the lagged independent variable values decline exponentially with the length of the lag; while the shape of the lag structure is thus fully imposed by the choice of this technique, the rate of decline as well as the overall magnitude of effect are determined by the data. In this model, Koyck assumed that all □'s in distributed lag model had same signs and decrease geometrically.

$$\square_k=\square_0\square^k \qquad k=0,1,2 \qquad (3)$$

According to the model, □ (0<□<1) is the rate of decrease of distributed lag. $\square_k$ is the lag coefficient. The closer □ to 1, the less the decrease in $\square_k$ and the closer □ to zero, the greater the decrease in $\square_k$ (Gujarati, 2009). Mean lag number is the weighted average of all lags. This is calculated as shown in equation (4).

$$\text{Mean lag number} = \frac{\lambda}{1-\lambda} \qquad (4)$$

According to these explanations, the infinite lag model is formed using ordinary least squares (OLS) method as shown in equation (5).

$$Y_t = \square + \square_0 X_t + \square_0\square X_{t-1} + \square_0\square^2 X_{t-2} + \ldots. + u_t \qquad (5)$$

But, the infinite lag and □ coefficients aren't linear. To solve this problem, the model has been taken one period back as shown in equation (6).

$$Y_{t-1} = \square + \square_0 X_{t-1} + \square_0\square X_{t-2} + \square_0\square^2 X_{t-3} + \ldots. + u_{t-1} \qquad (6)$$

New equation is obtained when the equation is multiplied by □ (7).

$$\square Y_{t-1} = \square\square + \square_0\square X_{t-1} + \square_0\square^2 Xt_{-2} + \square_0\square^3 X_{t-3} + \ldots. + \square u_{t-1} \qquad (7)$$

The equation (8) is reached when the equation (7) is subtracted from the equation (5).

$$Y_t - \square Y_{t-1} = \square(1-\square) + \square_0 X_t + (u_t - u_{t-1}) \qquad (8)$$

The equation (9) is reached when the equation (8) is reformulated.

$$Y_t = \square(1-\square) + \square_0 X_t + \square Y_{t-1} + v_t \quad (9)$$

In equation $v_t=(u_t-\square u_t-1)$ is the moving average of u_t and u_{t-1}. According to the above definition, the equation (9) is defined as Koyck model. Thus, the multiple correlation problems are also solved. On the other hand, while infinite distributed lag model is necessary to predict infinite number of □ using □, Koyck model distributed lag model can be resolved only through estimating □, □ and □.

RESULTS AND DISCUSSION

Potato, having a history of nearly 150 years in Turkey, has become one of the most important agricultural crops of the country and its production, industry, marketing and consumption have become a sector on its own. Potato production in Turkey has increased in a steady pace during 1985-2017. Up to 1999, both the area and the production showed a steady increase, and Turkey reached 220,000 ha of planting area and 6 million t of production. During 1999-2009, there has been a 35% decrease in cultivation area and a 28% decrease in potato production. In 2009, the acreage cropped to potato was 142,684 ha, and the volume produced was 4,397,711 tons. In 2017 the potatoes production reached to 4.8 million tons (Figure 1). On the other hand, there was not a noticeable change in current prices of potatoes between 1985 and 1997. Furthermore, potatoes prices significantly increased in Turkey from 1997 until 2017 and reached the highest value in 2014.

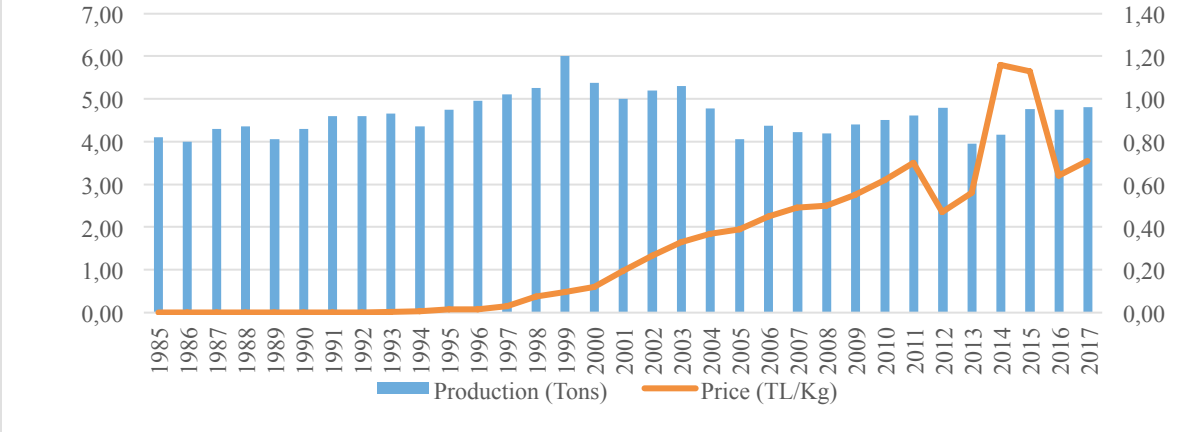

Figure 1: Potato Production and Prices of Production in Turkey (1985-2017)

Based on these data, the correlation coefficient was calculated to determine whether or not it is appropriate to apply distributed lag models to quantify the relationship between the potato production and its price. According to result of the correlation analysis that was made based on these data between 1985-2017, the correlation coefficient was found to be 0.71. Erdal et al (2009) also found high level of relationship between the two variables. This value shows that there is a strong relationship between two variables and can be examined by using Koyck model approach of the relationship between the production and the price. Distributed lag model was formed as follows:

$$Q_t = \square + \square_0 P_t + \square_1 P_{t\,1} + \square_2 P_{t-2} + \square_3 P_{t-3} + \square_k P_{t-k} + \ldots + u_t \quad (10)$$

In the model, Q_t is potato production in period t (tons), P_t is potato price in period t (TL/kg). In order to form Koyck model, it is necessary to determine lag value of potato price series lag length. In a distributed lag model, Schwarz criterion is used to determine the lag length. The lag length is selected by the smallest Schwarz value (Acquah, 2010). As can be seen in the Table 1, the lowest Schwarz value was obtained from lag length k=1. This means that from the first year onwards, potato price has no effect on potato production. Our result differs from other studies. Both Erdal et al (2009) and Doğan et al (2014) have found a lag length of 2 in their studies.

Table 1: Lag Length Selection

Lag Length	Schwarz Criterion
k=1	-75,90527*
k=2	-72,20038
k=3	-66,26299
k=4	-60,29049
k=5	-55,34948
k=6	-51,97421

According to the determined lag lengths, the relationship between potato production and price has been estimated using the classical least squares method given in Equation (10). The results of the model are given in Table 2. According to the results given in Table 2, potato prices in the period t has negatively affected the production while one period earlier (t-1) has positively affected the potato production. Partial regression coefficients in the model except ($\square_0$) have been statistically significant. Model, as a whole, is also statistically significant. The determination coefficient of the model is 0.57, which means that 57% of the changes in potato production can be explained through changes in potato price and its distributed lag values.

Table 2: The results of distributed lag model

$Q_t = 17.099 - 0.012\ P_t + 0.124 P_{t-1}$			
	Lag Length		
	Constant	P_t	P_{t-1}
Coefficient	17.099	- 0.012	0.124

t-values	14.00	□0.2294	2.385
Probability	0,000***	0,8202	0,0241**
R^2 = 0,57	F = 2,99	p = 0,0664	

Although statistically significant as a whole, the model has to be questioned in terms of reliability for two points related to distributed lag models. The first is the multiple relationship problems as a result of the fact that lag values of price variable was used in the model. The second problem is the loss of observations occurred in lag value set. If the number of data in formed series is not large, estimated values can be inconsistent due to lags. In order to overcome these two major problems, estimations were made using Koyck model. Estimation results of Koyck model are given in Table 3.

Table 3: The results of Kocyk model

$Q_t = 6.287 + 0.138P_t + 0.729Q_{t-1}$			
	Lag Length		
	Constant	P_t	Q_{t-1}
Coefficient	6.287	0.138	0.729
t-values	3.223	2.260	6.096
Probability	0.0031***	0.0315**	0.000***
R^2 = 0,57	F = 19,67	p = 0,000	LM= 0.323

The model was found to be statistically significant. The determination coefficient was obtained as 57% which means that 57% of the changes in potato production can be explained through changes in potato price and lagged production values. All of the parameters were statistically significant. Since the logarithms of the variables are used in the model, the coefficients give direct elasticities. In the short term, a 10% increase in potato price will cause a 1.38% increase in potato production. According to mean lag number, the time required for changes in potato prices to have a significant and appreciable effect on potato production was 2.69 years. Since the mean lag number is 2.69 years, the lag model with the effect of 3 years lagged price is calculated as follows:

The constant term is calculated from the equation $Q_t = □ + □_0P_t + □Q_{t-1}$ as

$□_0 = □/ (1- □) = 6.287/ (1-0,729) = 2.69$.

$\square_i = \square^i \square_0$

$\square_0 = \square^0 \square_0 = (0{,}729)^0.(0{,}138) = 0{,}138$

$\square_1 = \square^1 \square_0 = (0{,}729)^1.(0{,}138) = 0{,}100$

$\square_2 = \square^2 \square_0 = (0{,}729)^2.(0{,}38) = 0{,}073$

When the regression equation derived from the Koyck model is rewritten with these findings, the following equation is obtained:

$$Q_t = \square_0 + \square_0 P_{t-1} + \square_1 P_{t-2} + \square_2 P_{t-3} + u_t \quad (11)$$

It is predicted that the 10% increase in potato prices in the current year will increase the production previous year by 1.38%, 1.00% after two years and 0.73% after three years. The change in the lagged values of prices is steadily decreasing with positive impact on production.

CONCLUSION

Although the potato has a shorter history in Turkey compared to most European countries, now Turkey is one of the major potato-producing countries in the world due to rapid developments in the potato sector, especially during the last 30 years. Potato become more expensive both monthly and annually. The gap between demand and supply, along with bad weather conditions, caused a drastic increase in potato prices in Turkey from May to June 2018. The increase in prices is too high compared to the decrease of 1% in production. Such large fluctuations in the prices is a matter of concern so there is need to identify the influencing factors of these fluctuations. Therefore, in this study it is aimed to analyze the sensitivity of potato producers to prices via a distributed lag model, Koyck model.

According to the Koyck model results, it was determined that the change in potato prices required 2.69 years to have a significant and appreciable effect on potato production. The change in the lagged values of prices has been found to be accompanied by a gradual decline in production with positive impact on production. It is also envisaged that a 10% increase in the price of potato will increase the production volume by 1.38% a year, 1.00% two years later and 0.73% three years later.

For sustainable potato farming in Turkey, establishment of an efficient marketing organization is a necessity. Potato product in Turkey does not go beyond a registration process in trade stock markets. In this context, lack of crop-specific stock markets is a major drawback for Turkey. At this point, farmer unions have significant roles in protecting the farmer against the risks and uncertainties appeared under market conditions. For the potato crop, which is a major raw material for food industry as well as a direct food for human consumption, it is necessary to conduct a contract based production system. Policies are needed to be developed for efficient, profitable and sustainable potato farming. Thus, price uncertainties that the producers face can be overcome, and contribution of this major crop to national economy can be increased. Nowadays, government policies require more effective forecasting of the future and the need to determine the price of intervention before the fall of production by entering into these forecasts. For this purpose, it is necessary to increase the effectiveness of marketing channels that determine market prices such as marketable products stocks. In this way, the consistency of the predictions for the future will be increased.

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THE EFFECTS OF DIFFERENT PLANT EXTRACTS SUPPLEMENTED TO LAYER DIETS ENRICHED WITH OMEGA-3 FATTY ACIDS ON EGG EFFICIENCY, QUALITY, LIPID PEROXIDATION AND ANTIOXIDANT CAPACITY

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ABSTRACT

In this study, the effects of different plant extracts supplementation to egg layers feeds enriched with omega-3 fatty acids on egg efficiency, quality, lipid peroxidation and antioxidant capacity were investigated. In this article, obtained results on the □-tocopherol, fatty acid composition and lipid peroxidation of egg yolk were given. Twenty-eight weeks old one hundred and forty-four Super Nick genotype laying hens were randomly divided into six experimental groups. In trial, six experimental groups were fed diets supplemented without vitamin E or plant extract (Control), supplemented with 200 mg/kg □-tocopherol acetate (Vit-E), supplemented with 5 g/kg grape seed extract (GSE), supplemented with 5 g/kg rosemary extract (RE), supplemented with 5 g/kg green tea extract (GTE), and supplemented with 5 g/kg olive leaf extract (OLE), respectively. The □-tocopherol composition of yolk from laying hens fed Vit-E diets significantly ($P<0.01$) higher when compared to other laying hens fed diets. Total saturated fatty acid composition of egg yolks decreased with supplementation of plant extract while total polyunsaturated fatty acid composition of egg yolks increased with supplementation of Vit-E or plant extract to diets ($P<0.01$). In the room condition, MDA values of egg yolk from laying hens fed Vit-E or plant extract diets significantly ($P<0.01$) decreased when compared to control diet, whereas similar results were observed except for those from laying hens fed RE diet in the refrigerated condition. In conclusion, plant extracts can be used as natural antioxidants in laying hens diets.

Key words: Laying hens, plant extracts, □-tocopherol, fatty acids, lipid peroxidation

INTRODUCTION

In recent years, consumer demands for a more healthful diet are evident an efforts to produce eggs of modified nutritional quality. For this respect, the efforts are achieved by modifying egg yolk micronutrient and polyunsaturated fatty acid compositions (Hargis and Van Elswky, 1994). However, with increasing PUFA composition of egg yolk, there is a concomitant increase in the susceptibility to oxidative deterioration of eggs (Florou-Paneri et al, 2005).

Plant extracts from different sources have been shown to exhibit antioxidant activity *in vitro* (Rababah et al, 2004) and in vivo in plasma (chicken, Brenes et al, 2008). In this study, the effects of different plant extracts supplementation to egg layers feeds enriched with omega-3 fatty acids on egg efficiency, quality, lipid peroxidation and antioxidant capacity were investigated.

MATERIALS AND METHODS

Twenty-eight weeks old one hundred and forty-four (144) Super Nick genotype laying hens were randomly divided into six experimental groups. In trial, six experimental groups were fed diets supplemented without vitamin E or plant extract (Control), supplemented with 200 mg/kg □-tocopherol acetate (Vit-E), supplemented with 5 g/kg grape seed extract (GSE), supplemented with 5 g/kg rosemary extract (RE), supplemented with 5 g/kg green tea extract (GTE), and supplemented with 5 g/kg olive leaf extract (OLE) were formed. The experiment conducted for a period of 10 weeks.

Total lipid composition of the egg yolks were analyzed using a modification of the method of Bligh and Dyer (1959). HPLC determination was performed for the □-tocopherol composition of the egg yolks according to method of Qureshi et al (2000). Lipid peroxidation of egg yolks were evaluated at room (20°C±0.5) and refrigerated (+4 °C) storage conditions. The TBA-reactive substances (TBARS) were determined on egg yolk samples as described (Cherian et al, 1996). The TBA numbers were expressed as milligrams of malonaldehyde (MDA) per kilogram of egg yolk. Data were subjected to ANOVA using the GLM procedures of SPSS. Significant differences among treatment means were determined at P<0.01 by Duncan's multiple-range test.

RESULTS AND DISCUSSION

The α-tocopherol and Fatty Acid Composition of Egg yolk

Table 1 shows the results obtained for the □-tocopherol and fatty acid composition of eggs. Total saturated fatty acid composition of egg yolks significantly (P<0.01) decreased from the laying hens fed plant extracts compared to that of the laying hens fed control. In contrast, total polyunsaturated fatty acids composition of egg yolks significantly increased (P<0.01) from the laying hens fed Vit-E or plant extracts.

Table 1: Effects of treatments on □-tocopherol and fatty acid composition of egg yolk

	Treatments*							
	CONTROL	**Vit-E**	**GSE**	**RE**	**GTE**	**OLE**	**SEM**	**P**
α-tocopherol	19.73[a]	150.20[b]	31.95[a]	25.63[a]	25.05[a]	25.08[a]	5.68	<0.001
Fatty acids[1]								
□SFA	42.00[b]	35.66[ab]	32.99[a]	31.41[a]	31.24[a]	32.92[a]	1.57	<0.001
□PUFA	52.27[a]	62.76[b]	65.69[b]	67.31[b]	69.17[b]	63.41[b]	2.10	<0.001
□w-3FA	0.60	0.79	0.51	0.45	0.43	0.40	0.17	0.560
□w-6FA	14.58	14.73	15.37	16.32	17.29	14.84	0.55	0.162
□w-6/w-3	24.30	18.65	30.14	36.27	40.21	37.10	6.27	0.726

[1]: % of fatty acids [*]: Treatments; **Control;**unsupplemented with vitamin E or plant extract, **Vit-E;**supplemented with 200 mg/kg □-tocopherol acetate, **GSE;**supplemented with 5 g/kg grape seed extract, **RE;**supplemented with 5 g/kg rosemary extract, **GTE;**supplemented with 5 g/kg green tea extract, **OLE;** supplemented with 5 g/kg olive leaf extract; □SFA=Total Saturated Fatty Acid; □PUFA =Total Polyunsaturated Fatty Acid; □w-3FA =Total Omega-3 Fatty Acid; □w-6FA =Total Omega-6 Fatty Acid; [a-b]: The difference among the means represent by letters in the same row is important (P<0.01).

The □-tocopherol levels found in eggs were similar to those obtained by other researchers using 200 mg/kg □-tocopherol in the diets (Jiang et al, 1994; Galobart et al, 2001a). In contrast to the present findings, Galobart et al (2001a) reported that 500 or 1000 mg/kg commercial rosemary extract and 200 mg/kg of □-tocopheryl acetate supplementation in layer diet had no significant effect on fatty acid composition of egg yolk.

The Lipid Peroxidation of Egg yolk

Lipid peroxidation of egg yolks were evaluated at room (20°C±0.5) and refrigerated (+4 °C) storage conditions. The results are shown in Table 2.

Table 2: Effects of treatment on egg yolk lipid peroxidation at different storage conditions (mg MDA/kg)

Treatments*	**Room (**20°C±0.5**)**	**Refrigerated** (+4 °C)
Control	0.24^{d}	0.20^{c}
Vit-E	0.18^{bc}	0.15^{a}
GSE	0.18^{c}	0.18^{b}
RE	0.16^{ab}	0.21^{c}
GTE	0.16^{ab}	0.16^{a}
OLE	0.15^{a}	0.18^{b}
SEM	0.006	0.005
Storage time (day)		
0.	0.13^{a}	0.15^{b}
7.	0.22^{c}	0.12^{a}
14.	0.19^{b}	0.26^{d}
21.	0.18^{b}	0.19^{c}
SEM	0.005	0.004
P value		
Treatment(T)	< 0.001	< 0.001
Storage Time (ST)	< 0.001	< 0.001
T x ST	< 0.001	< 0.001

*****Treatments; **Control;** unsupplemented with vitamin E or plant extract, **Vit-E;** supplemented with 200 mg/kg □-tocopherol acetate, **GSE;** supplemented with 5 g/kg grape seed extract, **RE;** supplemented with 5 g/kg rosemary extract, **GTE;** supplemented with 5 g/kg green tea extract, **OLE;** supplemented with 5 g/kg olive leaf extract; $^{a-d}$: The difference among the means represent by letters in the same row is important.

Several studies (Cherian et al, 1996; Galobart et al, 2001b) reported that □-tocopherol prevent lipid peroxidation in omega-3 fatty acids enriched eggs similarly to this study. In this study, supplementation of grape seed extract to diets significantly decreased lipid peroxidation of eggs stored at 4°C, which is a similar finding to that reported by Kara et al (2016). Galobart et al (2001b) found that there was no change in lipid peroxidation by treatment both doses of rosemary extract (500 mg/kg and 1000 mg/kg). Uuganbayer et al (2005), reported that lipid peroxidation of egg yolk was significantly reduced in the layers fed diets supplemented with 0.5 to 2.0 % green tea powder when compared to those layers fed control diet. In another study (Sarıca and Toptaş, 2014) conducted with oleuropein and vitamin E supplementation to quail diets, the levels of 150 or 200 mg/kg oleuropein were effective in preventing lipid peroxidation of breast and thigh meats.

CONCLUSION

As a result of this study, total saturated fatty acid composition of egg yolks decreased and total polyunsaturated fatty acid composition of egg yolks increased with supplementation of plant extract to layer diets enriched with omega-3 fatty acids. Plant extracts were effective in preventing lipid peroxidation of egg yolk. In further studies, the plant extracts' different doses in laying hen feeds should be researched.

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HUMORAL IMMUNITY RESPONSES OF HONEY BEE SUBSPECIES TO *NOSEMA CERANAE* INFECTION

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ABSTRACT

Turkey is one of the World's most important origins of apiculture and harbors five subspecies of Apis mellifera L., approximately 20% of the honey bee subspecies in the world. In this study we addressed the immune defense reactions of five honey bee subspecies upon N. ceranae infection. For immune genes expression analyses, RNAs of 12 control and 12 infected bees for each of the 5 subspecies were used. As a parameter for immune strength, the increase in the production of antimicrobial peptides (defensin, hymenoptaecin, apidaecin and abaecin) was investigated for each subspecies. It was observed that honey bee defense machinery was activated by honey bee immune components for all of five the subspecies after infection with N.ceranae. This activation involved the expression of antimicrobial peptide encoding genes with rapid increments. Subspecies included in the study showed variation in the ability to generate antimicrobial peptides. The role of genetic diversity in decreasing the failure of the colonies against the pathogens in honey bees was underlined in many studies. Thus identification of immune responses across diverse honey bee genotypes may offer preliminary data and useful genetic information in this research area for future conservation and breeding studies of certain subspecies.

Keywords: Antimicrobial peptides, honey bee subspecies, immune response, Nosema ceranae

INTRODUCTION

According to morphometric, genetic, ecological, physiological, and behavioral characteristics, at least 29 subspecies of *A. mellifera* have been identified and branched into four major lineages (Han et al., 2012). Turkey is an important apiculture center and covers approximately 20% of the honey bee subspecies in the world with five subspecies of *Apis mellifera* L. Thrace region includes Carniolan honey bee (*Apis mellifera carnica,* Pollmann) in Turkey. *A. mellifera anatoliaca* is found across Anatolia from north to south and east to west with locally adapted ecotypes like Muğla and Yığılca (Bouga, 2011). *A. mellifera caucasica* inhabits northeastern Anatolia, near the Georgian border, especially in Ardahan and Artvin (Kandemir et al., 2000). *A. m. syriaca* is distributed in Hatay region.

Nosemosis has been reported as an important honeybee disease for most of the countries with beekeeping practices (Bailey and Ball, 1991). Causative agents of the disease are *Nosema apis* and *Nosema ceranae* that belong to genus of *Nosema*. Recently it's shown that *N. ceranae* which is originally observed in the Eastern honey bees, *Apis cerana* (Fries et al., 1996), now shows high incidence of pathogeny to European honey bees by replacing *N. apis* worldwide (Paxton et al., 2007; Higes et al. 2006; 2007; Klee et al 2007). Reductions in

population size, honey production, life-span and supreme autumn/winter colony loss are signs of *N. ceranae* infection in honeybee colonies (Fries et al., 2006). According to some reports *N. ceranae* resulted in collapse of the colonies with extreme virulence but these findings were not supported in some of the other studies.

Insects have behavioral, physiological, physical and immune barriers to defaecate the pathogens (Evans and Spivak, 2010). Cellular and humoral immunity occupy the second defense step against infectious agents to enter and invade (Boman, 2003). Humoral immunity produce antimicrobial peptides (AMPs); abaecin, apidaecin, defensin and hymenoptaecin in response to wide-spectrum of microorganisms (Evans et al., 2006). Apidaecin has strong antimicrobial activity to gram-negative bacteria and blocks enzymatic activities during parasite replication. Abaecin is active against gram-negative and gram-positive bacteria. Although it is weaker, it can assist apidaecin by affecting bacteria that have apidaecin resistance (Casteels et al., 1990). Hymenoptaecin also acts complementary to apidaecin and prevents fungi, gram-negative and gram-positive bacteria by restricting their development (Casteels et al., 1993). In later stages of infections, defensin peptide functions by specifically targeting and lysing gram positive bacteria directly.

In this study we addressed the immune defense reactions of five honey bee subspecies upon *N. ceranae* infection. As a parameter for immune strength, the increase in the production of antimicrobial peptides (defensin, hymenoptaecin, apidaecin and abaecin) was investigated for each subspecies.

MATERIALS AND METHODS

Sampling of **W**orker **B**ees and ***N****. ceranae* **I**noculum **P**reparation and **I**nfection **E**xperiments

Samples of 10 healthy colonies of 5 subspecies were used in this study. Newly emerging bees from each colony were examined under light microscopy to see if they were *Nosema*-free. *N. ceranae* inoculum was prepared by using the midguts of 20 heavily infected live bees and the spores per microliter were counted with a Neubauer hemacytometer counting chamber under the light microscope. For *N. ceranae* infection experiments**,** one day old bees were inoculated with 5 µl of sucrose solution containing 10.000 (10K) *N .ceranae* spores per bee. Control bees consumed 5 µl of sucrose solution without *N. ceranae* spores. Workers from 10 colonies (n = 20 for each colony) were kept in plastic hoarding cages and fed with 1:1 ratio of sucrose solution. All cages were placed in an incubator at 34 ± 1 °C with 55 % humidity.

RNA **I**solation for **I**mmune **G**enes **E**xpression **A**nalyses

For immune genes expression analyses, RNAs of 12 control and 12 infected bees for each of the 5 subspecies were isolated by using TRIzol® (Invitrogen, Carlsbad, CA).

RNA was dissolved in 50 ul of RNAse-free water and stored at -80°C immediately (http://www.coloss.org/beebook). RNAs were quantified by Nanodrop ND-1000 (Thermo Fisher Scientific,Inc.Wilmington, Delaware, USA) .

cDNA **S**ynthesis and **R**eal **T**ime **q**PCR

RNA extracts were used to generate first and second-strand cDNA's using random hexamer primers and the reverse transcriptase Superscript II® (Invitrogen™), as described in vanEngelsdorp et al., (2009). Pathogen loads were estimated using real-time quantitative-PCR (qPCR) and a Bio-Rad CFX-96™ thermocycler. Complementary DNA (cDNA) was generated from 1 µg RNA template and was amplified in a separate 20 µl final reaction volume of Sso-Fast™ SYBR® Green reaction mix (Bio-Rad™). Published primers for *N.*

ceranae were used (Fries et al., 2013). Honeybee ribosomal protein S5 (RPS5) and ß-actin were used to normalize for cDNA content and to filter samples for degradation or experimental losses. Real time q-PCR data statistics were performed by using JMP™ (SAS Institute, Cary, NC, USA, v.9).

RESULTS

The RNA expression levels of five genes were determined 6 days after *Nosema ceranae* infection. The infectivity of *N. ceranae* was successful according to One-way ANOVA analysis ($p \leq .0001$) (Figure 1). *N. ceranae* mRNA expression increased significantly after infection with *N. ceranae* when compared with the controls for all of the subspecies included in the study (Figure 2).

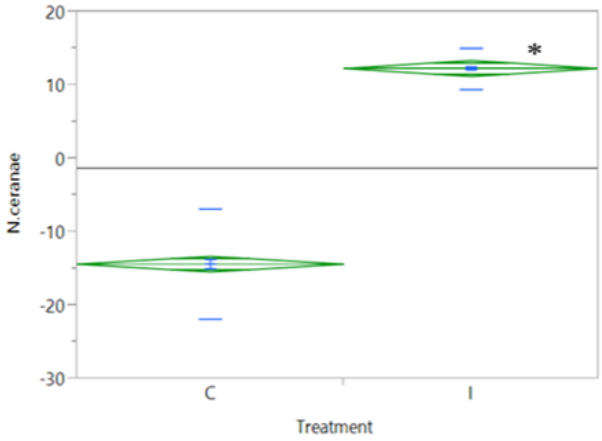

Figure 1 One way analysis of *N. ceranae* expression by treatment (C = Control, I = Infected) ('*' significant)

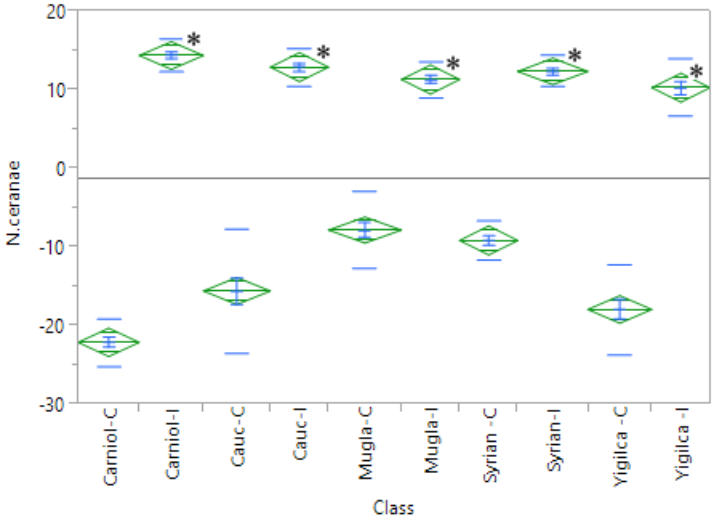

Figure 2 One way analysis of *N. ceranae* expression by class (C = Control, I = Infected) ('*' significant)

Defensin expression was upregulated significantly following *N.ceranae* exposure (ANOVA, $p < .0001$). The highest increase in mRNA levels of defensin was observed in

Caucasian race among the subspecies, (p = 0.0004). *N. ceranae* infection caused a significant increase in hymenoptaecin expression between control and treated bees of the subspecies (ANOVA, p < .0001). A significant response towards increased expression of hymenoptaecin was found for infected Yigilca (t- test, p < .0001) and Carniolan (t- test, p = 0.0013) subspecies. In the case of Apidaecin mRNA levels, significant differences were detected between *N. ceranae* infected and control bees (One –way ANOVA, p < .0001). The results were significant with a rapid increase in the apidaecin expression for infected Carniolan (p <. 0001), Caucasian (p = 0.0002) Syrian (0. 0299), Yigilca (p = 0.0104) races. Abaecin expression augmented in response to *N.ceranae* infection for each of the subspecies. Although this increase was apparent for Carniolan, Caucasian and Mugla, ANOVA analysis indicated a significant up-regulation in abaecin for only Caucasian race (t- test, p = 0.0185) (Tozkar, 2015).

DISCUSSION

Six days after inoculation with *N .ceranae*, increasing expression levels of defensin, hymenoptaecin, apidaecin and abaecin were signs of an activated humoral immune mechanism for all of the subspecies included in the study. This might be one of the ways of successfully preventing the pathogen development (Tozkar, 2015). This is supported by the data of Schwarz et al. (2013) in which honey bees showed escalating immune responses to experimental infections of *N .ceranae*.

The results were also similar to those found in honey bees having natural *N. ceranae* infections (Jefferson et al., 2013) and to artificial infections in drones (Huang et al., 2012).

Pairwise differences between infected and control bees showed higher increase in mRNA expressions in response to *N. ceranae* for Caucasian, Carniolan subspecies and Yigilca ecotype. Accordingly, escalations were observed in hymenoptaecin, abaecin, defensin and apidaecin transcripts of these subspecies. Overall, mRNA means of *N. ceranae* in both control and infected bee groups of Suriye race and Mugla ecotype were higher than the others. These subspecies also showed a trend towards an increase in the expression of antimicrobial peptides but this increase was not stronger than the other races. More susceptibility to *N. ceranae* might be the result of weaker humoral immunity of these subspecies than the other races. Especially Caucasian bees demonstrated highest immune response following the inoculation by *N. ceranae.* Varying immune responses may indicate the discrepancies in the ability of the honey bee subspecies to get rid of *N. ceranae* infection(Tozkar, 2015). In the study of Werner et al. (2000), dissimilarities among bees in their capability to perceive pathogens were also attributed to genetic variation in immune responsiveness. Variation in AMPs response intensity is based on honey bee genetic background (Decanini et al., 2007). The role of genetic diversity in decreasing the failure of the colonies against the pathogens in honey bees was underlined in many studies. Thus identification of immune responses across diverse honey bee genotypes may offer preliminary data and useful genetic information in this research area for future conservation and breeding studies of certain subspecies.

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EFFECTS OF STARCH-BASED SUGARS, CALORIE RESTRICTION, BEE PRODUCTS AND AD-LIBITUM FEEDING ON EGG QUALITY IN BROILER BREEDER HENS

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ABSTRACT

In this study, the effects of calorie restriction, bee products (royal jelly+apilarnil), starch-based sugar and *ad-libitum* feeding on egg quality of broiler breeder hens were evaluated. In addition, the effects of these practices were compared with commercial restricted feeding schedule used routinely. A total of 200 broiler breeder hens at 56 weeks of age were used for this experiment. Hens were randomly allocated to 5 groups, each with 4 replicates. Water was available *ad-libitum* during the 18 weeks experimental period. The 5 feeding treatments were as follows.

Group 1 (Control); fed on a basal diet at 160g/day/hen (commercial feed restriction) during the experimental period,

Group 2; applied commercial feed restriction after ad-libitum feeding for the first 4 weeks (ADL),

Group 3 (bee products); supplemented with royal jelly (200 mg/hen/day) and apilarnil (5 g/hen/ day) to the basal diet for the first 4 weeks and then applied commercial feed restriction (BP),

Group 4; supplemented with starch-based sugar to the basal diet for the first 4 weeks and then applied commercial feed restriction (SBS),

Group 5; applied commercial feed restriction after about 45 % calorie restriction for the first 4 weeks (CR).

The feeding treatments significantly affected internal (percentage of yolk and yolk colour) and external egg quality characteristics (egg weight, shape index and percentage of eggshell) when the values determined at 4th (at the end of the feeding treatment) and 16th weeks of the experiment were compared.

Keywords: Broiler breeder hens, bee products, calorie restriction, starch-based sugars, ad-libitum feeding, egg quality.

INTRODUCTION

Egg characteristics affect the hatchability, chick quality in breeder flocks and therefore the future performance of the flock. Hen age is one of the most important factors that affect egg quality in broiler breeder hens. Aging-induced ovarian dysfunction in broiler breeder hens results in lower egg quality. Egg weight and egg yolk weight increase, eggshell and albumen quality (Haugh Unit) decline with bird age (Silversides and Scott, 2001). Despite all the management techniques practiced, egg quality losses in broiler breeder hens increase, especially after the 40^{th} week.

Insufficient or overfeeding negatively affects egg quality, egg and chick production (Hocking et al., 1987; Robinson et al., 1991; Katanbaf et al., 1989; Chang et al., 2016). The lack or excess of some nutrients in the feed also causes poor egg quality (Wang et al., 2017). Moreover, overfeeding of broiler breeder hens accelerates ovarian follicular development and ad-libitum feeding causes the formation of multiple large yellow follicles (Yu et al., 1992). As a result, quality problems occur such as thin-unshelled egg, misshapen egg and so the hatching egg number decrease (Siegel and Dunnington, 1985; Robinson et al., 1991; Robinson et al., 1993; Hocking, 1993). Therefore, feed restriction is applied as a standard method in broiler breeder flocks and is an effective method to control obesity and ovarian follicular development with lighting programs (Summers and Robinson, 1995; Mohiti-Asli et al., 2012).

Royal jelly is a food which is secreted by the hypopharyngeal and mandibular glands of nurse bees (Fujita et al., 2013). It was suggested that there were bioactive substances in royal jelly which were prolonged the life and increased the reproductive performance of queen bee (Ramadan and Al-Ghamdi, 2012). Royal jelly has been shown to have many pharmacological activities in humans and laboratory animals. Royal jelly, which has antibacterial, anti-allergic, antitumor, antioxidant and anti-inflammatory properties, stimulates bone development and prevents osteoporosis and aging (Fujii, 1995).

Apilarnil is a natural bee product obtained from drone bee larvae. The main components of bee larvae are the amino acids. Bee larvae contains all essential amino acids, the only source being food products, as they can't be synthesized by human or animal organisms (Barnutiu et al., 2013). Seres (2014) reported that drone milk (apilarnil) was able to increase the relative organ weights of uteri in immature female rats and this result indicates that the drone milk has an estrogenic activity.

The use of starch-based sugars in the food industry (obtained from fructose conversion of starch glucose in plants) and their effects on human health are controversial. Many studies have shown that starch-based sugars cause various metabolic dysfunctions, especially obesity (Bray et al., 2004; Ünlü and Soysal, 2017; Aksoy et al., 2016).

The aim of the present study was to determine the effects of calorie restriction, bee products (apilarnil and royal jelly), starch-based sugar and ad-libitum feeding on egg quality of broiler breeder hens.

MATERIAL AND METHODS

A total of 200 Ross 308 broiler breeder hens (obtained from a commercial rearing farm) at 56 weeks of age were used for this experiment. Hens were randomly allocated to 5 groups, each with 4 replicates. Water was available *ad-libitum* during the 18 weeks experimental period. During the experimental period, the recommended management and lighting program were applied to hens. The 5 feeding treatments were as follows.

Group 1 (Control); fed on a basal diet at 160g/day/hen (commercial feed restriction) during the experimental period [2804 kcal metabolisable energy (ME)/kg, 15.72% crude protein (CP)],

Group 2 (ADL); applied commercial feed restriction after ad-libitum feeding for the first 4 weeks,

Group 3 (bee products, BP); supplemented with royal jelly (200 mg/hen/day) and apilarnil (5 g/hen/ day) to the basal diet for the first 4 weeks and applied commercial feed restriction,

Group 4 (SBS); supplemented with starch-based sugar to the basal diet for the first 4 weeks and applied commercial feed restriction (2874 kcal ME/kg, 15.16% CP),

Group 5 (CR); applied commercial feed restriction after about 45 % calorie restriction for the first 4 weeks (1551 kcal ME/kg, 15.41% CP).

Broiler breeder hens were placed in floor pens containing nest boxes and fed on the basal diet (15.72% CP and 2804 kcal/kg ME) except for a 4-week experimental period.

In that study, internal (yolk height and diameter, albumen height and diameter, yolk colour) and external (egg weight, egg length and width, shell thickness) egg quality characteristics were measured using 8 eggs from each experimental group. From the obtained data, yolk index, albumen index, Haugh unit, percentage of yolk, yolk colour, egg shape index and percentage of eggshell were calculated at 4^{th} (at the end of the feeding treatment) and 16^{th} weeks of the experiment.

Data was subjected to one-way ANOVA using General Linear Model Procedure of SAS (SAS Institute 2000). Means were compared using the Duncan's multiple range test at the 5% significance level ($p<0.05$).

RESULTS AND DISCUSSION

In this study, the effects of calorie restriction, bee products (royal jelly+apilarnil), starch-based sugar and *ad-libitum* feeding on internal egg quality were presented in Table 1.

In Control and BP groups, internal egg quality characteristics (yolk index (%), albumen index (%), Haugh unit, yolk weight (%) and yolk colour) did not differ significantly between post-treatment (4^{th} week) and end of the experiment (16^{th} week).

Albumen index and Haugh Unit are important commercial quality characteristics that provide reliable information on albumin quality and the freshness of the egg. In the TSE (Turkish Standarts, 1068) egg standards, Haugh Unit values in AA, A and B quality classes have been reported as ≥79, 55-78 and 31-54, respectively. All of the eggs produced during that study were of A quality class. As the hens' age increases, albumen quality deteriorates, thick egg white liquefies, and so albumen quality and Haugh Unit decrease (Jacob et al., 2000; Stadelman, 1986). Therefore, in that study, the low albumen index and Haugh Unit values in eggs produced from older breeder hens were compatible with the literature.

Yolk weight as a percentage of egg weight in SBS group was significantly lower at the end of the experiment ($P<0.05$). Yolk weight is related to the dietary protein levels (Gunawardana et al., 2008; Shim et al., 2013) and increases with hen age (Van den Brand et al., 2004; Johnstone and Gous, 2007). In accordance with our findings, Zita et al., (2009), reported that age of hens increased yolk proportion. However, higher yolk proportion in SBS

group at the post-treatment period could be related to stimulation of egg yolk synthesis in the liver.

Yolk colour was affected by feeding treatments between post-treatment and end of the experiment in ADL and CR groups ($P<0.05$). At the end of the experiment, yolk color score decreased from 12.28 to 11.12 in ADL group while it increased from 8.25 to 12.00 in CR group. The reduction in yolk colour score of CR group at 4^{th} week of the experiment is associated with less dietary carotenoid consumption because hens are not able to synthesize colour pigments.

The effects of feeding treatments on external egg quality were shown in Table 2. Egg weight in SBS group, egg shape index in BP group and both egg weight and egg shape index characteristics in Control group were statistically different between 4^{th} and 16^{th} week of the experiment ($P<0.05$). Van den Brand et al. (2004) and Petek et al. (2009) reported that egg shape index decreased with the age in laying hens.

In our study, the increase in egg weight due to breeder age, except ADL group, was consistent with the literature (Silversides and Scott, 2001). Egg weight in ADL group increased at 4^{th} week due to more feed consumption. However, at the end of the experiment, the expected increase in egg weight with advancing breeder age did not occur.

Feeding treatments had no significant effect on shell thickness at 4^{th} and 16^{th} weeks of the experiment ($P>0.05$). Eggshell thickness is expected to be an average of 0.32-0.33 mm for reducing the risk of breakage-cracking. The average shell thickness determined in the study were close to those values.

Shell thickness is an important eggshell quality characteristic for commercial layer and breeder operations. In addition, too thick or too thin shells cause insufficient or excessive moisture loss from the egg and so, hatchability decreases.

A significant difference was found in shell weight (%) in ADL and CR groups between 4^{th} and 16^{th} week of the experiment ($P<0.05$). In both ADL and CR groups, shell weight (%) significantly increased at the end of the experiment. The increase in ADL group is mainly related to higher dietary calcium consumption of hens. The elevation of shell weight in CR group may be associated with the reduction tendency in egg weight.

In conclusion, calorie restriction (yolk colour and shell weight), bee products (eggshape index), starch-based sugar (yolk weight and egg weight) and ad-libitum feeding (yolk colour and shell weight) affect some internal and external egg quality characteristics in broiler breeder hens. Especially the changes in egg weight and shell quality are commercially important because of affecting chick weight and hatchability.

Table 1. Effects of feeding treatments on internal egg quality characteristics in older broiler breeder hens *(P<0.05)*.

GROUP	Post-treatment (4. week)					End of experiment (16. week)					*P*				
	Yolk index (%)	Albumen index (%)	Haugh unit	Yolk weight (%)	Yolk color	Yolk index (%)	Albumen index (%)	Haugh unit	Yolk weight (%)	Yolk color	Yolk index (%)	Albumen index (%)	Haugh unit	Yolk weight (%)	Yolk color
CONTROL	44.42 ± 0.75	7.52 ± 0.61	75.56 ± 3.76	31.31 ± 0.75	12.00 ± 0.26	42.84 ± 0.62	6.34 ± 0.21	69.91 ± 1.32	31.97 ± 0.75	11.75 ± 0.25	0.1296	0.0792	0.1586	0.5469	0.5057
ADL	43.32 ± 1.06	7.59 ± 0.92	74.08 ± 5.02	30.66 ± 0.74	12.28 ± 0.28	43.31 ± 0.80	7.93 ± 0.67	76.81 ± 2.57	31.82 ± 1.10	11.12 ± 0.35	0.9970	0.7902	0.6781	0.4000	0.0256
BP	43.72 ± 1.07	7.56 ± 0.89	73.28 ± 3.58	32.62 ± 0.68	12.75 ± 0.16	44.48 ± 0.83	7.05 ± 0.80	70.65 ± 4.15	30.91 ± 0.88	11.87 ± 0.39	0.5875	0.6808	0.6476	0.1479	0.0615
SBS	43.07 ± 1.06	6.96 ± 0.69	73.49 ± 4.05	31.85 ± 0.38	10.62 ± 0.26	44.16 ± 1.34	8.39 ± 0.78	78.24 ± 3.77	28.53 ± 0.87	10.87 ± 0.29	0.5436	0.1978	0.4147	0.0091	0.5373

CR	42.02 ± 0.89	8.34 ± 0.77	79.80 ± 3.53	31.54 ± 0.72	8.25 ± 0.16	44.47 ± 0.97	7.17 ± 0.68	73.53 ± 3.14	30.35 ± 0.34	12.00 ± 0.18	0.0867	0.2867	0.2178	0.1618	<.0001

Table 2. Effects of feeding treatments on external egg quality characteristics in older broiler breeder hens *(P<0.05)*.

GRUP	Post-treatment (4. week)				End of experiment (16. week)				*P*			
	Egg Weight (g)	Eggshape index (%)	Shell thickness (mm)	Shell weight (%)	Egg Weight (g)	Eggshape index (%)	Shell thickness (mm)	Shell weight (%)	Egg Weight (g)	Eggshape index (%)	Shell thickness (mm)	Shell weight (%)
CONTROL	67.57 ± 1.28	77.95 ± 0.92	0.32 ± 0.00	8.68 ± 0.16	75.54 ± 1.50	74.77 ± 1.08	0.33 ± 0.00	8.43 ± 0.22	0.0012	0.0430	0.8649	0.4071
ADL	72.95 ± 2.52	76.19 ± 1.02	0.34 ± 0.00	7.89 ± 0.34	71.71 ± 1.73	73.85 ± 1.63	0.33 ± 0.01	8.89 ± 0.21	0.6859	0.2618	0.6448	0.0258
BP	71.76	78.07	0.32	8.55	75.73	72.20	0.32	8.61	0.1619	0.0013	0.8534	0.8596

	± 1.74	± 1.01	± 0.01	± 0.13	± 2.04	± 1.06	± 0.00	± 0.30				
SBS	68.10 ± 1.05	77.65 ± 1.26	0,32 ± 0.01	9.14 ± 0.36	75.43 ± 2.64	74.92 ± 0.93	0.33 ± 0.01	8.92 ± 0.25	0.0222	0.1050	0.7147	0.6392
CR	69.80 ± 0.83	77.12 ± 1.00	0.33 ± 0.01	8.21 ± 0.23	71.98 ± 2.24	75.61 ± 1.15	0.33 ± 0.01	9.19 ± 0.32	0.3774	0.3388	0.8072	0.0295

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THE EFFECT OF DIFFERENT LIGHT COLORS ON GERMINATION AND SEEDLINGS PERFORMANCE OF ONION SEEDS *(ALLIUM CEPA L.)*

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ABSTRACT

This study was conducted to determine the effect of different colors of light (blue, green, yellow, red, white and dark) on the germination and seedling performance of onion (*Allium cepa L.*) to break the dormancy with (+4°C, 4 days) or without pre-treatment by ISTA rules. Some parameters were measured in the study such as germination rate, mean germination time, homogeneity coefficient, length of radicle and cotyledon. It was determined that, pre-treatments were not significant effect on onion seed germination properties, but it had significant effect on seedlings development for onion. On the other hand, onion seeds germinated under dark condition had the most successful results in terms of germination rate (97.5%) and time (2.68 days), and length of radicle (35.33 cm) and cotyledon (59.25 cm). However, the seedlings were etiolated. It has been observed that onion seeds should be germinated under different light colors. Mainly in red light gave the best results in point of radicle length (23.15 cm) and cotyledon length (24.73 cm) in order to obtain vigorous seedlings.

Keywords: Germination, Light color, Phytochrome, Photodormancy

INTRODUCTION

Germination is expressed as the process by which the radicle breaks out the testa and create the new plant that is looks like main plant. (Bewley and Black, 1994, Kigel and Galili, 1995). During this process the seed needs; sufficient amounts of water for enzymatic activity, oxygen to increase metabolic energy and appropriate temperature. In some species, light is also a necessary environmental factor for germination. After germination growth and development of plants are depends on the intensity and energy of light (400-700 nm). Different colors are used in visible light to control seed germination and plant grow. Different wavelengths of light are used to trigger or block seed germination, plant growth and seedling development.

Water, oxygen and temperature factors are seen as essential requirements for seed germination, whereas in some plant species light is also necessary for germination. Studies on hundreds of plant species show that the effects of dark, light and different light colors on germination are effective on germination of almost half of these species (Copeland et al., 2001). In addition, plants require light as a growth trigger not only for photosynthesis, but also for the transformed the plants from the etiolated to normal plants (Taiz and Zeiger, 2002). Responses to light signals in plants are provided by pigments called photoreceptors (Taiz and Zeiger, 2002).

Red and infrared systems (phytochromes) and blue light systems (cytochromes and phytotropins) are photoreceptors that increase photomorphogenic responses. Phytochrome is a blue protein pigment that absorbs red and far red lights too much. It also absorbs blue light and plays a key role in vegetative and generative developments of plants. Blue light signals

are used to detect the amount of light and direction. The blue light signals help plants to change their growth, development and function.

Many researchers (Baskin and Baskin, 1989; Gutterman, 2000; Fener, 1991) stated that the breakthrough of dormancy involves significant influences of temperature, water intake (absorption) and light quality and density.

In this study, it is aimed to determine the effect of different colors of light (blue, green, yellow, red, white and dark) on the germination and seedling development of onion (*Allium cepa L.*) to break the dormancy with or without pre-treatment (+4°C, 4 days) by ISTA (International Seed Testing Association, 2009) rules.

MATERIALS AND METHODS

This study was conducted at the laboratory of Field Crops Dept., Faculty of Agriculture Ege University under control condition in 2014. The following colors of lights (Table 1) are tested on onion seeds germination.

Table 1: Wavelength and lux values of color of light tested.

Color of light	Wavelength (nm)	Intensity (lux)
Blue	470	1100
Green	530	7660
Yellow	590	4180
Red	627	3950
White	-	12260
Dark	-	-

Treatments were designed in factorial of two factors; first factor was with or without pre-treatment and another factor was the light colors (blue, green, yellow, red, white and dark). The seeds are germinated with or without pre-treatment in petri (120x20mm) under five light colors without photoperiod. The all applications have 4 replication and the all replications have 50 seeds as in ISTA rules. The samples put in to opaque plastic rectangular box (45×30×25 cm). Upper side of the boxes, a led group was fixed on an aluminum plate, which the same size with the cover. The led groups were connected to network electricity by a step down power supply unit (230V 50Hz to 12V DC). The pre-treatment was keeping the onion seeds in +4ºC for 4 days. Onion seeds with and without pre-treatment were taken to the germination test at 20°C for 12 days and data were recorded daily. Seeds were considered as germinated when the emergent radicle reached 2 mm in length (ISTA, 1996). Parameters of germination power (%), average germination time (day), homogeneity coefficient, cotyledon and radicle lengths (mm) were investigated. All data were statistically analyzed using analysis

of variance (ANOVA) with the Statistical Analysis System (SAS, 1990). If ANOVA indicated differences between treatment means, a LSD test was performed to separate them.

RESULTS AND DISCUSSION

Germination parameters and values obtained from the study are given in Table 2.

Table 2. The effect of the different light color and pre-treatments on germination rate (%), average germination time (day) and homogeneity coefficient of onion seeds

	Germination Rate (%)			**Average Germination Time (Day)**			**Homogeneity Coefficient**		
	Pre-treatment			Pre-treatment			Pre-treatment		
Light Colors	**(-)**	**(+)**	**Average**	**(-)**	**(+)**	**Average**	**(-)**	**(+)**	**Average**
Dark	97.5	94.5	96.0	2.70	2.68	2.69	1.45	1.65	1.55
White	91.5	94.5	93.0	3.70	4.63	4.17	3.13	1.15	2.14
Red	87.5	94.0	90.8	3.56	4.60	4.08	1.93	0.64	1.29
Yellow	93.0	95.0	94.0	3.61	4.17	3.89	6.39	1.16	3.78
Green	90.0	95.5	92.8	3.73	4.74	4.24	2.30	3.01	2.65
Blue	94.0	95.5	94.8	3.76	3.66	3.71	2.04	1.61	1.82
Average	92.3	94.8	93.5	3.51	4.08	3.80	2.87	1.54	2.21
LSD (%1)	**treatment:** NS **Light:** NS **İnteraction:** NS			**treatment::**0.293 **Light:**0.384 **İnteraction:** 0.543			**treatment::**0.285 **Light:**0.385 **İnteraction:**0.544		

The data show that there is statistically none significant effect on onion seeds about light colors, pre-treatment and the interaction of them (Table 2). When the results obtained from our study are evaluated in general, it is seen that pre-treatment and light colors are not important effects on germination rate of onion seeds. However, the highest value (97.5%) was obtained in seeds that were germinated under dark and without pre-treatment conditions. On the other hand, the lowest value (87.5%) was recorded in seeds, which were germinated under red light and without pre-treatment condition.

In our study; light colors, pre-treatment and their interaction have statistically significant effect on average germination time (Table 2). The lowest germination time was obtained from with pre-treatment and germinated in the dark condition (2.68 days) followed

by onion seeds that without pre-treatment and germination in the dark (2.70 days). The datas are utilize generally, the onion seeds, which are with pre-treatment, have longer germination time than the seeds without pre-treatment. On the other hand, we observe that the seeds that germinated in dark give much better results than the other seeds that are germinated under different light colors. As a matter of fact, Abu-Rayyan et al. (2012) reported that onion (*Allium cepa*) seeds that are germinated at 25 ° C and in dark conditions are gave the highest germination power and early germination time. Furthermore, Gutterman et al., (1993), working with different species of *Allium*, have determined that according to light condition *A. tunculum* seeds germinate at higher rates also it has early germination time than the other species under constant temperature and dark conditions. Moreover, the researchers also sight that, onion seeds germinated under different light colors have had more unsuccessful results than seeds germinated in the dark. This is explained by the fact that continuous exposure to light is a negative effect on onion seeds germination. Hence, this result similar with Lovato and Amaducci (1965) studies result that is continuous light inhibited germination to onion and leek seeds.

As it known, coefficient of homogeneity is a kind of correlation between germination time and quantity. It is explain that the maximum germination in minimum time and the results should be numerically high values (Duman et. al., 2007). Direction of this information, for our study the treatment that is germination without pre-treatment and in dark condition should gave the best coefficient of homogeneity. In state of this result, we have best coefficient of homogeneity from without pre-treatment and germination of under blue light conditions. This result could be explain like this; germination under dark condition in our study the germination get the highest results (59%) (increasing rate) in the 2nd day and the day after that (3rd days + 28 %, 4rd days + 6.5%, 5th days + 0.5%, 6th days + 1.5%, 9th days + 2%) germination results were descending ascension, so the coefficient of homogeneity was decrease. On the other hand, the results of germination time and coefficient of homogeneity are utilized together we obtain that the results of without pre-treatments gave the better results for all light color except yellow light.

The onion seeds germinated under different pre-treatments and light colors condition, after germination the radicle and the cotyledon length were measured and the results given in Table 3. Pre-treatments, different light colors and the interaction of these parameters are founded statistically significant.

According to the obtained results, it is seen that the longest radicle length (39.20 mm) was obtained from pre-treated and germinated in the dark condition, while the shortest lengths were obtained from (10.20 mm) without pre-treatment and germinated under white light.

The cotyledon length results given in Table 3 and the statistical analysis show that pre-treatment and the light colors are statistically significant but interaction of them are non-significant. The highest cotyledon length (59.25 mm) obtain from germination in dark and the lowest (18.25 mm) was obtain from the germinated in white light condition. On the other hand, the average of cotyledon length of the germinated onion seeds with pre-treatment (34.10 mm) was higher than the germinated seeds without pre-treatment (22.48 mm).

Table 3. The effect of the different light color and pre-treatments on radicle and cotyledon length of onion seeds (mm)

	Radicle Length (mm)			Cotyledon Length (mm)		
	Pre-treatment			Pre-treatment		
Light Colors	**(-)**	**(+)**	**Average**	**(-)**	**(+)**	**Average**
Dark	31.45	39.20	35.33	54.55	63.95	59.25
White	10.20	12.50	11.35	13.70	22.80	18.25
Red	17.60	28.70	23.15	17.75	31.70	24.73
Yellow	13.80	13.75	13.78	15.30	25.85	20.58
Green	22.25	34.80	28.53	20.20	33.10	26.65
Blue	19.40	31.15	25.28	13.35	27.20	20.28
Average	19.12	26.68	22.90	22.48	34.10	28.29
LSD (%1)	**Treatment**:1.145 **Light**:3.531 **Interaction:** 4.993			**Treatment:** 2.537 **Light:** 3.349 **Interaction:** NS		

In our study, pre-treatment have significant effect on the radicle and the cotyledon elongations. Especially dark, red, yellow and the green lights are promote the radicle occurrences on onion seeds. The highest cotyledon and the radicle length obtained from the germination under dark and with pre-treatment conditions. On the other hand, the lowest one is the germination under white light condition. In addition, we observed that, germination under white and the blue lights gave dark green cotyledons but under dark conditions gave yellowish green cotyledons. This is the meaning of dark condition cause the etiolated plants. Taiz and Zeiger (2002) report's was verify the our results for onion seedlings and plants which is the plants are use lights not just for photosynthesis they are use it also transformed the plants from the etiolated plants to normal plants.

CONCLUSION

The results of our study showed that onion seeds germinated in dark condition gave more successful results (germination rate and germination time) than the under other light colors conditions. Pre-treatment is not an important factor on the germination rate but we obtain that it is important for germination time and the homogeneity coefficient. In terms of healthy seedling development, it was determined that the seeds which were kept at + 4 ° C for 4 days gave more successful results under white, red and blue lights, whereas under dark condition caused the etiolated seedlings.

It is suggested that the effectiveness of red and blue light systems should be studying detail (measurement of enzyme, hormone, etc.) by spectrophotometric analysis in seeds exposed to different photoperiods to improve the knowledge about effects of lights on onion seeds germination. By determining the effectiveness of light on seeds germination and seedling development, we can obtain vigorous and high quality seedlings (plants) and better quality production will be achieved in a shorter time.

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EFFECT OF WHEY PROTEIN CONCENTRATE ADDITION ON SOME PROPERTIES OF FERMENTED MILK

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ABSTRACT

Milk whey is an important source of lactose, calcium, whey proteins and soluble vitamins, that cause to be considered it as a functional component. Different ingredients, such as skimmed milk powder (SMP), inulin and caseinates, are widely used to fortify fermented milks in order to increase the solid content of milk base and also improve the product quality. However; whey protein concentrates are a result of new technologies for milk and whey fraction recovery which produce various dairy ingredients having different amount and type of protein. Whey protein concentrate (WPC) can be used alone or mixed with SMP or other ingredients. Whey protein concentrate has higher biological value than SMP and also it stimulates the growth of several bacteria which result to a reduced fermentation time. Reducing fermentation time can be probably attributed to the increased availability of nutrients deriving from WPC that influences the growth of starter culture bacteria. The composition of dry matter in fermented milks is more important than the level of dry matter in terms of rheological properties. Improved rheological characteristics of fermented milk fortified with WPC can be explained by the interaction of positive active groups of proteins and water, which increases the viscosity of product. The viscosity can increase with a higher ratio of WPC. Such fortified products have greater amounts of protein globules that bind water molecules. In addition, denaturated whey proteins result higher consistency index values. The interaction between whey proteins has been also said to affect the formation of acid milk gels, so that improve their rheological parameters. The timing of addition of such ingredients may have importance. It has been also reported that the addition of WPC to fermented milk prior or after heat treatment may influence the rheological attributes.

Keywords: Whey protein concentrate, fermented milk, rheological properties

INTRODUCTION

Whey is residue that remains after recovery of the curd from the clotting of milk with proteolytic enzymes or acid. Whey shares about 85-95% of milk volume and contains 55% of milk nutrients like lactose, calcium, milk proteins and vitamins (Sady, Domagala, Najgebauer-Lejko and Grega, 2009, 764). Whey proteins are globular proteins that consist of lactose, a variety of proteins, minerals, vitamins and fat. Predominant proteins of whey are β-lactoglobulin and □-lactalbumin. Whey proteins are different from casein in terms of gelation, solubility, water binding, emulsification and foaming (Li, He, Meng, Chen and Wang, 2016, 453). The type and composition of whey depend highly upon the processing techniques. Sweet whey and acid whey can show different compositional characteristics. Coagulation of casein by rennet occurs approximately at around pH 6.5 thus, whey produced during the enzymatic treatment is called sweet whey. Acid whey, which has pH value of less than 5, is generated when coagulation is achieved by the addition of organic acids. Compositional characteristics of sweet and acid whey are given in Table 1 (Yadav, Yan, Pilli, Kumar, Tyagi and Surampalli, 2015, 758).

Table 1. Compositional characteristics of sweet whey and acid whey (Yadav, Yan, Pilli, Kumar, Tyagi and Surampalli, 2015)

Constituents	Sweet whey (g/L)	Acid whey (g/L)
Total solids	63.0-70.0	63.0-70.0
Lactose	46.0-52.0	44.0-46.0
Protein	6.0-10.0	6.0-8.0
Fat	5.0	0.4
Lactate	2.0	6.4
Ash	5.0	8.0
Calcium	0.4-0.6	1.2-1.6
Phosphate	1.0-3.0	2.0-4.5
Chloride	1.1	1.1

The presence of milk nutrients makes cheese whey important in order to obtain nutritive products. Whey protein concentrate (WPC) is a by product obtained by elimination of lactose. Lactose and some by products, such as whey protein concentrate, that are obtained by lactose elimination comprise 15% of these food items. Processing of whey is carried out by both physicochemical and biotechnological treatments to transform whey to value added products. Some physicochemical processes such as precipitation with the help of coagulants/flocculants, thermal/isoelectric precipitation and membrane separation are mainly used to obtain whey powder and whey protein concentrates (Prazeres, Carvalho and Rivas, 2012, 65).

EFFECT of USING WPC on PROPERTIES OF FERMENTED MILK

Whey proteins have been recognized for their various functional and nutritional properties. The functional properties are mainly due to their chemical, physical and structural characteristics whereas the nutritional value is directly linked to the concentration of essential amino acids and branched-chain amino acids. WPC is frequently used in dairy technology to enhance cheese yield or as a stabilizer in the manufacture of dairy products (Yadav, Yan, Pilli, Kumar, Tyagi and Surampalli, 2015, 768).

Effect on Rheological and Sensory Properties

In recent years, WPC is used in fermented drinks especially for improving rheological properties. The texture of fermented milk is an important criterion for the quality evaluation as it plays an important role in consumers' acceptance of these products (Herrero and Requena, 2006, 87). Consumers' acceptance of these products, apart from their nutritional and functional properties, depends on their appealing organoleptic characteristics, which are mostly affected by their rheological properties.

The major factors that affect rheological properties of fermented dairy products are kind of starter culture, the chemical composition of milk, fermentation conditions and heat treatment of milk (Dimitreli, Gregoriou, Kalantzidis and Antoniou, 2013, 419). For example goat milk is not suitable for fermented beverages or kefir manufacture, so more amount of milk powder, WPC or inulin should be used for a desired consistency (Sarkar, 2008, 283). Fortifying with different ingredients is a good alternative for improved rheological characteristics. WPC can be used separately or blended with skimmed milk powder (SMP) or other ingredients (inulin, caseinate etc.). In a previous study, it has been shown that, in comparison to control sample, all kinds of fortified fermented milks were characterized by significantly higher level of viscosity, but the product with blend SMP/WPC showed the best results in terms of some rheological parameters (Sady, Domagala, Najgebauer-Lejko and Grega, 2009, 769).

The use of different supplements in dairy products can improve the sensory properties by decreasing syneresis and so having a higher consistency. This is caused by the interactions of hydrophilic parts which are named positive active groups of proteins and water. Composition of the supplementation material is more important than its amount. The samples prepared with WPC had greater amounts of protein particles that binding water and increasing the viscosity of the product (Tratnik, Bozanic, Herceg and Drgalic, 2006, 43). In a study, it has been explained that the increase in the firmness of the yoghurt gel by addition of WPC to the goat milk can be explained by the protein aggregates which are formed by the interaction between casein micelles and whey proteins (Herrero and Requena, 2006, 90).

The viscosity can increase with a higher ratio of WPC in fermented dairy products. However, the state of the added whey proteins can also affect the rheological properties. Heat denaturation of WPC at acidic pH causes 10-fold increase in apparent viscosity compared with unheated WPC with approximate protein concentration. Denaturated whey proteins associated with the micelles after heat treatment can act as a bridging material because of the interactions with other denaturated whey proteins (Lucey, Munro and Singh, 1999, 275). In Table 1, it has been shown that an increase in the denaturated whey protein concentration caused an increase in the consistency index values thus in the apparent viscosity (Dimitreli, Gregoriou, Kalantzidis and Antoniou, 2013, 421). In Figure 1, micrographs of acid milk gels from unheated and heated milk have been shown. In the study of Lucey, Munro and Singh, 1999, 278, the effect of heat treatment of milk with WPC on microstructure of acid milk gels have been investigated. Denaturation of whey proteins present in milk and added WPC can cause an increase in viscosity.

Table 2. Mean values of the consistency index and flow behavior index of kefir samples manufactured with and without addition of WPC (Dimitreli, Gregoriou, Kalantzidis, and Antoniou, 2013)

Kefir samples	Consistency index	Flow behavior index
Without WPC addition	0.274	0.980
Addition of 1% WPC prior heating	2.120	0.737
Addition of 1% WPC after heating	0.503	0.858
Addition of 3% WPC prior heating	3.925	0.659
Addition of 3% WPC after heating	0.528	0.851
Addition of 5% WPC prior heating	12.500	0.531
Addition of 5% WPC after heating	0.703	0.844

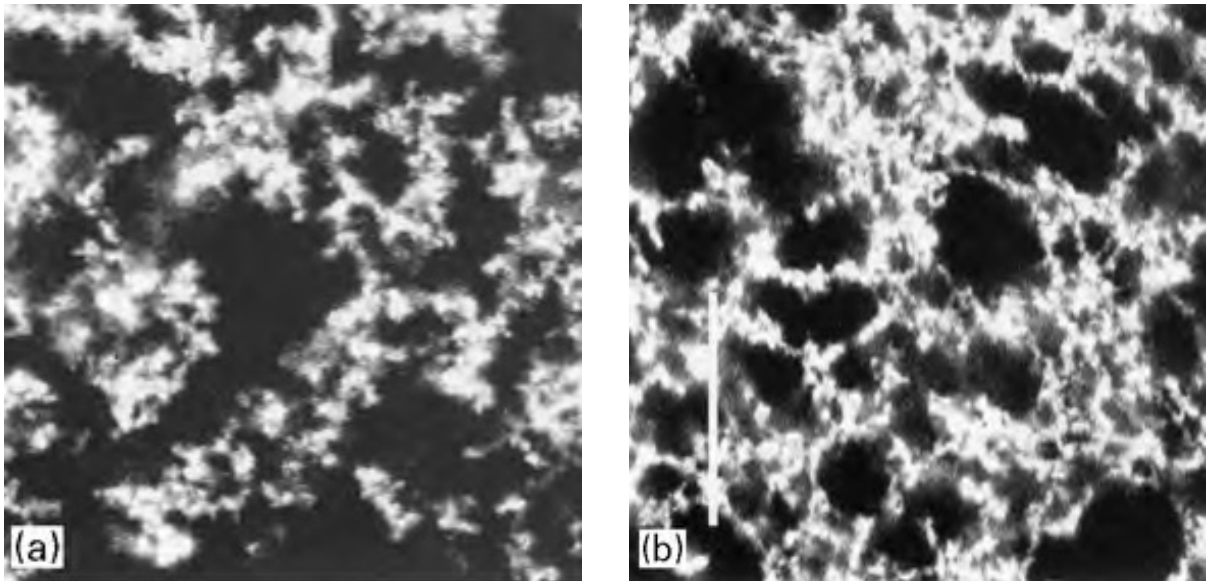

Figure 1. Micrographs of acid milk gels from unheated (a) and heated milk (b) added WPC (Lucey, Munro and Singh, 1999, 278)

Effect on Starter Bacteria Viability

Whey protein concentrate has been shown that it has stimulated the growth of starter bacteria and so reduced the fermentation time of fermented milks in various studies (Antunes, Cazetto and Bolini, 2005, 172; Dimitreli, Gregoriou, Kalantzidis and Antoniou, 2013; Zhang, McCarthy, Wang, , Liu and Guo, 2015, 793). In these studies authors observed an opposite trend between the fermentation time and the ratio of WPC. WPC has higher biological value than SMP, so it can also improve nutritive quality of the product (Janer, Pelaez and Requena, 2004, 263; Tratnik, Bozanic, Herceg and Drgalic, 2006, 40). Janer, Pelaez and Requena, (2004) (265), showed that the addition of WPC to the milk produced the highest increase in *Bifidobacterium* growth. Moreover, Antunes, Cazetto and Bolini (2005, 172), reported that WPC addition improved the growth and survival of *L. acidophilus* and *B. longum.*

A higher ratio of □-lactoalbumin and □-lactoglobulin, rich source of growth factors like peptides, amino acids presence especially after heat treatment, lower redox potential are favourable factors that improve the probiotic viability when WPC is added to the milk and heat treatment was applied. In addition, WPC can improve the culture viability due to its protein and phosphate contents that enhance buffering capacity. In such studies, WPC has been shown as a cheap and readily available additive that show enhancing effect to the activity of lactic acid bacteria. Another reason for the positive effects of WPC to the starter bacteria viability is its caseinomacropeptide contain. Caseinomacropeptide is a hydrophilic glycopeptide which contains not only available nitrogen for bacterial growth, but also amino-sugars such as sialic acid that could be fermented by bifidobacteria (Janer, Pelaez and Requena, 2004, 264; Li, He, Meng, Chen and Wang, 2016, 453).

CONCLUSION

Fermented milks fortified with WPC are generally characterized by improved rheological parameters. Improved sensory properties and viscosity property achieve consumer acceptance Related studies demonstrated that WPC can show better quality parameters when used with another ingredient especially SMP. The influence of the state of added whey protein on rheological properties of fermented dairy products has been also well studied. The researchers reported that the addition of WPC before heat treatment of milk showed better rheological properties. Whey protein concentrate also enhances the nutritional properties of the product, stimulates starter bacteria viability and so reduces fermentation time.

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EVALUATION OF TECHNICAL AND FUNCTIONAL FEATURES OF BEE HIVES USED FOR BEEKEEPING CONDITIONS IN TERMS OF BEE HEALTH AND WELFARE

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ABSTRACT

Turkey has 16.7% of the world bee hive with 7,486,000 hives and has a share of only 5.7% of world honey production with 107,665 tons honey produced. Beekeeping activities in our country are carried out under different climatic conditions as migratory and stationary.

The types of hives depend on the climate and production of honey. It is increasingly becoming widespread styrofoam hives that provides heat insulation instead of wood. Being able to make beekeeping activities in the best way requires that the bee hives first have the desired technical and functional characteristics. These information leads to provide the necessary conditions for the comfort of life. The technical and functional properties of wooden, plastic bottom board, foamed and plastic materials manufactured from different materials are required to be determined. Thus, it is necessary to provide basic data for the development of bee hives with optimum properties which will provide effects on bee health and welfare and consequently the comfort conditions of bees.

In this study, technical and functional aspects of bee hives used in migratory beekeeping conditions will be discussed in terms of bee health and bee welfare purpose of its effects on honey production.

Keywords: *Honey bee, migratory beekeeping, productivity, hive material, bee welfare*

INTRODUCTION

Honey is very important ingredient in traditional gastronomy in different parts of the world. It is widely utilized as an ethnic food item. On the other hand honey bee colonies have vital importance for agriculture and environment, ensuring plant reproduction by pollination, while beekeeping participates in the developing of rural areas.

As the world's second most important honey producer after China, the European Union (EU) offers a variety of apiculture products not just honey, but also pollen, propolis, royal jelly and beeswax. In EU honey production 240,000 tonnes in 2014 and 268,000 tone in 2015. Romania, Spain, Hungary, Germany, Italy, Greece, France and Poland are EU members with the largest honey production. The total number of beehives in EU is around 17 million (Anonymous, 2018a).

According to the Beekeepers' Association of Turkey, there are 57,000 registered beekeepers and 6.6 million registered hives in Turkey. 20% of the world's 25 bee sub-species can be found in Turkey. Due to this diversity, bee farmers are encouraged to breed bee species

native to their region instead of commercial bees (Duyum and Friedman, 2015). Turkey honey yield per hive is about 15-16 kg/year (Turkish Ministry of Food, Agriculture and Livestock, 2015). In 2020, according to the research, honey yield will rise up the 115,000 tonnes (Semerci, 2017).

In 2020, according to the research, honey yield will rise up the 115,000 tonnes (Semerci, 2017). In Turkey 107,665 tonnes of honey produced, this amount is equivalent to 5.7% of the world production of honey. Honey production per hive is well below the world average of 22 kg with 14.3 kg. This value is very low for our country which has 5% of world bee existence and provides 3-4% of produced honey (Anonymous, 2018b).

The development of beekeeping in the world began with the discovery of the hives in 1851, and the everyday use of it became increasingly widespread, with different hive types being produced. Old type hives manufactured in different ways from different materials in Turkey have different measurements together with few, bottom hatches, hatcheries, honeypot, cover boards, lids and frames are more common. Different processes are applied for a large numbers of products such as honey, pollen, propolis, royaljelly and bee poison obtained from beekeeping activities. All the mentioned processes require different mechanization applications due to reasons such as feasibility, labour utilization efficiency, economic efficiency and hygiene. Beekeeping activities in our country are carried out under different climatic conditions as migratory and stationary. It is desirable that the beehives used under these conditions meet the expected properties. Being able to make beekeeping activities in the best way requires that bee hives first have the desired technical and functional characteristics. Beehives are manufactured in different sizes and features using different materials. The increase in honey production per bee hive is primarily possible with the provision of comfort conditions during the life of the bee hives. In the last years, bee hives with different qualities are widely used in Aegean Region. It is necessary to determine the suitability of beehives for beekeeping activities and to determine the characteristics of beehives in order to be able to evaluate their superior and weaknesses in the best way. There are many types of beehive type in the world. Hive types vary depending on the beekeeping and climate. The most suitable material for making hives is timber of coniferous trees such as pine, fir and spruce. In addition, timber (plastic or styrofoam Langstroth type) is becoming increasingly common instead of wood. Hives are superior in terms of yield, ease of operation, adequate ventilation and control of demand when compared to primitive hives (Anonymous, 2016a; Anonymous, 2016b, Anonymous, 2016c).

The hive is the shelter of the bee colony and is one of the most important beekeeping equipment. To be able to apply the latest techniques known in beekeeping and to be successful, genotypes and region conditions of bees should be taken into consideration (Dulger et al., 2003). Dulger et al. (2003) examined some physiological and behavioural characteristics of the colonies depending on the type of hive and the feeding pattern. The most colony loss occurred in the styrofoam hives during wintering, while the least colony loss occurred in the wooden hives. The best results in terms of the survival period of the wintering period were taken in wooden beehives; in terms of colony losses in the production period, wood and styrofoam hive groups were found close to each other.

Morse and Hooper (1985) reported that in different climatic regions in the world, there have been different applications for wintering. They emphasized that the wintering was carried out in closed room conditions or under the porch where the altitude was high and the climate was harder in winter.

Karaca et al. (2000), in their study, wood or foam of the hive material, hive temperature and humidity have significant effects on the hive. In hives made of foam, they

stated that the temperature of the hive is lower or equal in summer than in hives made of wood and higher in winter months.

Kobayaski (1987) conducted a study in Japan that used some chemical substances (including styrofoam) in hive isolation. They reported that these isolates were not usable due to lack of moisture-absorbing properties and the best result was taken from straw isolation. They stated that the straw is a good isolating agent that protects the hives from sudden temperature changes due to the high moisture content of the straw.

Bobrzecki and Gromisz (1984) have stated that single-walled standard hives with body thickness of 25 mm had less moisture content than double-walled and styrofoam hives.

Saville et al. (1999) investigated about different beehives to determine the temperature characteristics and performances of bee colonies. As a result of this study; the hives in Jumla and Gadavori regions showed no significant difference between empty hives but there was a significant difference between full hives. Outside temperature for the hives which were made of straw had significant effect; it has been reported that cold air had a significant effect on Jumla hives and there was a significant difference between Newton and Barreled hives.

Burgut (2006) had a study in order to prevent colony losses occurring during wintering and transport of bee colonies to investigate the type of hive which may be more beneficial to beekeeping. It has been reported that bee colonies should have in-hive moisture level during wintering and transportation and bee colonies should have properties to balance the temperature of the hive during wintering and transportation.

The increase in honey production per bee hive is primarily possible with comfort of conditions during the life of the bee hives. At present, bee hives with different qualities are widely used in Aegean Region. It is necessary to determine the suitability of bee hives for beekeeping activities and to determine the characteristics of bee hives so that their superiority and weakness can be evaluated in the best way. Having the desired characteristics of the bee hives will facilitate the activities of the bees and will make an important contribution to increasing the honey production per hive by affecting the colony population positively. In this study, technical and functional aspects of bee hives used in migratory beekeeping conditions were discussed in terms of bee health and bee welfare purpose of its effects on honey production.

MATERIAL and METHOD

The Langstroth (wood), plastic-wood, plastic and Styrofoam (Polystyrene) materials are going to use in this research. For this reason 4 types of hives were manufactured in the local companies in Izmir. Each hive has some disadvantages and advantages in such cases.

Langstroth hives: This is the most popular beehive in the world. This type of hive is that the bees build honeycomb into frames, which can be moved easily. But they are heavy for transporting (Figure 1).

Figure 1. Langstroth hive

Wood-plastic composite hive: It is combination of plastic and wood materials. This type of hives have plastic bottom with wooden frame (Figure 2).

Figure 2. Wood-plastic composite hive

Plastic hive: These types of hives have twin walled hive body protects the bees from all weather conditions. They have to be Bisphenol A (BPA) free to achieve food safety, built in Ultraviolet (UV) resistance and can be easily washed with soapy water. They may have different ranges of colour and they are easy to assemble. It is very vital that they does not suffer from mould contamination and cannot be damages by moths and beetles (Figure 3).

Figure 3. Plastic hive

Styrofoam (Polystyrene) hive: It is made of Styrofoam with light weight. Main disadvantage of this hive is they cause too much humidly in the hive. Styrofoam is not a renewable resource. It is a petroleum-based product. For this reason it is not environmentally friendly product (Figure 4).

Figure 4. Styrofoam hive

Hives containing temperature and humidity sensors will be placed on the top and bottom of each hive. The data obtained by the sensors in these cover were collected via the central unit in which they were communicating and the data was obtained through the internet. In addition, a box containing a position, light intensity, temperature, humidity and air quality sensors will be used. The dimensions of the cover for the sensors are 100x40x30 mm (Figure 5). This protector is covered with a special net. By the help of the net, bees cannot

coat it with their beeswax. And it is easy to clean the cover. Some of the sensors such as position, light intensity, temperature and humidity will be located outside the hives. The sensors have the capability to measure the data in every 1.5 minutes. The data can be transferred up to 15 km distance. With the help of wireless technology the data will be transferred to the main computer. In addition, in the laboratory the measurement systems will be installed in the hive and the operation of the measuring system will be tested on the empty hive. During the field studies, bee hives with measurement system established in the previous work packages will be used to ensure that the measurement of technical values will be made during the season and recorded with the help of devices.

Figure 5. Sensor cover

In addition, colony development parameters of the number of frames, hatching area, wintering ability, the status of giving and honey yield, as well as characteristics of the disease and pest will be determined. For this purpose, the same elderly, same bee ecotype, consisting of bees and similar population strength colonies will be selected by selecting the experiment groups. The effect of all parameters except the type will be eliminated. Colonies will be circulated in the course of nomadic beekeeping according to nectar flow, simultaneous varroa struggle and nutrition program will be applied. The colony development parameters will be recorded and evaluated regularly during the trial period. In addition, microbiological development in colonies will be observed due to humidity and temperature changes in sample hives. The data obtained in the study will be evaluated and the technical and functional characteristics of beehives and their effects on bee health and welfare will be revealed.

CONCLUSION

The results of the research will provide significant progress in some of the issues given below.

- It will be the basic data for both manufacturers and researchers who working on this subject.
- It will increase the production of honey per hive with the help of hives that will be manufactured by taking into consideration.
- After the pre-trials in the laboratory the hives will be transferred for the field test.
- During these travels, the system keeps recording the data.
- At the end of harvesting season researchers will compare the honey amount, animal illness and the population in the hive. These data will assume the needs of bees according to the type of the hive.
- On the second stage or in a new project a new type of hive can be produced with the help of technical and functional data which were delivered from our system.

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DETERMINATION OF LIVESTOCK FARMERS' MANURE MANAGEMENT PERSPECTIVES: THE CASE OF IZMIR-BORNOVA*

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ABSTRACT

The aim of the study is to determine the livestock farmers'manure management perspectives in the province of Izmir, Bornova district, by factor and cluster analyses. For this purpose, the data on manure management practices and manure management perspective were obtained by face-to-face surveys with 39 livestock farmers. According to the factor analysis conducted on the obtained data, three-factor groups (manure disposal possibilities □=0.854, environmental sensitivity □=0.821, modern manure management awareness □=0.863) were determined.Cluster analysis was carried out taking into consideration the factors affecting the perspectives of manure management. In consequence of cluster analysis, three groups were formed in livestock farmers' manure management perspectives.The first group, which constitutes 25.6 % of the livestock farmers, is called "environmentalists", the second group which constitutes 59% is called "manure disposal oriented" and the third group which constitutes 15.4 % is called "innovators". These results show that livestock farmers' perspectives of manure management is focused on manure disposal, environmental sensitivity is poor, and that they do not have enough knowledge about modern manure management systems.

Key words: Livestock farms, manure management perspectives , environmental sensitivity, factor analysis, cluster analysis.

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INTRODUCTION

Nowadays, the cities that have developed to large areas have turned into large residential areas that contain urban and the rural areas together and have increased the pressure on herbal and animal production areas. The livestock farming in the countryside, which passed into the status of many metropolitan municipalities like Izmir, remained under the rapidly developing urban pressure. Especially in the livestock farms which are intertwined with the settlement areas, the existing positions of the farms should be changed and manure management should be improved in order to solve the problems caused (Karaman, 2006; Ünal et al., 2018). The studies are carried out about selection of suitable sites for livestock farms using remote sensing and the geographic ınformation system in Turkey as other countries (Deri and Unal, 2017). Manure management is defined as a decision-making process that aims to combine profitable agricultural production with the loss of the least nutrients at every process from collection and evaluation of animal production. The impact and scope of manure problems began to become clear in the 1970s and especially in the 1980s. This problem remains important today, and it has been difficult to develop an effective strategy to change manure management practices. The manure processing technologies that provide energy and

organic matter are alternative pathways that are economically feasible and environmentally acceptable. However, these alternative manure-processing technologies also have some problems. The fact that these technologies are often expensive is a major problem for livestock farmers to adopt.

The manure management systems and processing technologies, whose main objective is to reduce environmental impact, can not provide for reducing pollution. As a result, there is a need for a socially acceptable manure management system that both balances the socio-economic well-being of both farm owners and the community while reducing environmental impacts. In this context, firstly it is necessary to reveal an awareness of manure management perspectives and modern practices of livestock farmers (De Vos et al., 2002; Burton and Turner, 2003; Burton, 2007; Petersen et al., 2007; Langeveld et al., 2007; Karmakar et al., 2007; Sommer et al., 2009; Melse and Timmerman, 2009; Chadwick et al., 2011; Gebrezgabher et al., 2014; Gebrezgabher et al., 2015). In this study, the perspectives of the livestock farmers in the Bornova district of Izmir is shown.

MATERIAL AND METHOD

Material

The main material of this study is 39 livestock farms selected from 15 villages in the province of Bornova located within the borders of Izmir Metropolitan Municipality. These sample livestock farms have been selected by means of purposive sampling from among the livestock farms that allow the research to be carried out, taking into consideration the size of the farms and the transportation possibilities.

Method

Data Collecting

In the study, data related to the demographics and manure management perspectives of the livestock farmers, the physical infrastructure of the farms (location, structural and dimensional characteristics of the structures and facilities related to housing and manure management) and manure management processes (collection, storage, evaluation of manure) were used. These data were obtained through surveys and measurement studies conducted in face-to-face surveys and farm centers with farmers. Laser meter and GPS were used in the measurement studies.

Data analysis

In the research area, factor and cluster analyses were used to determine the farmers' manure management perspectives. Factor analysis refers to a group of processes used for data reduction or summarization. It does this by looking for groups among the intercorrelations of a set of variables. Prior to performing factor analysis, the suitability of data should be tested by three criterias. For the suitability of the analysis, the sample size should be at least four times the number of variables. The Kaiser-Meyer-Olkin (KMO) value must be exceeding the recommended value of 0.5 that indicate the adequacy of the sampling for factor analysis. Bartlett's tests of sphericity must be significant ($p<0.001$) indicating that the correlation matrix is significantly different from identity matrix. This show a significant correlation between the variables. So, it is appropriate to conduct factor analysis. Following extraction five items were removed that not suitable and then factor analyse was conducted with eight items.

In this study the "principal components (PCA)" was used that one of the common approach of factor analysis. The minimum factor number was determined by taking maximum variance in the data according to PCA. Eigenvalues were used to determine the number of

factors. The eigenvalue represents the total variance explained by each factor. Accordingly, only factors with an eigenvalue greater than 1 are included in the model. (Sharma, 1996; Malhotra,1996; Hair et al., 1998; Jollife, 2002; Günden, 2005; Gebrezgabher et al., 2015). Finally, the reliability analysis was conducted to assess the internal consistency among the set of items on each factor groups. Alpha (□) coefficient (Cronbach's Alpha Coefficient) which is the most common method, was calculated. Cronbach's alpha coefficient ranges from 0 to 1 and is generally not less than 0.70 (Sproles and Kendall, 1986; Özdamar, 1999; Akgül ve Çevik, 2005; Pallant, 2010; Thomas et al.,2013; De Vellis, 2014).

The factor groups obtained by factor analysis were used as variables in cluster analysis. Cluster analysis, a data reduction analysis, is a method used to combine observations (response, person, opinion, thought, etc.) into groups or clusters. Agglomerative cluster analysis, which is the hierarchical method used in the study, collects observations that have the closest characteristics to each other according to pre-determined criteria or criteria in the same group. In hierarchical methods, clusters are created by minimizing the intra-cluster variance by "variance method". The most widely used variance method is "Ward's method." According to Ward's method used in this study, farmers were divided into groups that homogeneity was maximum in each clusters (Sharma, 1996; Malhotra, 1996; Hair et al., 1998; Günden, 2005; Barnes. and Toma, 2011).

The differences between farmer groups were analized by parametric and non-parametric statistical tests.The Shapiro-Wilk normality test was used to check whether the component (dimensions) variables showed normal distribution, and then one-way analysis of variance (ANOVA) test was used to compare different groups of clusters. The Kruskal Wallis test was used for variables that not showed normal distribution. Then the differences between farmer groups were determined by multiple-comparison analysis (Post-Hoc). For categorical variables, Chi-square independence test was applied (Pallant, 2010; Kelly, 2014).

RESULTS AND DISCUSSION

Grouping of Factors Affecting Livestock Farmers' Manure Management Perspectives

In this study the factors affecting livestock farmers' manure management perspectives were determined by factor analysis. Prior to performing factor analysis, the suitability of data for this analysis was tested by three criterias. The sample size in the study, the data obtained from 39 livestock farmers' responses for 8 variables were used and the sample size was at least four times the number of variables. The Kaiser-Meyer-Olkin (KMO) value was 0.652, exceeding the recommended value of 0.5 indicated the adequacy of the sampling for factor analysis. Bartlett's tests of sphericity was significant ($p<0.001$), indicating that the correlation matrix was significantly different from identity matrix. This results were indicate that the suitability of data for factor analysis.Table 1 presents the results of the final solution generated by factor analysis. The factors affecting livestock farmers' manure management perspectives were grouped under three groups that explained was 81.549 % of the total variance. Finally, reliability analysis was conducted to assess the internal consistency among the set of items on each factor groups.

The first factor group was named "manure disposal possibilities" (□=0.854). This factor group has the highest effect (37.468 %) in determining the livestock farmers' manure management perspectives. According to the options of income from manure, farmers sells manures either on demand or in full. According to the options of manure disposal, all or part of the manure is provided in the own farm land. In the farms benefiting from the pasture, the manure of the animals grazing throughout the day stays in the pasture environment. So, they do not need any type of manure management system or manure disposal options.

The second group of factors is called "environmental sensitivity" (□=0.821). The effect of this group on determining manure management perspective (26.039 %) is less than the first group. The items such "If the manure in the farm is not controlled, the that will constitute a risk in terms of human health, water resources and animal health" are included in this group.

The third group of factor groups was named "modern manure management awareness" (□=0.863) is the one with the least effect (18.042 %). In this group, it is stated that livestock farmers have sufficient knowledge about modern manure management systems and they are willing to use methods such as compost or biogas production in the evaluation of manure if they have any opportunity.

Table 1. The Factor Groups Affecting Livestock Farmers' Manure Management Perspectives

Factor Groups	Items	Factor Loading	Explained Variance (%)
Manure Disposal Possibilities (□ =0.854)	Incomes from manure according to different options	0.965	37.468
	Evaluates manure according to different options	0.964	
	Farmers do not need to disposing manure , who use pasture	0.631	
Environmental Sensitivity (□ =0.821)	If manure is not controlled, it poses a risk for human health	0.882	26.039
	If manure is not controlled, it poses a risk for water resources	0.869	
	If manure is not controlled, it poses a risk for animal health	0.810	
Modern Manure Management Awareness (□ =0.863)	If I have an opportunity, I use manure in compost production	0.923	18.042
	If I have an opportunity, I use manure in biogas production	0.900	

Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.652
Bartlett's Test of Sphericity	198.801
Asymp. Sig.	0.000
Total Variance Explained (%)	81.549

Grouping of Livestock Farmers According to Manure Management Perspectives

In the study area, a cluster analysis was performed by considering the factors that affect the owners' approach to manure management and the results are given in Table 3 According to the results of the analysis, the farmers were divided into three groups. The first group; Environmentalists (25.6 %), the second group were "Manure Disposal-Oriented" (59 %) and the "Innovators" (15.4 %) are consisted of third group (Table 2).

When the farmer groups (Table 2) and factor groups are examined together (Table 1) for define this groups, "environmentalist" have opinion that "If the manure management isn't good controlled in farms, it considers that it will pose a risk to human health, water resources and animal health". So, they consider the damage of manure to the environment while decision making on manure management.

"Manure disposal-oriented", representing the majority of the farmers; farmers have decision making styles that based on manure disposal possibilities on manure management. This group have environmental awareness and modern manure management awareness that are very poor.

"Innovators" have knowladge on modern manure management systems and manure processing technologies, and if they have an opportunity to use these modern methods, they will adopt this methods and use in their farms.

Table 2. Livestock Farmer Groups According to Manure Management Perspectives

Factor Groups	Farmer Groups		
	Environmentalist	**Manure Disposal-Oriented**	**Innovators**
	Mean (M)	***Mean (M)***	***Mean (M)***
Manure Disposal Possibilities	-0.21789	**0.15211**	-0.21996
Environmental Sensitivity	**1.43491**	-0.41116	-0.81539
Modern Manure Management Awareness	0.16957	-0.52341	**1.72377**
N	10	23	6
%	25.6	**59.0**	15.4

Çayır et al. (2012) stated that there is no manure store in the dairy cattle farms around Burdur Lake and the manure produced is uncontrolled and this situation creates a pollution problem in the environment. Meyer et al. (1997), in dairy cattle farms in California to determine the practices related to manure management and reduce the negative impacts on groundwater and surface water in their work to improve the measures they do not have enough information about manuremanagement, for this purpose, the need for effective training to evaluate manure reported.

However, in order to adopt a method or strategy to be proposed in order to improve manure management, it is pointed out the necessity of a farmer-focused study. It is stated that such studies can be successful if it is carried out with groups of livestock farmers interacting with each other in terms of knowledge and experience (Mckenzie, 2011; Burbi, 2015). Similar to these results , majority of the farmers are not accept the negative effects of manure to the environment. This farmers except that the environmentalist group that are constitutes 74.4 % of the sample farms in the Bornova district. This situation shows that it is necessary to work on the development of manure management under the leadership of the environmentalists group in the region.

Differences Between Livestock Farmer Groups

Table 3 presents the results a one-way between-groups analysis of variance (ANOVA) was conducted to determine statistically significant differences between livestock farmer groups in terms of demographics. There was no significant differences between 3 farmer groups in terms of their age and farming experience means.

On the other hand, a statistically significant difference ($F = 7.843$, $p<0.01$) was found among the farmer groups in terms of education levels (Table 3). The Post-hoc comparisons using the Tukey HSD test indicated that the education mean score for "innovators" ($M=11.6$, $SD=3.204$) was higher than other groups ($p<0.01$). But neither "environmentalists" nor "manure disposal-oriented" groups did not have differences significantly from each other. These results indicate that as the level of education of farmers increases, they have more information about new methods of manure management processing**.**

Gebrezgabher et al. (2015) in the Netherlands, they researched the level of knowledge on manure management technologies and the adoption of new technologies of dairy cattle farmers, and reported that the size of the farm, the farmers age and education level, knowledge of manure management are important variables. Similar to these results, it has showed that the increase in the level of education of livestock farmers in Bornova district has a positive effect on the knowledge of manure management.

Table 3. Differences between livestock farmer groups by their characteristics

Livestock Farmer Groups	**Age (Year)**		**Education period (year)**		**Farming Experience (year)**	
	Mean (M)	***Std. Deviation (SD)***	***Mean (M)***	***Std. Deviation (SD)***	***Mean (M)***	***Std. Deviation (SD)***
Environmentalist	47	8.60	8.3	0.95	18.80	10.41
Manure Disposal-Oriented	47.39	9.76	8.5	1.65	16	9.52
Innovators	45	9.25	**11.6**	3.204	13.67	11.40
F	0.154		7.843		0.523	
p	0.858		0.001**		0.597	

*** One-Way ANOVA is significant at p<0.01*

Table 4 presents the results of Kruskal Wallis and Chi-square independence tests that were conducted to determine statistically significant differences between livestock farmer groups in terms of farm characteristics. The test results indicated that there was a statistically significant difference between 3 farmer groups in terms of elevation of farm location (m).Than the pairwise comparisons indicated that there was a statistically significant difference between "innovators" and "manure disposal-oriented". Elevation of farm location (m) means of "innovators" had lowest values (M:171.83, SD: 116.62. On the other hand "manure disposal-oriented" that representing the vast majority of farmers had the highest means values of elevation of farm location (M:502.78m, SD:159.63). But "environmentalists" did not have significantly differences from neither "innovators" nor "manure disposal-oriented". These results showed that elevation of farm location is affective on livestock farmers' manure management perspectives.

There was no statistically significant difference between the farmer groups in terms of farms' distance to centre of Bornova (km) and the animal stock. In addition, according to the Chi-square independence test results, a statistically significant ($p < 0.05$) relationship was found between the farmer groups and the basic production type (cattle or small ruminant production). In general, it is understood that the farms in the "innovators" group determined only cattle farms (N = 6). These results show that the cattle farmers have more knowladge about new manure processing technologies (Table 4).

Table 4. Differences Between Livestock Farmer Groups by Farm Characteristics

Livestock Farmer Groups	Elevation of Farm Location (m)		Distance to centre of Bornova (km)		Animal Stock (Livestock Animal Unit)		Basic Production Type (N)		Total (ΣN)
	Mean (M)	*Std. Deviation (SD)*	*Mean (M)*	*Std. Deviation (SD)*	*Mean (M)*	*Std. Deviation (SD)*	*Small Ruminant*	*Cattle*	
Environmentalist	380.8	212.52	5.5	2.07	30.10	66.51	6	4	10
Manure Disposal-Oriented	**502.78**	159.63	7.3	2.86	28.30	42.40	13	10	23
Innovators	171.83	116.62	6.5	2.26	31	60.00	0	6	6
Chi-squ	12.215		3.923		0.558		6.770		39
p	0.002*		0.141		0.757		0.034**		

**Kruskal Wallis Test is significant at p<0.01*

***Chi-Square Test for ındependence is significant at p<0.05*

CONCLUSION

In this study, the survey and measurement data on the manure management practices of livestock farmers in rural area of Izmir province were evaluated by factor and cluster anaylsis and livestock farmers' manure management perspectives were determinated. Then the statistically differences between farmer groups were analized. According to factor analysis, three factors groups (manure disposal possibilities, environmental sensitivity and modern manure management awareness) were obtained. It has been determined that the factor group that has the most effect on manure management perspective is "manure disposal possibilities" and the factors in this group contain different options related to income generation and evaluation from manure.

Farmers were divided into three groups (environmentalists, manure disposal oriented, innovators) according to manure management perspectives by cluster analysis. It is clear that live stock farmers' manure management perspectives generally focused on manure disposal possibilities and they do not consider the damage of manure to the environment while decision making on manure management in the research area. Only "environmentalists" have environmental sensitivity but they are in minority. Innovators; it is determined that they are willing to use modern manure management. The statistically significant differences were determined between livestock farmer groups in terms of demographics and farm characteristics. These result indicated that livestock farmers have more knowladge about modern manure management methods as their education level increases especially for “innovators”. The elevation of farm location (m) means of "innovators" had lowest values and they are mainly concentrated in cattle farming.

The results of study show that livestock farmers' manure management perspectives are focused on manure disposal. Environmental sensitivity is weak and livestock farmers do not have enough knowledge about modern manure management systems. Farmers' perspectives on manure management are a key element to understand the potential for adoption of modern manure management systems.The main recommendations to generalize modern manure management practices are given below:

- It should be planing educational programs targeting spesific groups of farmers for they adopting modern manure management practices. For the success of this educational programs, this is a key element that studying with the farmer groups which in interaction with each other in terms of knowledge and experience. Thus, the success of the studies will increase by ensuring the motivation of the other farmer groups by way of in communication with the farmers in "environmentalists" group.
- Rural areas that under the affect of expansion of urban areas such as in Izmir, animal production has come under great pressure and control of the negative effects of manure management practices on human health and environment has gained importance. In this context, modern manure processing and evaluation methods should develop in livestock farms. For this purpose, it is necessary to determinate the attitudes and behaviors of livestock farmers about manure management and consequently, comprehensive researches to develop adoptable manure management systems and strategies.

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DETERMINATION OF VEGETATION IN COASTAL SECTION OF GREAT MEANDER DELTA BY USING OBJECT-BASED CLASSIFICATION

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ABSTRACT

The Great Meander Delta, which provides a living space in natural life to many species, located in the south of Kuşadası district in the southwest of Aydın province has unplanned and rapid urbanization, due to opening the drainage channels of the areas with alkaline properties, which are significant food sources for the living creatures, and the use of the unsuitable areas have led to the loss of wetlands and caused the vast majority of them to have endangered flora and fauna endemic in the region. With this research study, the distribution map of each taxa was determined by creating a map of the floodplain found in the wetlands located inside the Delta and the known species within many of which are endemic but whose distribution areas are unknown. For this purpose, we used object-based classification method using "Rapid Eye" which is the first satellite image with a Red-Edge band, assuming that the density of chlorophyll and water in the plant is the greatest. In the coastal area of the delta where the bird's paradise is located, the flora and their distribution map of the wetlands, which have very rich biological flora and must be protected by the international RAMSAR contract, have been created.

Key words: The Great Meander Delta, Rapid Eye, Wetland, Object-Based Classification

INTRODUCTION

Wetlands are one of the three main ecosystems in the world; they occur through the interaction of soil and water (Zedler and Kercher, 2005; Kim et al., 2011). Being the beginning of biodiversity and its natural basic components, wetlands are considered to be the most efficient systems that incorporate the taxonomic units flora and fauna together (Garg, 2015).

In terms of natural wetlands, Turkey is the most important country in Europe and the Middle East. Turkey's geographical position of being located in the transition point among Europe, Asia and the African continents; being surrounded by the sea in different ecological character on three sides, having height differences in excess of 5,000 m above sea level and the occurrence of climate change as a result of these properties have made Turkey one of the most important countries in terms of wetlands (Engin, 2012).

The Great Meander River, which is one of the important water resources of the Aegean Region that contains the research area for the project, has formed an important delta in its disembogue points by the sediments carried out for thousands of years due to changing the river bed many times. The Great Meander Delta has a very rich variety of plants. The different physical characteristics of the Dilek Peninsula and The Great Meander Delta caused the vegetation to be different and varied within short distances. 804 plant species were determined in the National Park. 6 of these plants are only seen here in the world. It also

includes the 18 plant species found only in Turkey around the world. In other words, the National Park has the distinction of being a unique natural museum where natural plant species from Anatolia to the Black Sea are seen together naturally. Due to this unique biodiversity, the Dilek Peninsula has been recognized by the Council of Europe as the "Flora Biogenetic Reserve Area", a preservation area at an international level for the protection of the species or communities that are endangered or whose genetic diversity is declining in a critical level in terms of vegetation (Anonymous, 2018). Beside the plant variety, the Great Meander Delta also provides a home to different animal species in its natural areas. Dalmatian pelican, collared pratincole, snowy plover, Mediterranean Gull, Caspian tern and little tern are important species that are breeding in the area. In winter, significant numbers of waterbirds can be seen, including cormorant, pygmy cormorant, Dalmatian pelican, great white egret, flamingo, wigeon, avocet, and slender-billed gull. Other important birds breeding in the delta are the little egret, grey heron, oystercatcher, yellow-legged gull and the common tern. The animal species that live in Dilek Peninsula National Park, including the Great Meander Delta, involve Anatolian leopard, wolf, fox, jackal, lynx, wildcat, badger, marten, hedgehog, crested porcupine, wild boar, lizard, turtle, golden eagle, hawk, falcon, seagull, blackbird, partridge, rock pigeon, wood pigeon, wild cow, wild horse, rabbit, otter, woodcock, kestrel, mallard and Caspian tern (Anonymous, 2018).

The integration of Remote Sensing Technique and Geographical Information Systems (GIS) has been used in recent years effectively in order to determine the areas that need to be protected, with determining its properties and defining its borders, such as wetlands (Karabulut 2015, Beisiegel et al., 2016, Topaloğlu and Ekercin 2013, Ahmed et al., 2017, Açıkgöz 2010, Lee and Yeh, 2009).

In recent years, object-based image analysis (OBIA) has been used in the studies of detection, identification, extensive analyzes and changes of wetlands (Moffett and Gorelick, 2013). In many studies with OBIA, improvement in wetland classification accuracy has reached up to 31% compared to pixel-based methods (Kamal and Phinn, 2011; Myint et al., 2008, Laba et al., 2010, Harken and Sugumaran, 2005). The classification of the cover types and/or vegetation of the wetland, wetland surface composition and vegetation types, and also in some occasions mapping studies on specific subjects such as invasive plant species were carried out by OBIA method.

Wetlands in the life cycle are often exposed to the effects of misuse. Due to the deterioration of the natural water regime, important problems such as the progression of salty sea water to the inner parts and the salinization of soil; discontinuation of delta formation and severe coastal erosion have started to occur. For this reason, it was aimed to determine the plant communities of Great Meander Delta, which is an important wetland and protected under RAMSAR, at the taxon level. In this context, by using 5 m RapidEye satellite images with terrestrial resolution, object-based classification method which is a new approach in determining the use of area within the delta, was used. Classes were made and their spatial distribution was determined for species and other objects that are found within the wetlands and have unignorable areal size, Arthrocnemum fruticosum (L.)Moq., uncultivated lands without vegetation and sand plains, Halochnemum strobilaceum (Pall.) Bieb., Juncus, hills, Phragmites, Sarcocornia perennis, areas where the presence of water on the surface are observed, Tamaricetum, agricultural areas and algal communities.

MATERIAL AND METHOD

Study Area and Data

The Great Meander River after flowing 560 km from the west of Turkey, forms the Great Meander Delta, where it flows into the Aegean Sea. The delta is the largest one of the

Aegean Sea on the coast of our country, which consists of several lagoons and large salt marshes and mud plains. There is sweet water vegetation along the river and the main evacuation channels. It is located in the southwestern part of Turkey between 37 ° 12'-38 ° 40 'north latitude and 27 ° 15'-30 ° 15' west meridian. There are İzmir, Manisa, Uşak and Kütahya Provinces in the north; Muğla Province in the south; Afyon, Burdur and Isparta Provinces in the east; and the Aegean Sea in the west of the basin (Figure 1).

Figure 1.Geographic location of the Great Meander Delta.

There are cotton fields in the eastern part of the delta, but there are also some ponds that can provide suitable habitats for living creatures. Recently, the salt marshes in the delta were also partially converted into cotton fields. The steep slopes of the Dilek Peninsula form the northern border of the delta. The Karine Lagoon (or Dil Lake), the northernmost of the delta, is the largest of the lagoons in the region (2,460 km^2). Other lagoons include Deringöl (130 km^2), Mavigöl, Karagöl (or Karaca, 538 km^2) and Akköy (Kabahayıt or Bölme, 500 km^2) lagoon. A small sand wall separates the lagoons from the sea (Anonymous, 2018).

The research material consists of wetland vegetation distributed in the Great Meander Delta (Aydın). In order to determine the vegetations developing in wetlands, literature studies about plant communities in wetlands were made. The general characteristics of the natural main plant species classified within the scope of the study and shown as a union with other plant species in the classification were given below.

Pragmitetum communis Union (Schumale, 1939): *Phragmites australis* is one of the most common plants in wetlands. This plant, which has only one species in our country, can grow on both fresh and salty waterfronts. In this context, the phragmites plant can be seen both on the streamsides and lakeshore and at the seaside.

Arthrocnemo - Halocnemetum strobilacei Union (Oberd, 1957): It is one of the species that grow in the saline soil. This halophyte species, generally grown in seasides, deltas and salt marshes can tolerate excessive amounts of salt found in soil oppose to other plants with its succulent structure (Davis, 1965).

Tamaricetum symrnensis Union (Seçmen and Leblebici, 1991): Tamarix symrnensis is a perennial shrub that intensively inhabits coastal areas, deltas and saline soils in the Aegean and Mediterranean regions. However, it is also seen in İstanbul, Zonguldak, Uşak, Ankara,

Maraş, Diyarbakır Antalya, Mersin, Van, Mardin and Hakkari provinces. Outside our country, it can grow naturally in the Caucasus, Iran, Northern Iraq, Afghanistan, the Balkans, Romania and Crimea (Davis, 1965).

Sarcocornia perennis: It is a succulent euhalophite, which is a part of the Chenopodiaceae family that is distributed in the salt marshes. It is a perennial plant that can reach up to 30 cm in length. It blooms in August-September and the seeds ripen between September and October (Ushakova, 2005).

Halimione (=Atriplex) portulacoides: It is a perennial, C3 type halophyte, which is a part of the Chenopodiaceae family, that is widely distributed over the salt marshes of Europe, North Africa and South-West Asia. Generally, it is a dominant species on well-drained soil and upper marshes (Chapman, 1950). Even though *Halimione* typically lives in areas where salt is released near sea water, the environment in which they live may be slightly salty or very salty (Carvalho et al., 2001). Despite having the ability to remove salt from epidermal pouches on both surfaces of their leaves like other halophytes (Baumeister and Kloos, 1974; Freitas and Breckle, 1992), they can accumulate high concentrations of salt in their leaves (Jensen, 1985; Freitas and Breckle, 1992).

Salicornio europeae-Juncetum acutus ass. Union: It is distributed in the alkaline soils in the Great Meander Delta; Karaburun Peninsula, Karaburun road Sazadin streamside; among puddles in the Gulf of Gökova; Muğla, Milas Metruk salt marsh and swamp areas; Selçuk, the coasts of Little Meander Delta; İzmir-Alaçatı Yumru port, marsh areas; Alaçatı-Mersin bay and its coasts (Akyol and Gemici, 2017).

In order to determine the plant taxa, two RapidEye satellite images from August 2016 covering the research area were obtained. The most important feature of the RapidEye satellite image, which distinguishes it from other multi-band satellite images, is that the electromagnetic spectrum is the first high-resolution satellite image in the 690-730 nm range with a red-edge band, which is sensitive to chlorophyll content as well as the standard bands.

ArcGIS 10.5, a CBS-enabled software, was used for the E-Cognition software and for the evaluation, mapping and entering field information of the classification results in the object-based classification of the wetland plants. Advanced sensors collect data on the earth's surface. In this context, eCognition software is designed to accelerate, enhance and automate image interpretation, as well as to obtain geographic data on environmental monitoring, resource development, infrastructure management and global security. eCognition software allows you to work with various geographic data such as raster images, LIDAR, GIS vectors, radar and even hyperspectral data (eCognition, 2010).

Methodology

The main purpose of this study is to determine the plant communities of the Great Meander Delta, which is an important wetland in terms of natural resources, at the taxon level. The second objective of the study is to establish an accurate and reliable numerical database of the wetland vegetation. The data obtained were evaluated according to the diagram given below using the remote sensing technique and geographic information system software (Figure 2).

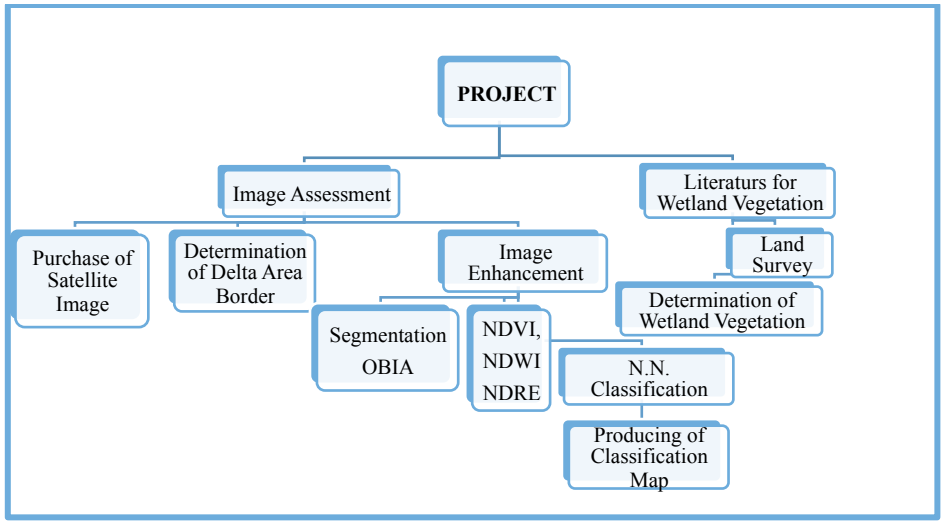

Figure 2. Project workflow chart

Object-oriented segmentations have been made in E-Cognition software to identify the taxonomic units obtained as a result of the field observations. In this process, the small-scale increases the dimensionality and large-scale collects multiple segments into a group while the small scale value divides the object into subgroups (Marangoz et al., 2005). For this reason, different vegetations in wetlands have been tested by using different scale parameters so as to distinguish them best. Segmentation in all parcels was performed by using "multiresolution segmentation" method and the scale parameter was changed between 25-100-200 values. Colour and shape parameters were applied as 1 and 0 respectively, meantime 1 and 0 values were applied for integrity and softness parameters.

The field observations were carried out on site and the plant species found in wetlands were marked on satellite images prepared in A3 size. Thus, the basic data were composed by the geographic distribution of the determined vegetative species and the different visibility on the satellite images.

NDVI was calculated on the images to determine the density of the vegetation in the study area. NDVI, which is generated by the mathematical modeling of these two wavelengths as indicated in the following mathematical equation, is considered to be the main indicator of the biomass quantity and the leaf area index value of the plants and is used for the monitoring of plant development during growth and for the purpose of yield estimation (Yıldız et al., 2012).

$$NDVI = (NIR - RED) / (NIR + RED)$$

By the classification of the obtained values, the places where NDVI was greater than 0.6 were defined as an agricultural area. Furthermore, in the mapping of "uncultivated areas", the non-vegetation areas were shown as places where NDVI is less than 0.

NDWI, which is another used method, is mainly used to determine open water surfaces according to the reflection status by using the green wavelength and near-infrared region (Kızılelma and Karabulut, 2017). The index is described by the following equation (Mcfeeters, 2013, Çelik et al., 2013):

NDWI= Green – NIR/Green+ NIR

NDWI was calculated on the images to determine the water surfaces distributed within the study area. In this way, the separation of the plants growing in the delta inside the water and the plants growing in sand flats/saline alkaline areas was made in more detail. The values obtained as a result of the calculation of NDWI were classified and the areas where the NDWI is greater than 0.4 were defined as "water surface".

Another index used to interpret the data is NDRE (Normalized Difference Red Edge Index). Red edge can be defined as the sharp rise area (between 690-740 nm) occurring in the area between red and NIR (Curran et al., 1990; Govender et al., 2009). It has been found that plants show a much better reflection in the Red-Edge band. Therefore, the studies in recent years also have concluded that it is more appropriate to use NDVI and NDRE calculation indices together for the classification and mapping of plant species (Fitzgerald, 2010; Curran et al., 1990; Govender et al., 2009).

According to the researches about the chlorophyll content in plants, the following formula was used in the NDRE calculation, which is preferred to be used with NDVI (Fitzgerald, 2010).

NDRE= (NIR–Red Edge)/(NIR+Red Edge)

In the study, it was determined that the 0.4 and 0.5 NDVI values within the agricultural areas were included in the "phragmites" class as a result of the classification. The green parts of such plants are similar to the green parts of agricultural products. To eliminate this error in the classification, the calculated NDRE values were taken into account. The NDVI values in the agricultural areas that were similar to the wetland plants were determined to have different NDRE values from each other. For this reason, in order to fully map the areas that have agricultural quality with a second classification, areas where NDRE value is greater than 0.2 were determined and "Agriculture 2" class was created.

By using the classification feature of the eCognition software, the classes have been created with the following names: Arthrocnemum fruticosum (L.)Moq. (ARTHROCNEMUM), uncultivated areas without vegetation (BARELAND), Halochnemum strobilaceum (Pall.)Bieb. (HALOCNEMUM), Juncus (JUNCUS), hills (HILLS), Phragmites (PHRAGMITES), Sarcocornia perennis (SARCOCORNIA), areas where the water is observed on the surface (WATER SURFACE), Tamaricetum (TAMARICETUM), agricultural areas (AGRICULTURE), algal communities (ALG). For each class, samplings were made on the image and with the help of the sample editor; it has been observed that the average reflection values of the segmented objects could meld.

After the necessary arrangements and changes were made, the classification was made depending on the segmentation, the results obtained in the research were converted to *.shp format, by using the features of the software, the average reflection value of the plant taxa, area and each band was transferred to the vector map as attribute information. At the next stage, the distribution and size of the geographical distribution areas of the wetland vegetation were determined by using the eCognition software.

RESULTS AND DISCUSSION

A significant portion of the data collection studies carried out at this stage was performed as a result of the field studies.

The "multiresolution segmentation" method was used to determine the wetland vegetation. In order to determine the difference of flora while determining the segmentation parameters, the best scale parameters, shape, colour, integrity and softness parameters were determined by experimenting. As a result of the experiments, the scale: 100, figure: 0.2, colour: 0.8, integrity: 1 and softness: 0. were typed into the software to have a clear differentiation of the flora in the wetlands.

In order to determine the density of the vegetation, which is distributed within the research area, NDVI on the images, NDWI to determine the water surfaces and once more the NDRE indices to better determine the differences in vegetation were calculated for each segment. By composing classes of different vegetation on the segmented images the classifications were made by the nearest neighbourhood classifier method. The results were transferred to ArcGIS 10.5 software by converting the feature to the .shp file. When the classification results were evaluated, the spatial distribution of the classes in the research area was determined (Figure 3).

According to the analysed results, the "water surface" was found to have the highest percentage in the terms of the distribution area it covered in the research area with 53.988%. This percentage is followed by uncultivated areas, which do not have vegetation, formed by sand plains with 18,085%. The species "Arthrocnemum" and "Sarcocornia", which represent halophytes and dune vegetation, occupy an area of 8,971% and 0,026% respectively. In addition to irrigation and evacuation channels, "Pharagmites" plant species which are found in the Delta and near the fields that are close the coastal areas are distributed in 1,833% of the area. Halochnemum strobilaceum (Pall.), Bieb. Juncus, which takes up the rest of the area has 0.038% and Tamaricetum, hills and the agricultural land area have 0.037%, 4.038%, 8.87% respectively of the whole area (Table 1).

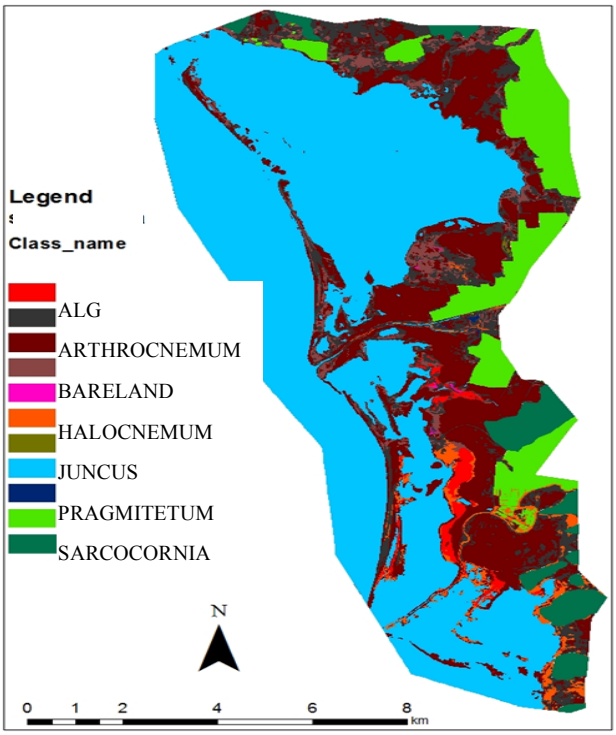

Table 1. Area distributions of plant species and other obiects in the research area

SPECIES	AREA (da)	(%) AREA
ALG	1.221,22	1,07
ARTHROCNEMUM	10.152,49	8,97
BARELAND	20.466,25	18,08
HALOCNEMUM	3.483,29	3,07
JUNCUS	44,00	0,03
PRAGMITETUM	2.074,62	1,83
SARCOCORNIA	30,08	0,02
WATER SURFACE	61.094,18	53,98
TAMARICETUM	41,90	0,03
AGRICULTURE	9.984,81	8,82
HILLS	4.569,56	4,03

TOTAL	**113.162,40**	**100**

Figure 3. Classification map of the research area

CONCLUSION

With the research that has been carried out with an object-based approach, classical classification processes have been added a new dimension that has increased their accuracy by comparison with the classical method. The ability to convert the classification results contained in the eCognition software into * .shp format, transferring the data by using the properties of the software to the vector map as the field and the average reflection value attribute information in each band will create a reliable base for the "Wetlands Management Plan", which has been indicated as the most effective way to protect the wetlands.

The wetlands formed by the Great Meander River prevented the progression of the salty sea water into the inner parts due to its support of the groundwater in its natural state, enriched the biodiversity through the species grown and developed there and contributed its sustainability by creating a natural habitat for other species. However, as wetlands take on the role of a natural biofilter, the pollutant materials (heavy metal, urban/industrial wastes, pesticides, chemical fertilizers, etc.) brought from the source of the Great Meander River to the sea are kept by the existing vegetation during its flow. Researches have shown that some in-water plants, (eg Eichhornia crssipes-water orchid), mainly withes and reeds (Phragmites), absorb liquid wastes such as mercury, zinc, copper, cadmium, nickel, copper and vanadium and store them in their bodies. By determining the widespread plant species and their geographical distribution within the Great Meander Delta, it will be possible to preserve the natural habitat of the species, determine and monitor the pollution situation that may occur in the delta, and observe the effects of climate change by keeping the water regime under continuous control.

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A PRE-STUDY ON COMPARING OF EFFECTS OF HUMIC SUBSTANCE ON SOME EROSION PARAMETERS OF A SANDY LOAMY SOILS AND PH AND EC OF DRAINAGE WATER

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ABSTRACT

The runoff formed by the impact of rainfall and topography in Turkey, causes the loss of huge amounts of soil. Some organic materials are applied to reduce soil losses. For this purpose in this study, skeleton, bulk density, texture, clay and silt rates (%), dispersion rate (%), percolation rate (%), erosion rate (%), pH, soluble salt (%), lime (%) and organic material content (%), aggregate stability were analyzed in soil sample. Soil sample was placement into the erosion pans. Humic substances (0, 5, 10, 20 and 40 ml l^{-1}) were sprayed to the soil surfaces and then 40 mm h^{-1} of artificial rainfall was applied during 1 hour. Runoff and sediments were weighted and calculated. In this study, it was found that humic substances increased runoff by 117-205 % and pH by 1-2 % and EC by 1-6 % and its decreased soil loss by 56-70 % and drainage by 3-52 % compared with control. According to the results, organic materials applied to the soil can change the pH and EC in the soil and ground water, it is absolutely necessary to drain the soils. It has been determined in this study; humic substances can be reducing the erosion significantly.

Key words: Runoff, soil loss, drained water, humic substance, rain simulator.

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INTRODUCTION

It is extremely important to protect our land, which is our most important natural resource for our future, against water erosion. In this context, a variety of methods are being applied to reduce irregular precipitation and surface flows caused by the topographic structure, to minimize soil erosion. One of these methods is to give organic materials to the soil. Piccolo and Mbagwu (1997) found that humic substances (100 and 200 kg ha^{-1}), decreased soil losses by 40 %. In other study, Piccolo et al. (1997) applied humic substances (0, 3, 6, 30 ve 60 g l^{-1}) on soil samples, placement into erosion trays (2x0.5x0.01 m sized at sloped by 15%) and applied simulated rainfall (40 mm $hour^{-1}$) by rain simulator. According to this study, humic substances decreased soil losses by 36%, significantly ($p=0.05$). Brandsma et al. (1999) reported that soil conditioners (Agri-SC, Soil-Tex, humus, Kiwi Green) applied on on a loamy sand textured soil decreased soil erodobility. Margherita et al. (2006) reported that 25 kg m^{-2} of fresh waste water treatment slurry, composting waste water treatment slurry and fresh waste water treatment slurry + humic substance applied on Xeric Torriorthent soils at slope 15% increased aggregate stability while decreased soil erosion. Tejada and Gonzalez (2006) carried out in the research, indicated that fresh beet pulp increased soil loss. Tejada and Gonzalez (2007) applied 10 tonnes ha^{-1} of 4 organic materials (gin compost, olive waste, municipal waste mud and urban solid waste) on a Typical Xerofluvent soil under 60 and 140 mm $hour^{-1}$ simulated rainfall conditions in 45 minutes. Researchers have reported that organic materials reduce soil losses by 30-32% at 60 mm $hour^{-1}$ and by 19-23% at 140 mm $hour^{-1}$ simulated rainfalls. Akbarzadeh et al. (2009) applied PAM, gypsum and PAM + gypsum on erosion parcels at different slopes (15, 20, 25 and 30%) under 25, 50 and 75 mm $hour^{-1}$ of

simulated rainfalls conditions. According to study, these applications were not found significant effects on runoff and soil losses. Ritchey et al. (2012) applied 20 kg ha^{-1} PAM, 0.3 kg ha^{-1} ammonium laurate sulfate (ALS), 5 tons ha^{-1} liquated humic substance and 5 tons ha^{-1} gypsum on erosion parcels (1x1 m sized). Researchers reported that liquated humic substance decreased runoff by 51 % and soil losses by 37 %, respectively. Yönter (2016) reported that olive mill wastes decreased runoff by 6-92 % and soil losses by 76-99 % respectively, and increased drainage by 2-6 times; while tobacco wastes decreased runoff and soil losses by 62-100 % and by 100 % respectively and increased drainage 1-6 times under simulated rainfall conditions (30, 60 and 90 mm $hour^{-1}$).

Organic materials applied to the soil increase infiltration. Gardiner et al. (1999) found that PAM and cactus extracts applied on Alfisol and Vertisol soils, increased infiltration ($p<0.05$) both of soils, significantly. Henriquez et al. (2003) reported that cactus extracts (500, 1000 and 2000 mg l^{-1}) applied into furrows on clayey Vertic Haplocambic soils. Depending on the chemical properties of the organic materials applied to the soil can also change the chemical properties of the soils. Kavvadias et al., (2010) reported that olive oil wastes increased soil EC and its affected soil pH, significantly. Candemir and Gülser (2011) applied fertilizer, hazelnut shell, tea and tobacco wastes on parcels prepareted clay and loamy soils. Researchers reported that soil pH is reduced during tea application and increased during fertilizer application, while increasing the pH and EC values of tobacco waste. Ntoulas et al., (2011) applied olive oil factory wastes (0, 12.5, 25 and 50%) on 24 parcels (1.44 x 1.44 m) grown in bermuda grass (Cynadon dactylon) after filling with sandy loam soil. Researchers reported that olive oil factory wastes decreased pH and increased EC. Yönter and Uysal (2016) reported that tobacco wastes (0, 10, 20 and 40 t ha^{-1}), decreased runoff and soil losses and increased drainage, significantly and in addition, tobacco wastes decreased pH and increased EC measured from soil and drainage, significantly and respectively under simulated rainfall conditions (30, 60 and 90 mm $hour^{-1}$).

The aim of this research is to determine the effects of different doses of humic substance solutions, sprayed uniformly on a soil surface with a hand pump, on runoff, soil loss, drainage and pH and EC in drainage water under simulated rainfall conditions.

MATERIALS AND METHODS

In the study, one soil sample (Litik Xerorthent) (Altınbaş et al., 2000) was taken from Hasanlar village-Menemen ($38^0$38'46.50"N-$27^0$08'22.74'E). In this study, the soil sample was taken from a depth of 0-30 cm and dried under laboratory conditions. Skeleton (Anonymous, 1993), bulk density (Hunt and Gilkes, 1992), texture (Gee and Bauder, 1986), clay and silt rates (%) (Neal, 1938), dispersion rate (%) (Middleton, 1930), percolation rate (%) (Lal, 1988), erosion rate (%) (Akalan, 1967), pH (Pansu and Gautheyroux, 2006), soluble salt (%) (Anonymous, 1993), lime (%) (Nelson, 1982) and organic material content (%) (Nelson and Sommers, 1982) were analyzed in soil samples. In addition, aggregate stabilities of soil samples made according to Yoder's wet sieving methods made and were calculated (Kempler and Rosenau, 1986). Liquated humic substance in this study was used as the examination material.

In the study, the 7 cm coarse gravel (1-16 mm diameter) was placement into the erosion pan, which sized 30x45x15 cm, sloped of 9 % and one drainage pipe underneath. After laying a permeable clothe on the coarse gravel layer, soil samples which were thought to the 8 mm sieve, were placement into the erosion pan (Piccolo et al., 1997; Yönter ve Uysal, 2016). Then, humic substance solutions (5, 10, 20 and 40 ml l^{-1}) were sprayed uniformly on soil surface by a hand type pump (100 ml) with 3 replicated (Piccolo et al., 1997).

In this study, 40 mm/h of artificial rainfall, which is similar to the natural rainfall intensities in the Mediterranean region (Zanchi and Torri, 1980), from 2.50 m height, was applied during 1 hour by a laboratory type rainfall simulator (Bubenzer and Meyer, 1965; Taysun, 1986; Yönter, 2010). In addition according to data of DMİ, the highest rainfall intensities in 2010 year were measured 43 mm and 34.2 mm between 18^{00} to 19^{00} and 19^{00} to 20^{00} hours in Menemen, respectively (DMİ, 2013). Then, the runoff start time is measured and recorded with a stopwatch (Taysun, 1986). During the artificial rainfall, runoff and soil loss were taken in each 10 minutes. Also tap water in the experiment was used (EC: 875µS/cm; SAR: 2.50).

After artificial rainfalls, containers were left for 24 hours in order for the sediment to settle in the containers. After settled the sediment, runoff were flushed down by a plastic pipe to the cups and recorded runoff amounts. After being transferred to the glass beaker, sediments were dried in an oven at 105 ^{0}C and were recorded (Taysun, 1986; Yönter and Uysal, 2007; Yönter, 2010). This study was conducted in a total of 15 experimental plots. Data were analyzed by SPSS statistical software package (Anonymous, 1999) using statistical analysis was performed. Groups of the average subject were determined using Duncan test.

RESULTS AND DISCUSSION

Some physical and chemical properties of the soil sample used in the study are given in Table 1 and chemical properties of the liquated humic substance are given in Table 2.

Table 1. Some physical and chemical properties of soil sample.

Skeleton (%)	Bulk Density (g cm^{-3})	Sand (%)	Silt (%)	Clay (%)	Texture	Clay Rate (%)	Silt Rate (%)	Suspansion Percentage (%)	
15.37	1.41	42.24	32.00	25.76	Loamy	2.88	1.24	7.04	
Dispersion Percantage (%)	Field Capacity (%)	Dispersion Rate (%)	Percalation Rate (%)	Erosion Rate (%)	Aggregate Stability (%)	pH	Soluble Salt (%)	Lime (%)	Organic Content (%)
49.76	27.94	14.14	0.92	15.37	53.87	7.41	0.051	4.2	3.7

Table 2. Chemical properties of humic substance used in the experiment.

Parameters	Humic Substance Content
pH	9.06
Total Organic Material (%)	5
Total (Humic + Fulvic) Acid (%)	15
Soluble K_2O (%)	1

According to Table 1, Skeleton materials of soil samples are fewer classes. Skeleton material in the soil keeps the soil surface from raindrop erosion by breaking the kinetic energy of the rainfall. (Taysun, 1986; Yönter ve Taysun, 2004). The bulk density of soil sample is

1.41 g cm^{-3}. In general, infiltration is being high due to soil organic matter and a good porosity and runoff is reduced in soils (Taysun, 1989). In terms of strength to erosion, it is desirable that the clay ratio in the soil approaches 1. However, this ratio varies between 1 and 3 in erosion-resistant soils, where the clay rate is 2.88 and soil is relatively susceptible to erosion (Taysun, 1989). The silt rate of soil samples is low. It is considered that silt rates of soils, which are greater than 2.50, are not susceptible to erosion (Taysun, 1989). The dispersion rate and erosion rate of soil samples were found high. It is considered that if dispersion rate in soils greater than 15 %, and erosion rate in soils greater than 10 %, soils can be erodible, if not, soils can be resist. (Akalan, 1974; Taysun, 1989). Organic matter is quite high with the amount of clay in the soil being insufficient and therefore the aggregate stability is high. The reaction of the soil sample is of the slightly alkaline class. According to water soluble salt percentage, there is no salinity problem in soil samples. The soil sample is in the calcareous class. The soil sample is in the humus class (Schlichting and Blume, 1966).

Runoff, soil loss, drainage, pH and EC values measured from drainage:

The runoff, soil loss, drainage, pH and EC values obtained from the study are given in Table 3.

Table 3. Runoff, soil loss, drainage, pH and EC values obtained from parcels treated with liquated humic substances.

HS (ml l^{-1})	RST (min, sec)	Runoff (mm $hour^{-1}$)	Soil loss (g m^{-2})	DST (min, sec)	Drainage (mm $hour^{-1}$)	pH	EC (□S cm^{-1})
0	38.54e	4.35a	12.68c	4.44a	23.79c	7.62abc	819a
5	25.41c	11.76c	5.53b	13.44b	26.73d	7.43a	832a
10	21.44b	13.25d	5.70b	19.34c	23.13c	7.54ab	858b
20	20.36a	13.14d	5.50b	26.31d	19.08b	7.70bc	830a
40	26.43d	9.45b	3.83a	27.03d	11.45a	7.78c	872b

(HS: Humic Substance; RST: Runoff Start Times; DST: Drainage Start Times)

According to Table 3, humic substances in the soil sample started runoff earlier than control treatments. As a result, runoff increased by 117-205% compared with control. In other words, humic substance did not effective in reducing runoff. Akbarzadeh et al. (2009), found similar results in a study they did. However, 40 ml l^{-1} of humic substance applications decreased runoff based on delayed by runoff start times compared with the other treatments. The runoff start times were in different groups, whereas 10 and 20 ml^{-1} of humic substance

application were included in the same group. Humic substance applications decreased by 56-70 % compared with control. These findings are similar to other studies (Piccolo and Mbagwu, 1997; Piccolo et al., 1997; Tejada and Gonzales, 2007; Richey et al., 2012; Yönter, 2016). Soil losses from 5, 10, 20 ml l^{-1} of humic substance treatments were in the same group. The least soil loss was obtained from application of 40 ml l^{-1} of humic substance treatment. 10 ml l^{-1} of humic substance treatments increased soil loss relatively compared with the other humic substance tratments. Tejada and Gonzalez (2006), reported that fresh beet pulp increased soil loss. Increases in humic substance rates in loamy soil delayed the drainage start times. For this reason, the amount of drainage was reduced in 20 and 40 ml l^{-1} humic substance treatments. On the other hand, 5 and 10 ml l^{-1} of humic substance treatments increased the amount of drainage by 12%. Some researchers reported that the physical and chemical properties of the organic material added to the soil affect runoff, soil losses and infiltration (Gardiner et al., 1999; Henriquez et al., 2003). pH measured from drainage in 20 ve 40 ml l^{-1} of humic substance treatments were greater than control treatments. EC values were measured higher than control treatments. Similar results were obtained in some studies (Kavvadias et al., 2010; Candemir and Gülser, 2011; Ntoulas et al., 2011; Yönter ve Uysal, 2016).

Statistical evaluation of data obtained from study:

Correlations of this experiment were given Table 4.

Table 4. Correlations between humic substance and measured parameters in the experiment.

Parameters	HS	Runoff	Soil loss	Drainage	pH	EC
HS	1.000		-0.681**	-0.932**	0.618*	0.657**
Runoff		1.000	-0.772**			
Soil loss			1.000			-0.573*
Drainage				1.000	-0.771**	-0.575*
pH					1.000	
EC						1.000

(**: 0.05; *: 0.01 significant levels; N: 15; HS: Humic Substance ; EC: Electrical Conductivity (□S cm^{-1})).

Humic substance treatments decreased soil loss (r = -0.681 **) and drainage (r = -0.932 **) to p <0.01 significance level. Similar results have been noted in some studies (Piccolo et al., 1997; Tejada and Gonzales, 2007). Humic substance treatments increased pH (r = 0.618 *) at p <0.05 significance level and EC (r = 0.657 **) at p <0.01 significance level. The organic matter given to the soil is effective on pH and EC (Kavvadias et al., 2010; Candemir and Gülser, 2011; Ntoulas et al., 2011). In other words, humic substance rates explained 98 % of runoff, 46 % of soil losses, 87 % of drainage, 38 % of pH and 43 % of EC, respectively.

RESULTS

According to the results obtained from this research, runoff and drainage increased while soil loss decreased as the humic substance rates increased. In addition, there were increases in the values of ta pH (7.43-7.78) and EC (830-872 □S / cm) due to the increase in the ratio of humic substance. As the organic materials applied to the soil can change the pH and EC in the soil and ground water, it is absolutely necessary to drain the soil. As a result, it has been determined in this study that liquated humic substance can reduce the erosion mostly.

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COMPARING OF THE EFFECTS OF HUMIC SUBSTANCE, POLYACRYLAMIDE AND POLYVINYLALCOHOL ON RUNOFF AND SOIL LOSS OF A CLAY SOIL UNDER SIMULATED RAINFALL

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ABSTRACT

The huge amounts of soils have been lost by erosion in Turkey, every year. Recently, some organic materials have been applied to reduce soil losses. For this purpose in this study, skeleton, bulk density, texture, clay and silt rates (%), dispersion rate (%), percolation rate (%), erosion rate (%), pH, soluble salt (%), lime (%) and organic material content (%), aggregate stability were analyzed in soil sample. Humic substances (HS), polyacrylamide (PAM) and polyvinylalcohol (PVA) (0, 1, 2 and 4 g l^{-1}; 100 ml) were sprayed to the soil surfaces into erosion pans and then 40 mm h^{-1} of artificial rainfall was applied during 1 hour. Runoff and sediments were weighted and calculated. In this study, it was found that humic substances decreased runoff by 3-36 % and decreased soil loss by 0.8-29, polyacrylamide decreased runoff by 3-32 % and decreased soil loss by 0.6-44 %, polyvinyalcohol decreased runoff by 4-19 % and decreased soil loss by 5-24 compared with control. According to the results, it has been determined in this study; organic materials can be reducing the erosion significantly.

Key words: Runoff, soil loss, humic substance, polyacrylamide, polyvinylalcohol.

INTRODUCTION

The huge amounts of soils are lost by erosion. In this study, a variety of methods are being applied to reduce irregular precipitation and runoff caused by the topographic structure, to minimize soil erosion. One of these methods is to give organic materials to the soil. To prevent soil erosion, kinds of polymers have been used since 1950's (Chepil, 1954). Levy et al. (1992), found that polyacrylamide applications increased permeability and decreased soil loss, significantly. Uysal et al. (1995), reported that polyvinylalcohol (PVA) and polyacrylamide (PAM) applications decreased runoff and soil loss. Teo et al. (2001), found that increasing polymers decreased soil loss, significantly. Flanagan et al. (2003) applied PAM (0, 20 and 80 kg ha^{-1}) on silty loam textured and sloped soils and applied simulated rainfall (69 mm h^{-1}) and reported that PAM applications decreased runoff by 40 and soil loss by 83 %. Takuma et al. (2003), applied a soil conditioner (E-soiru) on fine textured soils under simulated rainfall and found that soil conditioner decreased soil losses by 39-92 %. Cochrane et al. (2005) applied phosphogypsum (PG), polyacrylamide (PAM), and PG+PAM) on sandy Alfisol soils (Typic Paleudalf) under simulated rainfall conditions (25 mm h^{-1}; 2 hour). They reported that soil conditioners decreased runoff by 35 % and soil losses by 90%. Sepeskhah and Bazrafshan (2006), reported that PAM applications are more effective in reducing soil losses than in reducing surface flows. Yönter and Uysal (2011a, b) found that PAM and PVA applications under simulated rainfall conditions decreased runoff and soil losses, significantly. Piccolo and Mbagwu (1997) found that humic substances (100 and 200 kg ha^{-1}), decreased soil losses by 40 %. In other study, Piccolo et al. (1997) applied humic substances (0, 3, 6, 30 ve 60 g l^{-1}) on soil samples, placement into erosion trays (2x0.5x0.01 m sized at sloped by 15%) and applied simulated rainfall (40 mm $hour^{-1}$) by rain simulator. According to this study, humic substances decreased soil losses by 36%, significantly ($p=0.05$). Margherita et al. (2006) reported that 25 kg m^{-2} of fresh waste water treatment

slurry, composting waste water treatment slurry and fresh waste water treatment slurry + humic substance applied on Xeric Torriorthent soils at slope 15% increased aggregate stability while decreased soil erosion. Ritchey et al. (2012) applied 20 kg ha^{-1} PAM, 0.3 kg ha^{-1} ammonium laurate sulfate (ALS), 5 tons ha^{-1} liquated humic substance and 5 tons ha^{-1} gypsum on erosion parcels (1x1 m sized). Researchers reported that liquated humic substance decreased runoff by 51 % and soil losses by 37 %, respectively. Sinkpehoun and Yönter (2018) applied liquated humic substances (0, 5, 10, 20 and 40 ml l^{-1}) on loam soil samples placement into the splash erosion tray (30x30 cm) under simulated rainfall (40 mm h^{-1}). Researchers reported that humic substances reduced runoff (24-45%), soil losses by runoff (7-97%) and by splash (3-37%), significantly.

The aim of this research is to determine the effects of different doses of humic substances, polyacrylamide and polyvinylalcohol solutions, sprayed uniformly on a soil surface with a hand pump, on runoff and soil losses under simulated rainfall conditions.

MATERIALS AND METHODS

In the study, one soil sample was taken from the experimental field of Ege University, Agriculture Faculty ($38^0$27'12.46"N-$27^0$13'27.99'E). In this study, the soil sample was taken from a depth of 0-30 cm and dried under laboratory conditions. Skeleton (Anonymous, 1993), bulk density (Hunt and Gilkes, 1992), texture (Gee and Bauder, 1986), clay and silt rates (%) (Neal, 1938), dispersion rate (%) (Middleton, 1930), erosion rate (%) (Akalan, 1967), pH (Pansu and Gautheyroux, 2006), soluble salt (%) (Anonymous, 1993), lime (%) (Nelson, 1982) and organic material content (%) (Nelson and Sommers, 1982) were analyzed in soil samples. In addition, aggregate stabilities of soil samples made according to Yoder's wet sieving methods made and were calculated (Kempler and Rosenau, 1986). Liquated humic substance, polyacrylamide (PAM) and polyvinylalcohol (PVA) in this study were used as the examination materials.

In the study, the 7 cm coarse gravel (1-16 mm diameter) was placement into the erosion pan, which sized 30x45x15 cm, sloped of 9 %. After laying a permeable clothe on the coarse gravel layer, soil samples which were thought to the 8 mm sieve, were placement into the erosion pan (Piccolo et al., 1997; Yönter ve Uysal, 2016). Then, humic substance, PAM and PVA solutions (0, 1, 2 and 4 ml l^{-1}; 100 ml) were sprayed uniformly on soil surface by a hand type pump with 2 replicated (Piccolo et al., 1997).

In this study, 40 mm/h of artificial rainfall, which is similar to the natural rainfall intensities in the Mediterranean region (Zanchi and Torri, 1980), from 2.50 m height, was applied during 1 hour by a laboratory type rainfall simulator (Bubenzer and Meyer, 1965; Taysun, 1986; Yönter, 2010). In addition according to data of DMİ, the highest rainfall intensities in 2010 year were measured 43 mm and 34.2 mm between 18^{00} to 19^{00} and 19^{00} to 20^{00} hours in Menemen, respectively (DMİ, 2013). Then, the runoff start time is measured and recorded with a stopwatch (Taysun, 1986). During the artificial rainfall, runoff and soil loss were taken in each 10 minutes. Also tap water in the experiment was used (EC: 875µS/cm; SAR: 2.50).

After artificial rainfalls, containers were left for 24 hours in order for the sediment to settle in the containers. After settled the sediment, runoff were flushed down by a plastic pipe to the cups and recorded runoff amounts. After being transferred to the glass beaker, sediments were dried in an oven at 105 ^{0}C and were recorded (Taysun, 1986; Yönter and Uysal, 2007; Yönter, 2010). This study was conducted in a total of 20 experimental plots. Data were analyzed by SPSS statistical software package (Anonymous, 1999) using statistical analysis was performed. Groups of the average subject were determined using Duncan test.

RESULTS AND DISCUSSION

Some physical and chemical properties of the soil sample used in the study are given in Table 1.

Table 1. Some physical and chemical properties of soil sample.

Skeleton (%)	Bulk Density (g cm^{-3})	Sand (%)	Silt (%)	Clay (%)	Texture	Clay Rate (%)	Silt Rate (%)	Suspansion Percentage (%)
3.16	1.22	33.52	21.44	45.04	Clay	1.22	0.48	5.04
Dispersion Percantage (%)	Field Capacity (%)	Dispersion Rate (%)	Erosion Rate (%)	Aggregate Stability (%)	pH	Soluble Salt (%)	Lime (%)	Organic Content (%)
66.48	27.77	7.58	4.68	38.65	7.74	0.063	14.90	4.27

According to Table 1, Skeleton materials of soil samples are fewer classes. Skeleton material in the soil keeps the soil surface from raindrop erosion by breaking the kinetic energy of the rainfall. (Taysun, 1986; Yönter ve Taysun, 2004). The bulk density of soil sample is 1.22 g cm^{-3}. In general, infiltration is being high due to soil organic matter and a good porosity and runoff is reduced in soils (Taysun, 1989). In terms of strength to erosion, it is desirable that the clay ratio in the soil approaches. However, this ratio varies between 1 and 3 in erosion-resistant soils, where the clay rate is 1.22 and soil is relatively susceptible to erosion (Taysun, 1989). The silt rate of soil samples is low. It is considered that silt rates of soils, which are greater than 2.50, are not susceptible to erosion (Taysun, 1989). The dispersion rate and erosion rate of soil samples were found low. It is considered that if dispersion rate in soils greater than 15 %, and erosion rate in soils greater than 10 %, soils can be erodible, if not, soils can be resist. (Akalan, 1974; Taysun, 1989). Organic matter is quite high with the amount of clay in the soil being insufficient and therefore the aggregate stability is high. The reaction of the soil sample is of the slightly alkaline class. According to water soluble salt percentage, there is no salinity problem in soil samples. The soil sample is in the calcareous class. The soil sample is in the humus class (Schlichting and Blume, 1966).

Runoff, soil loss, drainage, pH and EC values measured from drainage:

The runoff and soil loss values obtained from the study are given in Table 3.

Table 3. Runoff and soil loss values obtained from parcels treated with liquated humic substances, PAM and PVA.

HS ($ml\ l^{-1}$)	**Runoff start times** (sec)	**Runoff** ($mm\ hour^{-1}$)	**Soil loss** ($g\ m^{-2}$)
Control	**685**	**13.09**	**66.51**
1	710	12.65	65.99
2	845	12.23	65.23
4	1348	8.32	47.14
PAM ($ml\ l^{-1}$)	**Runoff start times** (sec)	**Runoff** ($mm\ hour^{-1}$)	**Soil loss** ($g\ m^{-2}$)
1	713	12.67	66.09
2	868	12.26	65.30
4	1573	8.84	37.30
PVA ($ml\ l^{-1}$)	**Runoff start times** (sec)	**Runoff** ($mm\ hour^{-1}$)	**Soil loss** ($g\ m^{-2}$)
1	700	12.52	63.31
2	983	12.90	64.52
4	1773	10.61	50.78

(HS: Humic Substance; PAM: Polyacrylamide; PVA: Polyvinyalcohol)

Table 3 show that, humic substances, PAM and PVA applications started runoff later than control treatments in this study. In other words delaying runoff start times, PVA was

found more effective than HS and PAM in this study. As a result, runoff decreased by 3-36 %, 3-32 % and 4-19 % in humic substance, PAM and PVA treatments compared with control, respectively. In other words humic substance, PAM and PVA were effective in reducing runoff compared with control. Based on decreasing runoff, soil losses were decreased in all treatments. Humic substance decreased soil losses 0.8-29 %, PAM decreased soil losses 0.6-44 %, and PVA 5-24 %, respectively. PAM found more effective than other treatments in decreasing soil losses. Some researchers found that humic substances decreased runoff and soil losses significantly (Piccolo and Mbagwu, 1997; Piccolo et al, 1997; Ritchey et al, 2012; Sinkpehaun and Yönter, 2018). Similarly, some researchers also found that PAM and PVA as soil conditioners decreased runoff and soil losses significantly (Levy et al, 1992; Uysal et al, 1995; Flanagan et al, 2003; Yönter and Uysal, 2011a, b).

Statistical evaluation of data obtained from study:

Correlations of this experiment were given Table 4.

Table 4. Correlations between HS, PAM and PVA, and measured parameters in the experiment.

	HS	RST	Runoff	Soil loss
HS	1.000	0.942**	-0.930**	-0.902**
RST		1.000	-0.966**	-0.954**
Runoff			1.000	0.976**
Soil loss				1.000
	PAM	RST	Runoff	Soil loss
PAM	1.000	0.935**	-0.933**	-0.893**
RST		1.000	-0.966**	-0.979**
Runoff			1.000	0.977**
Soil loss				1.000
	PVA	RST	Runoff	Soil loss
PVA	1.000	0.951**	-0.757*	-0.880**
RST		1.000	-0.788*	-0.939**
Runoff			1.000	0.789*
Soil loss				1.000

(**: 0.05; *: 0.01 significant levels; N: 20; HS: Humic Substance; PAM: Polyacrylamide; PVA: Polyvinyalcohol RST: Runoff Start Times;).

Humic substance treatments decreased runoff (r = -0.930**) and soil loss (r = -0.902**) and PAM treatments decreased runoff (r = -0.933**) and soil loss (r = -0.893**) to p <0.01 significance level. Also PVA treatments decreased runoff (r = -0.757*) and soil loss (r = -0.880**) to p<0.05 and p <0.01 significance levels. Similar results have been noted in some studies (Levy et al, 1992; Piccolo and Mwagbu, 1997; Piccolo et al., 1997; Teo et al, 2001;Yönter and Uysal, 2011a,b; Sinkpehaun and Yönter, 2018).

RESULTS

According to the results obtained from this research, runoff and soil loss decreased as the humic substance, PAM and PVA rates increased As a result, it has been determined in this study that liquated humic substance, PAM and PVA applications on soil surface can reduce the erosion mostly.

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IODINE IN MILK AND DAIRY PRODUCTS AND ITS RELATIONSHIP WITH PUBLIC HEALTH

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ABSTRACT

The trace element iodine is a required component of thyroid hormones, thyroxine (T4) and triiodothyronine (T3), and is necessary for growth and development. Insufficient iodine intakes adversely affect growth and development as a consequence of impaired thyroid hormone production. The most common clinical sign of iodine deficiency is the enlargement of the thyroid (goiter), but iodine deficiency also increases the risk for hypo- and hyperthyroidism. Salt iodization has been recommended as an alternative to control and eliminate iodine-deficiency disorders by the World Health Organization. Food regulations permit the addition of 5 □g I/g NaCl to salt; however, this amount is too low to contribute significant amounts of iodine compared with foods such as milk and fish. At this point, milk and dairy products are becoming an increasingly important source of iodine in the diet of humans. The contribution of milk and dairy products to dietary iodine has been estimated at ~25-70% of total daily iodine intake. Iodine concentrations in milk and dairy products are influenced by some factors such as iodine intake of dairy cows, iodine antagonist components in the cow's diet, milk yield, season, disinfection with iodine-containing products, type of farming and processing. Therefore, consumption of milk and dairy products may be a good strategy for supplying the adequate dietary iodine.

Key words: iodine, milk, dairy products, public health

INTRODUCTION

The mineral iodine is an essential part of human diet as it is not made in the body. It is required for the synthesis of thyroid hormones, thyroxine (T4) and triiodothyronine (T3), which are important for metabolism and growth. It also plays a critical role in brain development in utero and early childhood (Chambers, 2018, 46). Based on the United Nations Children's Fund (UNICEF) estimation, over thirty five million newborns currently remain unprotected against the lifelong consequences of brain damage associated with iodine deficiency (Nazeri, Mirmiran, Tahmasebinejad, Hedayati, Delshad, Azizi 2017, 1).

Iodine deficiency can cause to a range of adverse effects. It can affect different lifecycle stages with a variety of symptoms, including hypothyroidism, stillbirth, impaired mental function, congenital anomalies and iodine-induced hyperthyroidism. Iodine deficiency is the most preventable cause of brain retardation for the infant and also consequences the loss of intelligence quotient. In addition the main visible sign of severe iodine deficiency is goiter (Bouga, Lean, Combet, 2018, 302). Furthermore, iodine deficiency has also adverse effects on reproductive functions and increases the frequency of abortions and congenital anomalies, as well as still-births and perinatal mortality (Arrizabalagaa, Jalónb, Espadac, Ca˜nasb, Latorred, 2015, 56). Salt iodization has been recommended as an alternative to control and eliminate iodine-deficiency disorders and thereby improve the health by the World Health Organization (WHO)/UNICEF/Iodine Global Network. They recommend universal salt iodization at a fortification level of 20-40 mg iodine per kg salt (van der Reijden, Zimmermann, Galetti,

2017, 386). On the other hand, foods that provide the highest concentrations of iodine per average portion include fish and shellfish, dairy products and eggs (BDA, 2016). At this point, milk and dairy products are becoming an increasingly important source of iodine in the diet of humans.

The aim of this review is to focus on the importance of the consumption of milk and dairy products in terms of iodine intake. The factors that influence the iodine amount in milk and dairy products and some recommendations about its importance in human nutrition have been also reported.

IODINE IN HUMAN NUTRITION

Dietary intakes of iodine need to be adequate in order to provide sufficient iodine for a proper thyroid hormone production. Recommended intake varies depending on age and life-stage (Table 1), and intake recommendations have been proposed by WHO and the U.S. Institute of Medicine (U.S. Institute of Medicine, 2001; WHO. UNICEF, and the International Council for the Control of Iodine Deficiency Disorders (ICCIDD), 2007).

Table1: WHO and U.S. Institute of Medicine Recommendations for Iodine Intake (□g/day) by age or life-stage

Age or Population Group	WHO[a]	U.S. Institute of Medicine[b]
0-12 months[c]	-	110-130
0-5 years	90	-
1-8 years	-	90
6-12 years	120	-
9-13 years	-	120
≥13 years	150	-
≥14 years	-	150
Pregnancy	250	220
Lactation	250	290

[a]Recommended nutrient intake.

[b]Recommended daily allowance.

[c]Adequate intake.

Different food groups contribute at different ratios to iodine intake among human population. Table 2 shows the percentage contribution of food groups to iodine intakes in UK. The data demonstrate that the food group ‘milk and milk products’ is the principal source of iodine in the diet and that milk is the individual product contributing most to the population’s intake (Chambers, 2018, 43).

Table 2: Food Groups Contributing to Iodine Intakes in the UK

	Percentage Contribution				
	1.5-3 years	4-10 years	11-18 years	18-64 years	65+ years
Food group					
Milk and dairy products	67	54	41	35	37
Of which cow's milk	*45*	*36*	*26*	*24*	*26*
Cereal and cereal products	8	14	17	11	11
Fish and fish dishes	8	9	7	10	14
Meat and meat products	4	7	11	9	7
Egg and egg dishes	3	4	5	7	6
Alcoholic beverages	0	0	1	9	6
Vegetables and potatoes	2	3	5	4	4
Other (fat spreads, fruit, sugar, preserves and confectionery, non-alcoholic beverages, miscellaneous such as sauces)	8	9	13	15	15

MILK AND DAIRY PRODUCTS IN TERMS OF IODINE INTAKE

Iodine in milk naturally occurs in small levels, and most of the iodine in milk comes from indirect fortification through animal feeds and iodine-containing antiseptic use. Seasonality and farming practices affect milk iodine concentration (152 - 256 ng/g), and summer and organic milk have been found to have lower iodine compared with winter and conventional milk (Bouga, Lean, Combet, 2018, 304). In fresh dairy milk, iodine is mainly found in form of iodide, but also marginal amounts of iodate may be present. The amount of milk iodine that is organically bound and how milk processing affects this iodine fraction remains uncertain (van der Reijden, Zimmermann, Galetti, 2017, 387).

There are some factors that influence iodine content in milk and dairy products. Iodine intake is the most important influencing factor on the iodine content of milk. Commonly used unsupplemented feeds and water do not meet the iodine requirements of food-producing animals. Therefore, iodine supplementation of feed depending on animal species/categories, animal yield, or any other influencing factors is necessary to meet the iodine requirements and to influence the iodine content of the food of animal origin (Flachowsky, Franke, Meyer, Leiterer, Schöne, 2014, 354). The iodine transfer from the feed into the milk is influenced by

the presence of goitrogens in the cow's diet (van der Reijden, Zimmermann, Galetti, 2017, 389). Goitrogens are agents that may cause thyroid enlargement by interference with the thyroid hormone synthesis and secretion including feedback mechanisms of thyroid-stimulating hormone (TSH) and TSH-releasing factor. They either influence the iodine uptake into the thyroid, the oxidation of iodide to elemental iodine with the subsequent transfer into the thyroglobulin, the synthesis of thyroid hormones, or the proteolysis or release of the thyroid hormones (Flachowsky, Franke, Meyer, Leiterer, Schöne, 2014, 356). Milk yield has been also said to affect the iodine concentration in cow's milk.

Season is another factor that influences milk iodine concentration. It tends to be higher in winter milk (61-534 mg/L) than in summer milk (33-434 mg/L). Seasonal milk iodine concentration variation is most likely explained by seasonal variations in the type of feed, which is influenced by feed availability, feed market price, the type of farming (organic versus conventional) and the amount of mineral feed provided as based on actual milk yield (van der Reijden, Zimmermann, Galetti, 2017, 390). Type of farming seems to be a further influencing factor on the iodine content of milk. Various factors may be responsible for the lower iodine content in milk from organic farming compared with milk from conventional farming. The differences in iodine content between organic and conventional milk can mainly be explained by the variation in feeding practices. A reduced use of iodine-containing mineral mixtures and the less frequent practice of teat dipping in organic farms could be reasons for lower iodine content in organic milk (Flachowsky, Franke, Meyer, Leiterer, Schöne, 2014, 359).

Processing steps in the milk industry, such as heat treatment and skimming, are considered potential causes of iodine loss. The reason for iodine losses during treatment is the sublimation characteristic of the element, because more than 90 % of iodine in milk is inorganic. The iodine losses during pasteurization could also be one reason for the differences in iodine concentration in raw milk and in bulk milk or in milk samples from the food retail sector (van der Reijden, Zimmermann, Galetti, 2017, 390).

CONCLUSION

As it can be seen milk and dairy products are important contributors to iodine intake in human nutrition, with an estimated contribution ranging from 13 to 64% of the daily adult requirement. On the other hand, the consumption of milk and dairy products should be encouraged for infants and the first year and in preschool children because they may be the major iodine source at those ages, when salt consumption is limited. Vegans who avoid all dairy products, as well as people with allergies to milk protein and/or lactose intolerance, are at risk of iodine deficiency.

There are many factors that affect the iodine content of milk and dairy products so that, the percentage of contribution is unpredictable and not constant. As the iodine amount in milk and dairy products is uncertain, iodine supplements can be used with caution in the feed of lactating cows and other lactating ruminants in order to supply the recommended levels of iodine. But high iodine concentrations in milk should be avoided while this supplementation is done. Consumption of milk and dairy products may become increasingly important iodine source by this was so that the risk of cardiovascular disease can be reduced by consuming less iodized salt. In addition, studies are needed to identify and quantify the sources and losses of iodine during dairy processing and to investigate the iodine bioavailability from milk and dairy products in order to better estimate the contribution of milk and dairy iodine to the total dietary iodine intake in the human diet.

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A STUDY ON DETERMINING OF SOME PRODUCTION TRAITS IN MENEMEN SHEEP

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ABSTRACT

This study was carried out to determine fertility, growth and testes traits for Menemen sheep. Two hundred Menemen sheep, raised in Faculty of Agriculture, Practice, Research and Production Farm, were used as experimental material. Average fecundity, fertility and twinning rate in Menemen sheep were 0.74, 1.26 and 22.8%, respectively. The effect of years was significant on fecundity except for fertility and twinning rate. Average weaning weight for Menemen lambs was 23.37 kg. The effect of sex, birth type and year were significant on weaning weight ($P<0.05$). Weaning weight for male and female Menemen lambs were 24.09 kg and 22.37 kg, respectively. Average 120 days weight for Menemen lambs was 31.78 kg. The effect of sex, birth type and year were significant on 120 days body weight ($P<0.05$). Average daily gain for Menemen lambs was 140 g. Daily gains for male and female Menemen lambs were 183.33 g and 120.50 g, respectively. The effect of sex, birth type and year on daily gain was significant ($P<0.05$). Wither at height, back and rump height, body length for Menemen sheep were 69.17 cm; 67.86 cm, 69.68 cm, 69.58 cm, respectively. The effect of age on body measurements was not significant. As a result, the Menemen genotype can be recommended for the production of meat-type lambs in the surrounding sheep breeders. However, in addition to the existing projects carried out by our faculty, studies should be conducted to determine the individual fattening and carcass characteristics of male lambs.

Key words: Menemen sheep, fertility, growth traits, daily gain

INTRODUCTION

Small ruminants are important to the subsistence, economic and livelihoods of a large human population. Sheep production has a great importance in rural due to its relation with the socioeconomic conditions of the Turkey. The great majority of the sheep population of Turkey is composed of multipurpose native breeds, producing meat, milk and wool.

Breed diversity is an important aspect in any livestock breeding program, but is extremely critical in the sheep industry. Producers have to know which breed best fits to their own production system. In some conditions, none of the pure breeds cannot be ideal for what a producer's goals and in this will encourage the producer to practice a method known as crossbreeding. Crossbreeding is a very effective tool and can be used to enhance the efficiency of your operation as long as you have a specific plan. There are different types of crossbreeding systems are available for producers.

A profitable commercial sheep operation should take advantage of the benefits of crossbreeding. Crossbreeding increases the efficiency of the operation by crossing two breeds that have high genetic merit for different traits. Maternal traits or reproductive traits tend to be negatively correlated to terminal, or growth and carcass traits - an animal that has more lambs born and more milk will tend to be less muscular, with poorer feed conversion and gaining ability.

Menemen sheep is one of the crossbred sheep breeds of Turkey. The Menemen breed is the recent sheep breed in the Ege University Faculty of Agriculture in over 30 years developed for high performance and low maintenance. Compared to many Turkish pure breeds, Menemen sheep has more heat tolerance. The breed is actually very good for meat production, and it produce more meat than many pure breeds in Turkey. Menemen breeds of sheep are produced for their carcasses. Their wool is not very valuable, therefore they are selected for mainly carcasses.

Menemen sheep was developed by Ege University Faculty of Agriculture at Menemen Research, Application and Production Farm, Izmir. It was actually created by using the traits of Ile de France and Tahirova sheep and then their negative traits removed via selective breeding over many years. Tahirova is another thin tailed crossbred sheep breeds of Turkey has a fine milk, meat and wool, a white body, and is originated from the Tahirova State Farm, bred from the East Friesian (75%) and Kıvırcık (Mason 1996). It has a 160-180% lamb yield and a 250-300 kg milk yield (Sönmez et al. 1975; Sönmez et al. 1991; TAGEM 2009). The Ile de France sheep is a breed of domestic sheep from France. It is native to the region of Île-de-France near Paris. It is known that with very high performances, with the best level of genetic guarantee in the world, and which has demonstrated its ability to adapt to all breeding systems and to regions with extremely varied climates.

A strong demand for red meats such as lamb or sheep meat has led to a resurgence of interest in sheep production. In the Turkish sheep industry, the Menemen is not recognized as being the best in any one particular area or trait. This study was carried out to determine the effects on fertility, growth traits and yield performance of Menemen crossbred ewes in semi-intensive condition.

MENEMEN SHEEP CHARACTERISTICS

Menemen sheeps are medium sized animal and are thick set. They are white in color and have white face. Their lower legs and face are free from wool. Both rams and ewes are naturally polled, that means they have no horns. Average live body wight of the mature Menemen rams is between 80 and 100 kg, average live body weight of the mature ewes vary from 60 to 70 kg. General Menemen sheep breed profile.

Table 1. Menemen sheep characteristics are summarizes in Table 1 below.

Breed Name	Menemen
Other Name	None
Breed Purpose	Mainly meat
Special Notes	Very hardy and strong animals, disease-resistant, very good for meat production, produce tender meat with a mild sweet flavor, the leather is of garment quality and can be split, lambs grow very fast
Breed Size	Medium
Weight	Rams weight between 80 and 100 kg, and average weight of the ewes vary from 60 to 70 kg
Horns	No horn

Climate Tolerance	Native climates
Color	White
Rarity	Not common, regional
Country/Place of Origin	Izmir, Turkey

MATERIALS AND METHODS

At the beginning of the study, Ile de France (IF) × Tahirova (T) crossbreed has been obtained F1 genotype. Then IF rams were mated first F1 ewes and were obtained first back cross to IFT1 ewes, which were called "Menemen" genotype. The Menemen new type would have 75% Ile de France and 25% Tahirova.

The experiment was conducted at Ege University Faculty of Agriculture Menemen Research, Application and Production farm in the North side of Izmir from 2016 to 2008. Growth traits evaluated were those measured from the start of lambing to weaning of the lambs, which occurred at 120 days of age. Litter size at birth, sex of lambs, birth weight and weaning weight of lambs were recorded.

Data were analyzed by ANOVA using the GLM procedure of SAS (1999). The difference between means was compared using the Duncan's multiple range tests. Survivability data was analyzed by chi-square (□2).

RESULTS

Survival rate in the menemen lambs is 98.70%.The weight of the lambs at birth was 5.28 kg. Average 120 days weight for Menemen lambs was 31.78 kg. The effect of sex, birth type and year were significant on 120 days body weight ($P<0.05$).

Average daily gain for Menemen lambs was 140 g. Daily gains for male and female Menemen lambs were 183.33 g and 120.50 g, respectively.

The effect of sex, birth type and year were significant on 120 days body weight ($P<0.05$). Average fecundity, fertility and twinning rate in Menemen sheep were 0.74, 1.26 and 22.8%, respectively. The effect of years was significant on fecundity except for fertility and twinning rate. Average weaning weight for Menemen lambs was 23.37 kg.

The effect of sex, birth type and year were significant on weaning weight ($P<0.05$). Weaning weight for male and female Menemen lambs were 24.09 kg and 22.37 kg, respectively. The effect of sex, birth type and year on daily gain was significant ($P<0.05$).

Average 120 days weight for Menemen lambs was 31.78 kg. The effect of sex, birth type and year were significant on 120 days body weight ($P<0.05$). Average daily gain for Menemen lambs was 140 g. Daily gains for male and female Menemen lambs were 183.33 g and 120.50 g, respectively.

Wither at height, back and rump height, body length for Menemen sheep were 69.17 cm; 67.86 cm, 69.68 cm, 69.58 cm, respectively.

CONCLUSION

The concern about global warming is increasing. The increase in temperature will result in a decreasing grazing capacity and a higher exposure to parasites and diseases for the animals. Understanding the adaptation of livestock to their production environment will therefore be important. Because of these and other reasons the amount of sheep population decreases year by year and the sheep breeds disappear rapidly. Meat prices higher day by day

and number of sheep production per year by person lower step by step. In conclusion, none of the crossbreeding programs in Turkey could be successfully completed.

Menemen sheep are very hardy and strong animals and they are disease-resistant. Compared to many pure breeds, Menemen are rated highly by both agro-pastoralists and pastoralists in terms of drought and heat tolerance. They are very good for meat production, and they produce tender meat with a mild sweet flavor. Their leather is of garment quality and can be split. The lambs are fast-growing, vigorous and lean. They produce carcass with a high cutting out percentage which yield 54 percent meat at a weight of 50 kg. Ege University Faculty of Agriculture Menemen Research, Application and Production is continuing to improve this breed in regards to genotyping and will continue improving traits for such things as scrapie resistance and even more parasite resistance.

As a result, the Menemen breed can be recommended for the production of meat-type lambs in the surrounding sheep breeders. However, in addition to the existing projects carried out by Ege University Faculty of Agriculture, studies should be conducted to determine the individual fattening and carcass characteristics of male lambs.

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SUGGESTIONS FOR PREVENTION OF CANNIBALISM IN ORGANIC EGG PRODUCTION

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ABSTRACT

Cannibalism usually occurs when the birds are stressed by poor indoor conditions or feeding with unbalanced diets. These are higher stocking density, excessive heat, over light intensity, absence of feed or water or a shortage of feeder and waterer space, mixing of different types, sizes, and colors of fowl, brightly lit nests or shortage of nesting boxes, allowing cripples, injured or dead birds to remain in a flock, introducing new birds to the flock, prolapses. On the other hand, many nutritional factors, such as dietary protein, energy and fiber levels, protein sources, feed form, amino acid levels (methionine, cysteine, lysine, arginine, tyrptophan), mineral levels (magnesium, zinc, sodium) and supplying roughage, may positively or negatively affect feather pecking behavior and cannibalism in laying hens. It should be matched the nutritional composition of the diet to the requirements of the bird at all stages of its life to prevent cannibalism. In addition, it may be beneficial for hens to spend more time on feed intake. Try to correct any practices which may have lead to cannibalism, darkening the facilities by using red bulbs, remove any badly injured birds. Applying an "anti-peck" ointment on any damaged birds usually stops pecking, lower the pen temperature a bit if possible. Make cannibalism control part of your management program and you will save a great deal of time and money.

Key words: Poultry, organic, egg, cannibalism.

INTRODUCTION

Cannibalism in fowl is a costly and vicious habit that poultry producers cannot afford to ignore. Cannibalism is common amongst chickens and it may occur at any age, breeds, strains and sexes of fowl. There are a number of theories as to why it happens including dietary inadequacies, genetics and simple chicken boredom.

Feather pecking and cannibalism remain major welfare issues in the laying hen business. In the European Union (EU), conventional cages were prohibited at the end of the 2010 and immediately after then beak trimming were prohibited too and then cannibalism started to be a common problem in organic egg production especially. In the meantime, in order to ensure that the highest possible standards of welfare are maintained at all stages during the beak trimming procedure, a Beak Trimming Code of Best Practice has been produced and debeaking is illegal in parts of Australia, Sweden, Finland and Norway; it was eventually banned in Switzerland in 1992, Denmark in 2014, and will have been phased out in Germany by 2017.

The beak is a main organ for chickens not only for acquiring food and also for the sense of touch. In other words, it's the equivalent of our hand. Pecking is an inborn behavior and newly hatched chick doesn't know that it has to eat. From hatching it is programmed to peck at anything and everything in its environmental stimulus. This behavior is essential for the survival of the chicken. Severe feather pecking is characterized by forceful pecks and vigorous pulls, which often result in removal of the feathers. The plucked feathers are frequently eaten by the pecker. In the denuded body areas of the victim, cannibalistic tissue

pecking can develop, resulting in the wounding and death of the victim. A separate form of bird-to-bird pecking is aggressive pecking. Aggressive pecks are directed to the head or neck of the recipient and are used to maintain the dominance hierarchy. Aggressive pecking usually results in little damage in laying hens. So, feather pecking and cannibalism should not be confused with aggressive pecking. In large flocks of birds with intact beaks, feather pecking and cannibalism are much more difficult to control, which will probably result in more feather damage and increased mortality levels (Rodenburg, 2011).

Cannibalism in organic laying hens is associated significantly with several housing and management practices. These are higher stocking density, excessive heat, over light intensity, absence of feed or water or a shortage of feeder and waterer space, mixing of different types, sizes, and colors of fowl, brightly lit nests or shortage of nesting boxes, allowing cripples, injured or dead birds to remain in a flock, introducing new birds to the flock, prolapses. On the other hand, many nutritional factors, such as dietary protein, energy and fiber levels, protein sources, feed form, amino acid levels (methionine, cysteine, lysine, arginine, tyrptophan), mineral levels (magnesium, zinc, sodium) and supplying roughage, may positively or negatively affect feather pecking behavior and cannibalism in laying hens.

2. Management components

Cannibalism usually occurs when the birds are stressed by a poor management practice. Since there are numerous reasons for outbreaks of cannibalism, it is important that cannibalism control be a part of your management program because of once this habit gets out of hand it is difficult to eliminate. With an increase of keeping layers in free range systems, the incidence of feather pecking also increases. Research on this matter indicates, however, that breeding for low mortality and providing natural rearing conditions, results in less pecking and cannibalism. If you notice the problem soon after it begins, cannibalism can be held in check. However, if the problem is allowed to get out of hand it can be very costly. Cannibalism will lower the bird's value due to torn and damaged flesh, poor feathering and can result in high death losses. Mixing different ages of fowl or fowl with different traits promotes pecking by disrupting the flocks' normal pecking order. Never brood different species of birds together. Birds with slow feathering have immature tender feathers exposed for longer periods of time leaving them open to damage from pecking. Don't raise slow feathering birds with other fowl. Don't brood feathered leg fowl, crested fowl or bearded fowl with fowl without these traits.

When the birds become uncomfortably hot they can become extremely cannibalistic. Be sure to adjust the brooding temperature as the young fowl get older. Brood young fowl at 35°C for the first week and then decrease the temperature 3°C per week, until you reach 21°C or the outside temperature. The temperature should be measured at the height of the birds back directly under the heat source. Do not heat the entire brooding facility to the recommended temperature.

Extremely bright light or excessively long periods of light will cause birds to become hostile toward one another. Never use white light bulbs larger than 40 watts to brood fowl. If larger bulbs are required for heat, use red or infra-red bulbs. In birds 12 weeks of age or older, use 15 or 25 watt bulbs above feeding and watering areas. But do not place bright lights near the nesting areas, allow 1 nest for every 5 hens. Because of constant light can be stressful to the birds, do not light fowl more than 16 hours per day. Overcrowding can be another reason of cannibalism, chicks should be allowed 0.01 m^2/bird for first 2 weeks, 0.02 m^2/bird for 3-8 weeks, 0.1 m^2/bird from 8 to 16 weeks of age and 0.15 m^2/bird from 16 weeks or later. If the birds have to fight for food and water, or if the birds are always hungry they will increase pecking. Be sure that there are adequate number of feeders and waterers and birds have free

access to water and feed at all times. Be avoid from abrupt changes in environment or management practices. If young birds will move to a new location, it is best to move some of their feeders and waterers with them in order to help them adapt. When you change over to larger feeders and waterers it is helpful to leave the smaller equipment in the pen for a few days to help during the change.

Fowl will pick on cripples or dead birds in their pens because of the social order and curiosity. Once pecking starts it can quickly develop into a vicious habit. Also prolapses and vent pecking by layers is also a common problem in organic poultry production. Uniformity of the herd must be under control and checked periodically. Uniformity is expressed as the percentage of individual weights which occur within ±10% of the current flock average.

3. Nutritional components

In laying hens, feather pecking behavior and cannibalism are caused by many nutritional factors such as nutritional deficiencies, dietary fibre, feedstuffs and diet form.

3.1. Dietary Deficiencies

Diet composition (protein, amino acids, energy and minerals) is known to produce feather pecking and cannibalism. Regulations of organic production system limit on use of nutrients and feed additives. The legislative prohibition may cause nutrient deficiencies or imbalances. If hens are offered diet with unbalanced one or more specific nutrients, the risk of feather pecking and cannibalism will be increased.

The ban on animal slaughter by-products and synthetic amino acids (only limited use for methionine) in organic layer diets causes protein and amino acid deficiencies that trigger feather pecking and cannibalism. Protein and some crucial amino acids (methionine, cysteine, lysine, tryptophan and arginine) significantly impact feathering in birds. On the other hand, methionine, lysine, and tryptophan are often considered as the most limiting amino acids in typical layer diets based on maize-soybean meal. In organic animal nutrition based on use of natural sources especially plant origin, consequently, it is difficult to design diets with sufficient methionine and other essential amino acids.

Sufficient dietary protein and some essential amino acids (especially methionine in organic production) intake is significant to maintain healthy plumage. It was found that the correlation between plumage condition and cannibalism was 0.90 (Ambrosen and Petersen (1997). In this study, authors (Ambrosen and Petersen, 1997) observed an improved plumage and a reduced cannibalism mortality in caged layers with increasing protein levels in isocaloric diets. In organic production, feeding laying hens with a protein/amino acids-deficient diet (135 g/kg crude protein, 5.9 g/kg lysine and 5.1 g/kg methionine + cysteine) resulted in an inferior plumage condition and a higher incidence of peck injuries of the comb and the rear body parts compared to feeding a standard diet (169 g/kg crude protein, 8.7 g/kg lysine and 6.7 g/kg methionine + cysteine) (Elwingeret al., 2002,). Supplementation of synthetic methionine (up to 0.41%) to the organic layer diet low in methionine (0.34%) reduced cannibalism mortality by approximately 10 % (Anonymous, 1997). In another study conducted by Kjaer and Sørensen (2002), no effect was found of a low (4.2 g/kg) versus a high (8.2 g/kg) level of methionine + cysteine in organic diets on the plumage condition of laying hens. Søerensen and Kjaer (1999) also reported that no feather pecking or cannibalism was recorded in free range hens fed diets containing 0.5 or 0.9% of methionine+cysteine.

In addition, tryptophan has previously been found to suppress feather pecking in poultry (Savory et al. 1999), presumably because of its sedative-like properties (Leathwood,1987). According to Quentin et al. (2005), high dietary protein levels associated with subdeficiency in lysine might favour cannibalism in label chickens during the finishing

stage. Siren (1963) was reported that cannibalistic pecking in cockerels was stopped by increasing dietary arginin level (from 3.9% to 6.9% of the total protein).

The energy requirements of free range (organic) laying hens are higher than those of birds in conventional cage systems due to rised demand for movement and thermo-regulation in changing environmental conditions (Sundrum, 2005). On the other hand, low energy diet can improve plumage condition (Van Der Lee et al., 2001) and can prevent or reduce feather pecking and cannibalism

Dietary Na deficiency can cause cannibalism (Baloš et al.,2016). Hughes and Whitehead (1979) reported that cannibalism was observed in birds receiving both low (0.003%) and intermediate (0.03%) levels of Na, although not in the controls (0.13%). Nester et al. (1945) suggested that salt supplementation should be efficacious for a few days in controlling cannibalism. Likewise, Zn-deficient diet might increase the risk of cannibalism because of its effect on feathering (Batal et al., 2001). Soros et al. (2018) indicated that Zn can improve laying performance and decrease aggressive behaviour. On the other hand, Willimon and Morgan (1953) were not able to find any consistent effect on feather pecking and cannibalism in layers by adding trace elements such as Al, Ba, Cr, Pb, Ag, Sn, Zn and others.

3.2. Fiber contents and fiber sources

As known, dietary fibre modulates gastrointestinal development and digestive functions, and prevents cannibalism in poultry. Low energy or high fibre diets may improve plumage condition and decrease feather pecking behaviour.

Low energy or high fiber diets decrease eating rate and increase eating time. Prolonged eating time may reduce feather pecking behavior (Van Krimpen et al. 2007; 2008;Qaisrani et al. 2013). Van Krimpen et al., (2009) reported that the 15% diluted rearing diets improved feather condition of hens at 49 weeks. Hartini et al. (2002) showed that addition of insoluble (millrun) or soluble (barley) fiber to the diet instead of wheat might prevent cannibalism mortality in the pre-lay period (13.2 vs. 3.9 or 5.8%) and early lay period (28.9 vs. 14.3 or 15.9%). In an earlier study of Wahlströmet al.(1998), hens fed oat-based diet (8.7%) showed a significantly lower incidence of cannibalism than those fed wheat-based diet (13%). According to Qaisrani et al. (2013), the use of oat hulls as the dilution source was more effective in preventing feather damage. Hartini et al. (2003) indicated that oat hulls and rice hulls are showing a similar effectiveness in controlling cannibalism in layers. Moreover, Kriegseis et al. (2012) reported that dietary supplementation of 10% feather coarse reduced feather pecking and improved plumage condition.

3.3. Protein sources

Soybean, due to the high protein content and high protein quality, is the main source of protein in organic diets as in conventional diets. The lack of animal protein (bone meal, meat meal etc.) in organic diets has been considered one of the causes of feather pecking and cannibalism. Suppressive effects on feather pecking induced by animal proteins could be related to something beneficial found only in animal protein sources, for instance vitamin B_{12} (Bolton and Blair, 1974). In addition, it was claimed that phytoestrogens in plant protein sources could rise plasma oestradiol concentrations and affect bird behavior (McKeeganet al., 2001). Richter and Hartung (2003) comparing different animal (meat meal and bone meal) and plant (extracted soybean meal, peas, faba beans and extracted sunflower seed) protein sources, they were observed a tendency of higher mortality due to feather pecking in vegetarian diets. Otherwise, Van Krimpen et al. (2011) reported that dietary supplementation of processed animal proteins did not generally reduce feather pecking behavior.

3.4. Diet form

The physical form of the diet (e.g. mash, crumble or pellet) can affect feather pecking behavior, possibly due to differences in time spending on feed intake (Van Krimpen et al., 2005). Hens fed on mash spent more time on feeding than those fed on pellet (Aerni et al., 2000). Linberg and Nicol (1994) were indicated that the risk of feather pecking was increased by feeding pellets and decreased by feeding mash. According to Aerni et al. (2000), who test whether provision of foraging material and diet form influence feather pecking and feather damage in laying hens, this result could be related to increased foraging behavior when feeding mash. In addition, El-Lethey et al. (2000) found that hens housed without straw and hens fed on pellets showed prolonged tonic immobility duration and higher heterophil/lymphocyteratios when compared to hens with access to straw and hens fed on mash.

3.5. Roughage

Feeding with roughage, such as fresh green fodder, silage, root crops etc., may also reduce feather pecking (Steenfeldtet al., 2001; Van Krimpenet al., 2005) because of the larger fibrous material contents of these feeds. Petek and Mc Kinstry (2010) reported that free-range (organic) hens spend more time on foraging and less time on pecking each other. Steenfeldt et al (2007) found that access to maize silage, barley-pea silage or carrots decreased damaging pecking, reduced severe feather-pecking behavior and improved plumage quality at 54 weeks of age. Johannson et al. (2016) declared that affinity for feeding barley silage to laying hens reduced aggressive and feather-pecking behaviors and, consequently, improved plumage condition.

4. Genetic components

The genetic component has been worked on for many years by efforts to improve the following characters: bird behavior, viability and plumage quality. Genetic evaluation of individuals as been carried out under different production conditions, which have been more or less stressful and representative of field conditions. There is increasing evidence that foraging behaviour plays a central role in the development of feather pecking. Modern laying hens do not need to show foraging behavior, consisting of ground pecking and scratching, to obtain their feed. Like their wild ancestors, the jungle fowl, however, they remain highly motivated to perform this behavior. Foraging can take up 65% of the birds' daytime in the wild. In the 1980's, Blokhuis (1986) showed that birds that have access to foraging material, show much less feather pecking than birds kept in a barren environment. This indicates that birds tend to redirect their foraging pecks to feathers if they lack the opportunity for foraging on the ground. According to (Rodenburg, 2011) foraging behavior during the first four weeks of life was stimulated both by selection on low mortality and by brooding by a foster mother, but that this did not lead to more feather pecking. It seemed that these birds better learned to target their pecks to the environment, instead of to other birds. In the open-field test, birds from the low mortality line were more active than birds from the control line, indicating lower fearfulness in the low mortality line. This findings indicated that a relationship between fearfulness and feather pecking. Similar to the low mortality line, brooded chicks were less fearful in the open-field test compared with non-brooded chicks. When birds were subjected to a stress test as adults (30 weeks of age), the control line also showed a stronger stress response than the low mortality line. Feather damage was limited in this experiment, but there were quite some problems with cannibalistic toe pecking. Levels of toe pecking were much lower in the low mortality line than in the control line. These results show selection on low mortality and improved rearing conditions offer promising solutions for feather pecking and cannibalism in laying hens.

RESULT AND SUGGESTIONS

Cannibalism usually occurs when the birds are stressed by a poor management practice. Once becoming stressed, one bird begins picking the feathers, comb, toes or vent of another bird. If there is an open wound or blood is visible on the bird, the vicious habit of cannibalism can spread rapidly through the entire flock. Since cannibalism can be caused by several conditions, you may not be able to determine the exact cause of the problem. However, stress no matter how slight, is usually the main factor.

Make the cannibalism control part of your management program and you can save a great deal of time and money. Ensuring good house design and layout, e.g. by careful planning of the positioning of feeders, drinkers, nest boxes, perches and lighting. Maximizing use of the range area, e.g. by providing shelter, making water available outside and allowing hens onto the range as early as possible in daytime.

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EFFECT OF DIFFERENT HARVEST STAGES ON SOME SILAGE QUALITY CHARACTERISTICS OF SWEET SORGHUM (*Sorghum bicolor var. saccharatum*) AND COWPEA (*Vigna unguiculata* (L.) Walp.) MIXTURES

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ABSTRACT

This study was conducted to assess silage and forage values of sweet sorghum [*Sorghum bicolor var. saccharatum*] silage when ensiled with different proportions of cowpea [*Vigna unguiculata*]. Keller cv. of sweet sorghum and Karagöz cv. of cowpea were used as crop material. Sweet sorghums were cut 3 different harvesting stages (panicle emergence, anthesis and doughy) and were mixed with cowpea at sorghum crop:cowpea ratios of 100:0, 75:25, 50:50, 25:75, and 0:100% on dry matter bases. All crops were chopped using a conventional chopper, and for each mixture 500 g of fresh material was vacuum sealed in a plastic bag and fermented for an average of 40 days, four bags per mixture. Some yield and quality parameters were tested in the experiment such as dry matter (DM) yield, content of lactic and acetic acids (AA), pH of silage and relative forage value (RFV). There were significant differences between harvest stages and mixture rates. Delaying harvest stage affected positively on DM yield and fermentation quality but not RFV. Crude protein content increased as proportion of cowpea increased in the mixture. In addition, pH and AA increased when cowpea was added. Silage with 100% cowpea without sweet sorghum had the highest pH and AA concentration.

Key words: Sweet sorghum, cowpea, harvest stage, mixture rate, silage quality.

INTRODUCTION

In Turkey, corn (*Zea mays*) is generally preferred as the main summer forage crop because it is capable of producing higher yields of high quality silage and it is able to store high amounts of energy. In addition, it has excellent intake characteristics compared to other forage crops, such as sorghum and millet. However, corn fresh yield for silage and its quality are influenced by many interacting environmental, cultural, production costs (hybrid seed, irrigation, etc.) and genetic factors. Therefore, the producers are trying to reduce production costs by better use of grazing and alternative crops for silage making (Geren and Kavut, 2009). Sweet sorghum (*Sorghum bicolor* (L.), Moench *var. saccharatum*) may be one of those alternatives to produce large amount of high quality roughage (feed) instead of corn.

Sweet sorghum is a promising forage in the arid, semi-arid and high salinity areas due to its rapid growth, high biomass yield, drought tolerance and high water-use efficiency (Almodares *et al*., 2007). Sweet sorghum can be conserved as ruminant feed through ensilage. However, the crude protein (CP) content in sweet sorghum fresh or its silage (~10%) is insufficient to fulfil the requirement of growing or lactating ruminants (Geren and Durul, 2017). In order to meet the CP requirement of ruminants, forages with a high CP content, such as legume, can be mixed with low CP forages before ensiling (Stoltz *et al*., 2013). However, silage only making from legume is often challenging, due to its low water-soluble carbohydrates content and high buffering capacity and extensive proteolysis during ensiling (McDonald *et al*., 1991).

The cowpea (*Vigna unguiculata*) is a common legume cultivated for its edible seeds all over the world. It is a fast growing, warm season legume, and, it can grow in a diverse range of

environmental conditions worldwide because of its adaptability. There are many varieties of cowpea grown in all the regions. However, selecting high yielding (seed and herbage), disease resistant variety is most important factor for successful cultivation. In addition, the cowpea forage serves as an adequate source of protein. Furthermore, it can be planted alone or intercropped with other crops such as corn and sorghums (Geren *et al*., 2008). Many factors influence the growth and yield of sweet sorghum or cowpea. In sweet sorghum, sugar content changes with development, so stage of harvesting is an important factor determining crop yield and forage quality. Therefore, it is important to determine the proper combination of legume crop that will result in the optimum mixture for nutritive value and fermentation. The objective of the study was to evaluate the nutritive value and fermentation profile of sweet sorghum silage when mixed with different proportions of cowpea.

MATERIALS AND METHODS

The experiment was carried out second crops production season in 2013 at Bornova experimental fields and laboratory of Agricultural Faculty of Ege University, Izmir, Turkey, at about 20 m above sea level with typical Mediterranean climate characteristics. Seeds of sweet sorghum cultivar 'Keller' and cowpea cultivar 'Karagöz' were sown on 1 July 2013, in separate fields at a plant density of 57,143 (70 cm x 25 cm) and 285,714 (70 cm x 5 cm) plants per hectare, respectively. Based on soil test results, sweet sorghum was fertilized with 220 kg N and 80 kg P_2O_5 per hectare; cowpea was fertilized with 25 kg N and 120 kg P_2O_5 per hectare. Half a dose of N fertilizer (urea) and full dose of P (triple superphosphate) were applied before planting, and the rest of nitrogen was applied when the sweet sorghum crops were 50-60 cm plant height as NH_4NO_3 **(**Almodares *et al*., 2007)**.** Drip irrigation system was installed on the field during the establishment and growing seasons. Weed control was performed by manual hoeing only. No evident crop diseases or insects were detected.

Sweet sorghums were cut 3 different harvesting stages (panicle emergence, anthesis and doughy) and cowpea which was harvested a day before, was at vegetative stage with some legumes. Fresh yields of the crops were recorded. Cowpea was wilted for 24 h before chopping. Sweet sorghum and wilted cowpea were chopped separately using a static precision-chop forage harvester to give a chop length of 5–10 mm. After chopping, approximately 15 kg of fresh material were collected in separate plastic bags for each crop and taken to the laboratory to make mixtures. Five sweet sorghum: cowpea mixtures (on wet weight basis) were hand-made using: (*i*) 100:0, (*ii*) 75:25, (*iii*) 50:50, (*iv*) 25:75, and (*v*) 0:100 ratios, respectively. Samples of mixture (500 g) were vacuum-packed into polythene bags (dimensions 30-20 cm) with addition of 0.5% salt. No inoculant was applied to any combination. There were four plastic bags for each combination and bag was considered the experimental unit. The vacuum bag silos were kept in storage (room temperature) without light for 40 days for anaerobic fermentation.

Dry matter (DM) content, pH value, lactic (LA) and acetic acids of matured silage samples was determined (Geren *et al.*, 2008). Matured silage samples of each component were dried at 65ºC for 48 h. The dried samples were milled passing through a 1 mm screen. The crude protein (CP) was calculated by multiplying the Kjeldahl N concentration by 6.25. The neutral detergent fiber (NDF) and acid detergent fiber (ADF) concentrations (Van Soest, *et al*., 1991) were measured to Ankom Technology to determine the relative feed value (RFV) which was estimated according to the following equations adapted from Trotter and Johnson (1992): DM intake (DMI)=(120/$NDF_{\%}$), Digestible DM (DDM)=88.9-(0.779x$ADF_{\%}$), RFV= $DDM_{\%}$x$DMI_{\%}$x0.775. All data were statistically analyzed using analysis of variance (ANOVA) with the statistical analysis system (SAS, 1998). Probabilities equal to or less than 0.01 were considered significant. If ANOVA indicated differences between treatment means, a LSD test was performed to separate them (Stell *et al*., 1997).

RESULTS AND DISCUSSION

DM yield: The results showed that the effect of harvest stage on DM yield of sweet sorghum and cowpea was significant (Table 1). DM yield was highest (11.56 t ha^{-1}) at doughy stage and lowest (4.55 t ha^{-1}) at panicle emergence stage. A delay in harvesting stage after flowering increased DM yields of sweet sorghum and cowpea. Thus, the plants did have adequate opportunity for photosynthesis and their height and stem diameter capacity increased. These results are in agreement with the results of Almodares *et al*. (2007) and Zhao *et al*. (2012) on sorghum. Moreover, Geren and Durul (2017) stated that with the delay in harvest date caused an increase in DM yield.

Table 1. Yield, silage fermentation and forage quality characteristics of sweet sorghum fermented with different cowpea proportions under different harvest stages.

	Harvest stages of sweet sorghum											
Silage	PES	AS	DS	Mean	PES	AS	DS	Mean	PES	AS	DS	Mean
proportion	Dry matter yield (t ha^{-1})				Silage pH				DM content of silage (%)			
100S+0C	4.55	8.80	11.56	8.30	4.18	4.05	3.77	4.00	25.5	25.4	24.7	25.2
75S+25C	-	-	-	-	4.34	4.27	4.21	4.27	25.0	26.1	25.7	25.6
50S+50C	-	-	-	-	4.68	4.28	4.24	4.40	25.9	25.6	25.5	25.6
25S+75C	-	-	-	-	4.96	4.40	4.29	4.55	25.7	25.3	25.6	25.5
0S+100C	1.26	2.59	3.31	2.39	5.28	4.81	4.55	4.88	24.8	25.8	25.9	25.5
Σ / ✕	5.81	11.39	14.87	10.69	4.69	4.36	4.21	4.42	25.1	25.6	25.3	25.3
LSD(.01)	HS:1.24				SP:0.14 HS:0.11 SPxHS:0.24				SP:ns HS:ns SPxHS:ns			
	Lactic acid content (%)				Acetic acid content (%)				Crude protein content (%)			
100S+0C	1.19	2.48	2.66	2.11	0.19	0.14	0.07	0.13	9.4	8.0	7.1	8.2
75S+25C	0.83	2.46	2.65	1.98	0.21	0.23	0.17	0.20	10.1	12.2	9.0	10.4
50S+50C	0.77	2.47	2.61	1.95	0.53	0.24	0.18	0.31	14.1	14.8	12.3	13.7
25S+75C	0.72	1.43	1.90	1.35	0.65	0.62	0.35	0.54	17.4	16.4	14.1	16.0

0S+100C	0.64	1.27	1.34	1.08	0.84	0.72	0.44	0.67	23.5	22.6	20.5	22.2
Mean	0.83	2.02	2.23	1.69	0.48	0.39	0.24	0.37	14.9	14.8	12.6	14.1
LSD(.01)	SP:0.25 HS:0.19 SPxBD:0.43				SP:0.11 HS:0.09 SPxHS:0.19				SP:0.77 HS:0.59 SPxHS:1.34			
	NDF content (%)				ADF content (%)				Relative Feed Value			
100S+0C	42.5	44.1	47.5	44.7	27.2	31.9	33.8	31.0	148	135	123	135
75S+25C	42.7	44.6	47.8	45.0	25.3	29.8	31.7	29.0	151	137	125	138
50S+50C	42.6	44.7	46.6	44.6	24.7	27.2	29.1	27.0	152	141	132	142
25S+75C	42.4	44.2	46.9	44.5	25.5	28.4	30.3	28.0	152	141	129	141
0S+100C	41.8	43.9	47.0	44.2	26.1	30.5	32.4	29.7	153	138	126	139
Mean	42.4	44.3	47.2	44.6	25.8	29.6	31.5	28.9	151	138	127	139
LSD(.01)	SP:ns HS:1.36 SPxHS:ns				SP:1.0 HS:0.8 SPxHS:ns				SP:4.0 HS:4.2 SPxHS:ns			

PES: panicle emergence stage, AS: anthesis stage, DS: doughy stage,

HS: harvest stages, SP: silage proportions, ns: not significant, Σ / ✕: total or mean

Silage pH: There was significant interaction between harvest stages and silage proportions in terms of silage pH (Table 1). The lowest pH of silage obtained from sweet sorghum (3.77) with 0% cowpea, which is an indicator of good fermentation cut at doughy stage. In contrast, silage with 100% cowpea cut at panicle emergence stage had the highest (undesirable) pH (5.28), which is probably an indicator of clostridia fermentation (McDonald *et al*., 1991). This result shows that pH values increased with addition of cowpea to the mixtures and decrease by delaying of harvest stages. The most important physicochemical parameter for the evaluation of silage quality is a pH value 4.2 or below, which was observed for sweet sorghum silage from 0% to 50% cowpea was added (McDonald *et al*., 1991; Geren and Durul, 2017). As it known that total sugar in juice of sweet sorghum is relatively high compared to other annual crops for making silage like corn or sorghum hybrids. The juice sugar content depended on the plant stage of development, because at the early development stage, fructose is more abundant, whereas sucrose is dominant after heading (Almodares *et al*., 2007; Geren and Kavut, 2017). At doughy stage, the sweet sorghum juice sugar content (brix) was average 23% (not seen the table) in our experiment. Sugars are the substrates for the fermentation process, so that their concentration in the crop has a major influence on the extent and type of fermentation in silage. It appears that high sugar concentration in fresh sweet sorghum gives a high probability of lactate type silage and of the silage being well preserved. In the study, cowpea increased in the mixture from 50% to 100% increased the pH value from 4.00 to 4.88 and the fermentation type was acetate.

DM content of silage: Harvest stages or silage proportion had no significant effects on the DM content of silage in our experiment (Table 1). DM content of silage ranged from 24.7% to 26.1% depending on the harvest stages and silage proportion. DM concentration was in the range recommended for ensiling in sorghum crop by wilting procedures. Many researchers (Comberg, 1974; Woolford, 1984; McDonald *et al*., 1991) informed that wilting is recognized to be an effective procedure in silage making but wet forage, a low buffering capacity like legume crops, was difficult to ensile, because high moisture content generally promotes the development of clostridial fermentation and also dilutes plant sugar concentrations and slows the decline in silage pH (Geren and Durul, 2017; Geren and Kavut, 2017).

LA and AA contents: There were significant interaction between harvest stages and silage proportions in terms of LA and AA concentrations of silage (Table 1). The highest LA (2.66%) concentrations was obtained at pure sweet sorghum silage cut at doughy stage while the lowest LA content of silage (0.64%) was obtained pure cowpea silage cut at the first maturity stage. On the other hand, pure sweet sorghum silage cut at doughy stage had the lowest AA concentration (0.07%), whereas pure cowpea silage cut at the first maturity stage was the highest (0.84%). In our present experiment, LA concentration decreased linearly as increasing level of cowpea addition in the mixture and increased by delaying harvest stages. Vice versa, AA concentration also decreased as decreasing level of cowpea addition to the silage and delaying cutting stages. Similar results were obtained by Contreras-Govea *et al*. (2011 and 2013) and Geren and Kavut (2017). It appears that addition of cowpea (below 50%) in to sweet sorghum silage had acceptable level under anthesis and doughy stage; however, higher rate of addition cowpea material had negative effect on silage fermentation properties.

Crude protein content: Significant interaction was detected on protein content of silage samples in the experiment. The highest CP content (23.5%) was recorded at pure cowpea silage cut at the first maturity stage as compared to pure sweet sorghum silage (minimum: 7.1%) cut at the third maturity stage in our experiment. Generally, average CP concentration increased linearly from 8.2% to 22.2% as the amount of cowpea increased from 0 to 100% in the mixture, and decreased from 14.9% to 12.6% by delaying harvest stage. This response is in agreement with previous research (Contreras-Govea *et al*., 2011-2013; Geren and Kavut, 2017). CP content of sweet sorghum is low naturally (Geren and Durul, 2017). Therefore, adding a legume such as cowpea or soybean, which is high in CP, would be expected to increase CP in the mixture. Previous field intercropping studies (Armstrong *et al*., 2008; Geren *et al*., 2008) had reported that planting corn and legume at the same time increased CP concentration from 12.9 to 29.0%. Contreras-Govea *et al*. (2011) ensiled corn and forage sorghum with different proportions of lablab bean, and reported that legume must make up at least 50% of the mixture to affect fermentation and nutritive value. They found that quality traits such as pH, AA, CP, NDF or ADF concentration were higher as the proportion of lablab bean in the mixture increased. Geren *et al.* (2008) and Contreras-Govea *et al*. (2013), who assessed the fermentation of corn silage in mixture with cowpea or other climbing beans, reported similar results. They also reported that, compared to corn alone, CP concentration increased in the mixture, but pH, NDF, and lactic acid concentration also increased, with no significant difference in in-vitro digestibility.

NDF and ADF contents: Harvest stages had significant effects on the NDF and ADF content of silage in the experiment, and for ADF, mixture rate was also significant, but not NDF content. The highest average NDF content was 47.2% for the latest harvesting time, while the lowest NDF was 42.4% for the first harvesting time. On the other side, the lowest average ADF content (27.0%) was recorded in 50% sweet sorghum+50% cowpea silage, whereas the highest ADF content was 31.0% for pure sweet sorghum silage in our experiment. ADF content increased by delaying harvest stage from 25.8% to 31.5%. Generally, ADF content of silage decreased with increasing of cowpea rate from 0% to 50% then increased again. These results are in disagreement with those reported by

Geren and Durul (2017), evaluating sweet sorghum + bean mixtures, and by Geren and Kavut (2017), assessing sweet sorghum + mung bean mixture, in which NDF or ADF concentration increased with the addition of legume to sweet sorghum. As expected, cell wall concentrations (NDF, ADF, etc.) were the lowest in the immature plants (panicle emergence stage) and gradually increased as the plants matured (doughy stage). Many researchers stated that the nutritional value of cell wall components decreased with plant age was related to increased lignin content (Contreras-Govea *et al*., 2011-2013; Zhao *et al*., 2012).

Relative feed value: There were statistically significant differences among harvest stages and silage proportions regarding average RFVs. The highest average RFV was 151 for first harvesting stage, while the lowest RFV was 127 for the third harvesting stage. On the other side, the highest average RFV was obtained from 50% sorghum+50% cowpea silage (142), whereas the lowest average RFV obtained from pure sweet sorghum silage being 135, but there was no significant difference among 25%, 50%, 75% or 100% cowpea addition. RFV values increased as the amount of cowpea increased from 0 to 100% in the mixture. Geren and Durul (2017) ensiled sweet sorghum with different proportions of bean; reported RFV was significantly affected by bean addition to the mixtures. They also found that RFVs were higher as the proportion of bean in the mixture increased. Previous studies (Contreras-Govea *et al*., 2011; Geren and Kavut, 2017) about improving of forage quality of grass silage displayed that some additives to the crop at the time of ensiling process had greater effect on RFV.

CONCLUSIONS

It was concluded that cowpea addition to sweet sorghum silage had significant effect on silage quality but harvest stages of sorghum had greater effect on the forage DM yield. Addition of cowpea compensates for the low crude protein content of sweet sorghum and also affecting other nutritive value characteristics in silage. Soft doughy stage can be recommended for suitable harvest stage of sweet sorghum for silage production. However, a greater benefit in nutritive value was observed when cowpea was between 50 and 75% of the mixture. Additional research activities with rumen digestibility are needed to assess mixtures that produce silage with more desirable fermentation characteristics.

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THE FATTY COMPOSITION IN MILK AND EFFECT OF NUTRITION OF SHEEP IN VARIOUS PERIOD OF LACTATION

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ABSTRACT

The aim of this study is to examine the impact of plant sources of fat in food for sheep on the fatty acid composition of milk samples obtained from 210 sheep, of breed Pramenka in the area of the Una Sana Canton. The studies were conducted in three periods: winter, spring and summer, and the heard is divided into experimental and control groups of sheep. Extruded flax has been added to nutrition in experimental group of sheep in every period of research in the amount of 3,5%. The total content of saturated fats was the highest during the summer with the experimental group (70,75% g/100 fat), which plant sources of fat were added to. The most common saturated fatty acids (SAFA) in the analyzed samples of milk are: palmitic, myristic, stearic, capric and lauric, whose values varied depending on the treatment of nutrition and research period. The differences found in the content of saturated fatty acids between the period of investigation of milk sample of experimental and the control group showed statistically very highly significant effect ($p<0,001$).

The content of unsaturated fatty acids was the highest during the summer in the control group of sheep (32,00% g/100 fat). Of monounsaturated fatty acids (MUFA) mostly consisted of oleic during the summer period (25,60% g / 100 fat) in the milk of the control group. Of polyunsaturated fatty acids (PUFA), linoleic acid (3,6% g/100 fat) in the milk of control and -linolenic (1,90% g/100 fat) of milk sample group of sheep were the most prevalent in the winter. Factor of term and factor of treatment and their mutual interaction showed statistically very highly significant effect ($p<0,001$), on the content of unsaturated fatty acids.

Key words: Sheep's milk, fatty acids, SAFA, MUFA, PUFA

INTRODUCTION

Sheep farming is an important branch of livestock production, especially in hill-mountain areas that are rich with important natural resources. Based on production scope, sheep's milk does not have the same value as cow's milk, but based on its composition and technological properties, it has considerably better quality and is a better raw material for processing. In EU countries, sheep's milk production is significantly better organized compared to other countries of the world thanks to the market that recognized quality of sheep's milk products *(Bulletin , 2004.)*. Over the last few years, fatty acids content and quality of human nutrition have become the main nutrition topic. Evidences for this can be found in more recent French nutrition guidelines that point out to the recommended input of some fatty acids in diversification of nutrition *(Anses, 2011a)*. Dairy industry needs to confront with 2 main issues regarding these new recommendations: (1) identification of fatty acids content to the consumer's request and (2) the way of a precise notation of fatty acids content. In correlation to the first issue, conducted researches have shown that modification of nutrition *(Chilliard et al., 2007; Raynal-Ljutovac et al., 2008; Coppa et al., 2013)* and genetic selection *(Arnould and Soyeurt., 2009; Schennink et al., 2009; Stoop et al.,, 2009)* can be effective at change of composition of fatty acids found in milk. Many researches

warned about possibility of modelling fatty acids' content of milk fat in order to increase content of desired n-3 unsaturated fatty acids and to decrease content of saturated fatty acids with adequate nutrition.

The primary goal and task of this paper was, based on theoretical and experimental studies, to make an assessment about influence of nutrition that is enriched with omega-3 preparations (extruded flax 3,5 %) and decrease of disproportion in relation between omega-6 and omega-3 fatty acids in sheep's milk.

Researches have shown that fatty acids of milk fat make milk especially important for consumers, due to its positive effects on human health *(Babayan and Rosenau, 1991. Haenlein, 2002, Sretenovic et al., 2009)*. However, only a small number of studies was conducted on fatty acids of sheep's milk, majority of studies were based on researches of fatty acids in cow's milk. Majority of studies is directed in the first place on influence of nutrition on profile of fatty acids of milk fat *(Adis et al., 2005;. Mele et al., 2007;. Gomez-Cortes et al., 2008;. De La Fuente et al.,, 2009;. Tyag et al., 2010*).

Few factors affect total profile of fatty acids in milk, but it seems that nutrition is the most important one. *De La Fuente et al. (2009)* found factors that are indirectly closely related to animal feed (e.g. combined effect of feed and the season). In that sense, it has been shown that during feeding, FA content of milk can be efficiently changed in order to obtain profile of FA closest to the ideal one: increased share of MUFA and PUFA, and decreased percent of SAFA *(Cabiddu et al., 2005;. Gómez-Cortés et al., 2008)*. Concentration of PUFAs in the milk can be increased by nutrition (addition of linseed oil) that is enriched with □-linolenic acid, even if a part of them is hydrated in rumen *(Addis et al., 2005)*.

MATERIALS AND METHODS

Two flocks of sheep were taken for observations, (a flock of pure Pramenka and a flock of crossbreeded sheep) in the area of the Una–Sana Canton. In flocks, groups of 35 animals as experimental sheep and 35 control sheep, kept under the same conditions, were formed. Besides regular nutrition, concentrate mixtures in daily amount of 300 g per head were added to the sheep. Concentrate mixture with addition of omega-3 preparation was added to the sample group (Sg) of sheep. In addition to regular meal, concentrate mixture without omega-3 preparation is added to the control group (Cg) of sheep. Experimental researches were done during three different periods.

The first period is winter, the second one spring, and the third one summer. Determination of fatty acids in sheep's milk has been done using gas chromatography (GC) with flame ionization detector (FID), according to ISO/TS 17764 - 2:2002 (E). Preparation of fatty acid methyl esters (FAME) was done by *in situ* transesterification (ISTE) method by methanol without previous extraction, that is based on fatty acids hydrolysis in lipids and origination of fatty acid methyl esters. Separation of fatty acid methyl esters (FAME) is determined with usage of capillary gas chromatography. The analysis was done on the device of Agilent Tehnologies 6890 N, Serial No CN10351006. Capillary column of Supelco Omegawax 320 (dimensions 30 m, of the inner diameter 0,32 mm and thickness of stationary phase film of 0,25 μm), stock No 24152, serial No 53624-04-A was used. As a gas carrier, helium with pureness of 99,999% was used, and flow of 0,3 ml/min., make-up gas N_2-25 ml/min., H_2 - 30 ml/min., synthetic air (21 % O_2) 400 ml/min. FAMEs were identified by comparing time of keeping peaks in chromatogram with known fatty acids in standard solutions (Nu-Check Prep. Inc.Sigma). Weight percentage (ut. %) is calculated by using corresponding factor (Rf.) that is established based on quantitative standards. For testing the

influence of factors (term and treatment) on observed traits, variance analysis (ANOVA) was used. Among *post-hoc* tests for detection of differences between modalities, Tukey test was used.

RESULTS AND DISCUSSION

The value of the analyzed fatty acids (g / 100 of total fatty acid methyl esters) of sheep's milk fat from sheep monitored during the three diet periods (winter, spring, summer) of two groups of sheep (experimental -Sg and control group-Cg) are shown in the Table 1.

Table 1. Profile of fatty acids in sheep's milk during research periods

Fatty acids	**Winter [1]**		**Spring[2]**		**Summer [3]**		**Significance level (*p*)**		
(g/100 FAME)[4]	Sg	Cg	Sg	Cg	Sg	Cg	period	treatment	Interaction
C12:0	3,7	6,0	3,70	6,00	4,20	3,65	***	***	***
C 14:0	12,50	12,85	11,85	12,10	13,30	12,95	***	***	***
C 16:0	32,6	27,2	28,35	35,70	29,70	28,95	***	***	***
C 18:0	10,7	9,6	14,30	10,05	12,90	12,80	***	***	***
C 20:0	0,25	0,3	0,40	0,40	0,30	0,35	*	ns	ns
C 22:0	0,1	0,1	0,20	0,20	0,20	0,20	***	ns	ns
C 24:0	0,1	0	0,1	0,1	0,1	0,1	ns	ns	ns
Σ Saturated	**68,50**	**68,45**	**68,25**	**69,35**	**70,75**	**67,65**	***	***	***
C 14:1	0,70	0,30	0,20	0,30	0,20	0,10	***	***	***
C 16:1 c+t	1,60	1,70	1,30	2,30	1,20	1,20	***	***	***
C 18:1 c+t	22,75	22,70	24,0	22,0	22,50	25,60	***	***	***
C 19:1 c+t	0,20	0,0	0,0	0,0	0,0	0,0	ns	ns	ns
C 20:1 c+t	0,20	0,0	0,0	0,0	0,20	0,0	ns	ns	ns
C 18:2 c+t, n-6	3,01	3,60	3,20	3,20	2,80	2,60	***	***	***
C 18:3 c, n-6	0,0	0,10	0,10	0,10	0,0	0,10	ns	ns	ns
C 20:3 n-6	0,10	0,0	0,0	0,0	0,0	0,0	ns	ns	ns
C 20:4 n-6	0,20	0,2	0,20	0,10	0,20	0,20	***	***	***
C 18:3 c, n-3	1,90	1,70	1,70	1,60	1,55	1,50	***	***	*
C 20:3 n-3	0,10	0,0	0,0	0,0	0,0	0,0	ns	ns	ns
C 20:5 n-3	0,10	0,20	0,20	0,20	0,20	0,10	***	ns	***
C 22:5 n-3	0,30	0,30	0,20	0,20	0,20	0,20	***	ns	ns
C 22:6 n-3	0,10	0,10	0,10	0,10	0,0	0,10	ns	ns	ns
Σ Unsaturated	**31,85**	**31,50**	**31,70**	**30,65**	**29,15**	**32,0**	***	***	***
Σ MUFA	26,15	25,40	25,90	25,10	24,10	27,20	**	***	***
Σ PUFA	5,70	6,10	5,80	5,55	5,05	4,80	***	ns	***

p– **significance level**: *p<0,05; **p<0,01; *** p<0,001; ns – no statistical significance
Sg - Sample group
Cg - Control group
[1,2,3]– research periods: [1](winter); [2](spring); [3](summer)

[4]FAME – fat acid methyl esters
SAFA – Satured fat acid
MUFA – Monounsatured fat acid
PUFA – Polyunsatured fat acid

By an analysis of the variance (ANOVA), it was established that there was statistically very significant influence of the experimental factor (period) on almost all the examined fatty acids of the sheep's milk ($p < 0.001$), except for those fatty acids that had trace values or were not identified.

Factor of treatment showed a very high statistically significant effect ($p < 0.001$) on most of the tested fatty acids of the sheep milk.

In addition, statistically very significant influence of factor interaction on the majority of the tested fatty acids was established.

The most frequent SAFA in sheep's milk samples: palmitic, myristic and stearic, while the caprine and laurin are present in slightly lower values.

The most frequent saturated fatty acid in sheep's milk samples is palmitic, which had a value in the winter diet period had 32.6%, while in the milk of the control group, this value was significantly lower (27.2%).

In the second study period (spring), palmitic acid value was 28.35% in the milk of the experimental group and in the control it increased to 35.7%, which is the highest established value of this unsaturated fatty acid during the study.

In the third period (summer) in the milk of experimental group, there was a slight increase in palmitic acid (29.7%) compared to the milk of the control group (28.95%). The established differences in palmitic acid content between the research period, the milk of both the experimental and control group showed a very high statistically significant effect ($p < 0.001$).

The determined content of myristic acid was 12.5% in the milk of the experimental group of sheep in the period of winter nutrition, and in the control 12.85%. In the second period of research (spring), the values of myristic acid were in the milk of the experimental group 11.85% and in the milk of the control group 12.1% respectively. In the third period, the values were the highest, with the milk of the experimental group the determined value of 13.3% and in the milk of the control group 12.95%.

The third in terms of presence is stearic one whose values of the experimental group were the largest in the second period of research (spring) 14.3% while in the milk in the control group it was lower - 10.05%.

In the third period (summer) it was found in Sg - 12.9% and in Cg - 12.8%. In the first period (winter), stearic acid had the lowest established value (Sg: 10.7%, Cg: 9.6%).

The total average value of SAFA in the first research period (winter) in experimental milk was 68.5% and in the control one 68.45%. In the second period (spring), the total average value of SAFA is in the milk of the experimental group 68.25% and in the milk of control group 69.35%. The highest total SAFA value was determined in the third period (summer) Sg: 70.75% and Cg: 67.65%. A very high statistically significant effect ($p < 0.001$) was shown by both factors on the total SAFA content as well as on/by their mutual interaction.

The total saturated fatty acids in sheep milk are presented graphically (Chart 1).

Graph 1. Total SAFA in sheep's milk

Gomez-Cortes et al., (2009) in their studies added extruded flax to sheep concentrates and determined palmitic acid values of 21.02%, which is significantly lower than our results. The same authors established the values of myristic of 8.11%, which is not in accordance with our results, while the value of stearin of 12.46% was in correlation with our results in the third period of research. Similar results were found in earlier studies (De La Fuente et al., 2009) that established statistically high significance ($p < 0.001$) in different periods of fatty acid research of sheep's milk, which is in correlation with our results.

The most frequent unsaturated fatty acid in sheep's milk is oleic (MUFA). In the milk samples, its determined value in the first study period was 22.75% in the milk of the experimental group (Sg), and in the milk of the control group (Cg) 22.70%. In the second period in the milk of experimental group, its value increased to 24%, and in the milk of the control group it was 22%. In the third study period, the value of oleic acid in the milk of the experimental group of 22.5% and in the milk of the control group it had the highest established value of 25.6%. At the beginning of the grazing period (spring and summer), the proportion of oleic acid in milk was gradually increasing. The influence of grazing on the increase in oleic acid content is indicated in his research by *Salamon et al.* (2006), *Baltusnikienė et al.* (2008). The established value of linoleic acid in the first peroid of research in the milk of the experimental group was 3.1% and was lower than the milk of the control group 3.6%. In the second period, the values were the same - 3.2%, while in the third period in the group of experimental groups the value decreased to 2.8%, and in the milk of the control group to 2.6%.

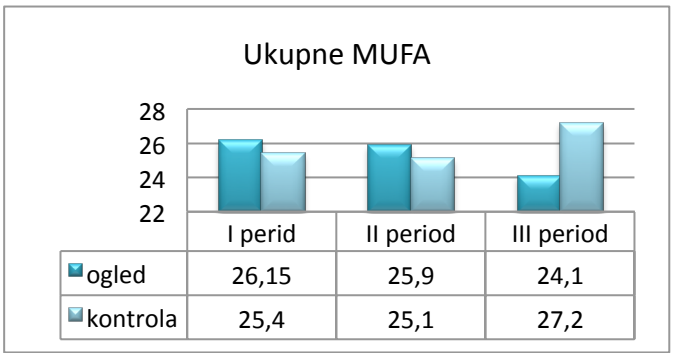
The next significant PUFA was □ - linolenic its values were decreasing from the first to the last research period and in both types of milk samples. Thus, the value of □ - linolenic acid in the first period in milk of the experimental group was 1.9%, and in the milk of the control one 1.7%. In the second period, the milk of the experimental group had the value of 1.7% and milk of the control one 1.6%, so that in the third period of research its value was the lowest and amounted to the first 1.55%, and in the second 1.5%. Statistically very significant influence ($p < 0.001$) on the content of unsaturated fatty acids was shown by the factor of term and factor of treatment, as well as on their mutual interaction.

Linseed oil is a good source of □-linolenic acid whose content is of 62.2 ± 1.24 g / 100 g in the fatty acids (Li et al., 2012). The mentioned authors added linseed oil to the feed for goats and the research was being carried out for eight weeks. As a result, the content of stearic, oleic and □-linolenic acid has been increased, which is in correlation with our research.

The average value of MUFA in the first study period (winter) in the milk of the experimental group was 26.15% and in the milk of the control one 25.4%. In the second period (spring), the total average value of MUFA was 25.9% in the milk of the experimental

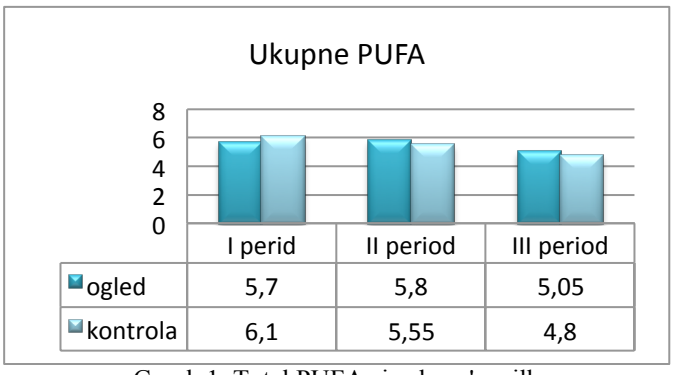
group, and 25.1% in the milk of the control one, while the third period (summer) the milk of the experimental group was 24.1% MUFA and the milk of the control group 27, 2%.

The significance level ($p < 0.01$) was shown by the factor of the term to the total MUFA content, while the factor of nutrition and interaction among factors showed a very high statistically significant effect ($p < 0.001$). The total MUFA in sheep's milk was presented graphically (Chart 2).



Graph 2. Total MUFA in sheep's milk

Vargas-Bello-Pérez et al., (2014) along with the extruded flax in ovum feed tested the content of fatty acids in sheep's milk. In their research, the value of this group of fatty acids was consistent with our results (26.95% and 28.81%). The average value of PUFA in the first study period was in the milk of the experimental group was 5.7%, and in the control group milk, slightly higher - 6.1%. PUFA values decreased during the study, and in the second period, in the milk of experimental group were 5.8% and in the control one 5.55%. In the third period, the determined values were at least 4.8%. The nutritional treatment did not show statistical significance (ns) to PUFA content in research periods. Total PUFA in sheep's milk was presented graphically (Chart 3). In the studies conducted by Einar Vargas-Bello-Pérez et al,. (2014) values of total PUFAs (5.24% and 5.77%) were correlated with our research.



Graph 1. Total PUFAs in sheep's milk

CONCLUSIONS

The highest total value of SAFA is established in the third period (summer) in milk of sample group (Sg) of sheep (70,75 %). Very high, statistically significant influence ($p<0,001$) were shown by both factors on content of total SAFAs.

On the content of total MUFAs, factor of nutrition treatment showed very high statistically significant influence ($p<0,001$).

By observing average value in all periods of research, conclusion is that in the first period, in milk of sample group (Sg), PUFA value was 5,7%. PUFA values were decreasing in the course of the research, so in the second period in milk of sample group (Sg) this value was 5,8 % , while in the third period, the established values were the lowest - 4,8%. The highest values of PUFAs were detected in the spring period.

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QUANTITATIVE METHODS FOR OLIVE HARVEST PREDICTION: A CLASSIFICATION BASED ON PRIOR RESEARCH

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ABSTRACT

The overwhelming progress in Information & Communication Technologies (ICT) maintains a basis for development in various areas. Emerging technologies including Internet of Things (IoT), Cyber-Physical Systems (CPS), Robotics, and mobile technologies have enabled a disruptive transformation; namely, Industry 4.0 in modern production systems. In the agriculture domain, the utilization of ICT had been effective since the 1990's, and resulted in 'Precision Agriculture'. Recent studies indicate that such progress in technology paves the way for 'Agriculture 4.0', a vision that emphasizes a high level of automation and control over machines, land, and equipment. Within the Information Systems (IS) context, such vision corresponds to the better use of data and automated decisions with complex analysis methods for decision support. In this perspective, selection or development of efficient methods is an essential prerequisite for innovative systems that are to be designed to fit the Agriculture 4.0 vision. In our study, the prior literature on olive harvest prediction will be addressed to provide an overview of quantitative methods. Moreover, the forecasting methods addressed in such studies will be evaluated considering the challenges and constraints attributed to the domain. Finally, a classification of methods will be proposed to demonstrate the usability of olive prediction methods in future studies.

Keywords: Agriculture 4.0, Olive Harvest Prediction, Forecasting Methods

INTRODUCTION

The recent progress in information technology including Internet of Things, Wireless Sensor Networks, Cyber-Physical Systems, Robotics, Cloud Computing have been triggering innovative business models and transforming businesses – especially the manufacturing industry. Such a transformation has been expressed with the term *"Industry 4.0"* by many research scholars over the last decade. Furthermore, it is trivial to notice that the boost led by such technological progress might also transform many industries, including agriculture.

The significant leaps in agriculture in the last century had been possible with the use of non-traditional inputs such as machinery, pesticides, and non-traditional fertilizers. In addition, it can be noticed that 'Precision Agriculture' had been succeeded with the use of digital technology, especially telecommunications, mobile technologies, and GPS. In the final report of the World Government Summit organized this year, De Clercq et al. (2018) noted the importance of digital advancements in the future of agriculture and qualified the Internet of Things and data-driven farming technologies as "game changers" in Agriculture 4.0. Besides, the report signifies the importance of analysis on historical data (including weather, soil, plant health, market trends) for decision makers, especially the farmers (De Clercq et al. 2018:16).

Ojha et al. (2015:68) explored the potential use of Wireless Sensor Networks (WSN) for agricultural production; outlined that context-awareness, autonomous operating ability, fault-tolerance and intelligent decision-making capability of WSN's renders this technology appropriate in automated agricultural tasks such as smart irrigation scheduled by means of moisture sensing. Moreover, it can be argued that the utilization of advanced data analytics

over data sensor data might prove useful for decisions in agriculture. In an attempt to provide smart decisions about insecticide application decisions, Hill et al. (2014) proposed a forecasting model based on data mining; in particular, classifiers that suggest actions were generated using several techniques including Naïve Bayes, Support Vector Machine, AdaBoost, Random Forest and Logistics Regression.

As noted by Basso et al. (2013), crop simulation models involve digital representations of crop growth and development, have the ability to provide yield prediction, and increasingly provide decision support functions for farmers. Furthermore, proper foresight on harvest might also signify shortage or excess of goods and trigger international trade; as well as providing insights for future decisions. In particular, the forecasting of yield and prices are essential for farmers, governments, and agribusiness industries (Allen, 1994). In this sense, olive harvest prediction can be described as a task that has the potential to provide benefits for both olive producers and consumers.

In this study, the models proposed by scholars with the aim of olive harvest prediction were addressed. Inherently, the problem can be described as a forecasting task. Thus, it might be expected to figure out relevant models that utilize one of the forecasting methods that relate olive harvest prediction (the dependent variable) with various independent variables. Accordingly, the models chosen among prior studies were mentioned with underlying forecasting technique. Furthermore, the independent variables remarked in such models were presented.

QUANTITATIVE METHODS FOR OLIVE PRODUCTION: REVIEW OF PRIOR STUDIES

Corrales et al. (2015:210) underlined the use of classification and regression, or in general, supervised learning models in agriculture for several problems including prediction of various diseases that can be encountered. Considering the models addressed in this study, it can be argued that such an argument is also appropriate for the olive harvest prediction problem as well.

Olive is an anemophilous species and has well adapted to wind pollination. The airborne pollen releasing from olive trees into the atmosphere is an important phenological data (García-Mozo, 2011). In our inquiry of literature, it was noticed that the studies on the prediction of olive production mostly have two different approaches. Some of the studies have focused on predicting the number of airborne pollens before the spring since the pollen index has been found highly correlated with olive production (Orlandi et al., 2016). Such studies provide a Pollen index prediction as output. It can be argued that such studies provide a clue for the problem of olive harvest prediction in an indirect manner. Alternatively, some other studies have developed models that use variables, including a key indicator - pollen index, to predict the overall olive harvest. The studies being grouped into two approaches mentioned have a similar subset of variables that were mostly aggregated from various meteorological data.

The Problems Related to Olive Harvest Prediction Problem

Intuitively, a problem such as olive harvest prediction could be related tightly to environmental variables. Besides, differences might arise from the characteristics of the area for which fruit harvest is to be predicted. Furthermore, even in adjacent locations, data might differ due to specific conditions such as exposure to sunlight, micro-climate effects, elevation, type of soil, etc. The variety of data involved in the various models for harvest prediction might show significant differences due to the constraints of the study as well.

A difficulty related to olive harvesting prediction might involve obstacles related to financing. As an anchorage, most models depend on airborne pollen statistics and requires specialized equipment. Besides, continuous operation would probably demand routine tasks such as maintenance and calibration. After all, proposing a proper estimation method to obtain Pollen Index indicator is quite hard, as highlighted by Oteros et al. (2013:313).

The budgets granted for projects, availability of staff charged for data collection, the availability of technical equipment used for measurements in the course of sample collection might also create constraints and lead to differences over the data being collected. As a result, methodologies being adopted in various studies might differ due to several factors.

Olive Fruit Harvest Prediction Models

Without a focus on the olive fruit, Basso et al. (2013:10) mentioned the statistical regression as the primary technique in crop forecast task based on agrometeorological inputs. In addition, it is important to note that the parameters chosen as inputs might be innumerable. Specifically, the models aimed at olive crop harvest prediction have been intentionally prioritized in this study.

The most common forecasting method in fruit harvest production until the 1960's, *'plot censuses'*, was a method based on a limited set of observations to predict the total olive production of a large region (García-Mozo, 2011:3; Dhiab et al., 2017:541). Virtually analogous to random sampling, plot censuses approach was criticized by scholars due to several drawbacks including high costs and observer subjectivity. Accordingly, both studies mentioned (García-Mozo, 2011; Dhiab et al., 2017) advocate the rise of airborne pollen models with such justifications.

In airborne pollen models, an indicator that signifies the pollen count is generated through a straightforward process that involves collecting and counting the pollens. The most common device for data collection is the Hirst-type spore trap; moreover, there are recent developments that pave the way for online data collection with the utilization of new technology including image recognition, bio-molecular analysis, chemical identification (Oteros et al., 2015:159). The progress in airborne pollen measurement and pollen index monitoring has importance for other disciplines as well; for instance, the study by Buters et al. (2018) highlights the recent development in pollen monitoring technology within the context of allergy and public health.

As a frontier in the studies that prioritize the pollen count, the study by Galan et al. (2004) underlined the pollen emission as a reliable indicator to predict the olive fruit harvest. The study was conducted over a 20-years data of metrological measurements, pollen concentrations, and olive tree phenology; and the findings confirm the importance of pollen emission data to predict olive production, approximately eight months before the harvest. The study proposes multiple regression models, in which the dependent variable is the olive production, and the independent variables consist of Pollen Index (PI), and monthly rainfall & temperature data recorded over the flowering period and before the harvest. Moreover, the results of the study involve multivariate regression models developed at different times. The independent variables involved in models consist of pollen index as well as various periodical statistics over the meteorological data.

The study by Galan et al. (2004) proposed sample forecast models with statistically significant results as presented in Table 1:

Model #	Forecast Date	Independent Variables
1	July	- Pollen Index - Rainfall amount in May - The minimum temperature in May - The minimum temperature in June - The maximum temperature in June
2	November	- Pollen Index - Rainfall amount in May - The minimum temperature in October - Rainfall amount in October - Rainfall amount in July - The maximum temperature in October - The minimum temperature in July
3	January (in the subsequent year)	- Pollen Index - Rainfall amount in May - The minimum temperature in October - Rainfall amount in October - Rainfall amount in July - The maximum temperature in October - The maximum temperature in December - Rainfall amount in June - The maximum temperature in June - Rainfall amount in September - Rainfall amount in November - The maximum temperature in November - The minimum temperature in September

Table 1 – Several multivariate regression models to predict olive fruit harvest by Galan et al. (2004)

As the results in Table 1 suggest, Pollen Index is an independent variable that seems to correlate the fruit harvest positively, with a positive correlation coefficient. However, since the term 'Pollen Index' is vogue and not self-exploratory, the definition of the term was clarified by Galan et al. (2004:46) as the peak pollen concentration among the daily samples.

More recently, Oteros et al. (2014) developed a model based on partial least squares regression method to predict olive harvest. The independent variables of the regression model involve temperatures, humidity, wind, rainfall, and daily solar radiation data. The authors reported that higher Pollen Index and water availability in spring positively affect the harvest in the areas covered in their study. It was noted that regression models included variables derived by periodic averages of meteorological data, similar to the study conducted by Galan et al. (2004).

For olive harvest prediction in Tunisia, Dhiab et al. (2017) also proposed a model based on partial least squares regression method that takes total harvest as the dependent variable. The regression model involves a set of independent variables derived from phenoclimatic measurements. Other than the cumulative data based on temperature, humidity, and rainfall; several independent variables were uncommon compared to other studies. Such variables mentioned, that could be described as synthetic derivations of raw data, are reported in Table 2:

Independent Variable	Description

Growing Degree Days (GDD)	A variable derived as a degree of accumulated heat requirements. Calculated as: $$GDD = \sum [(T_{max} + T_{min})/2] - T_b$$ where: T_{max}: $Maximum\ daily\ temperature$ T_{min}: $Minimum\ daily\ temperature$ T_b: $Respective\ threshold\ for\ the\ site$
Chilling Units (CHU)	A variable derived as a degree of accumulated cold requirements, calculated using the method presented by Crossa-Raynaud (1955).
Hot Days During Fruit Development	Count of days, when the average daily temperatures during the fruit development phase were over the average maximum temperatures.
Days For Optimal Pollen Grain Germination	Count of days during the flowering period when the average temperature exceeded 25°C.

Table 2 Notable independent variables included in the regression model proposed by Dhiab et al. (2017)

Pollen Prediction Models

Utilizing a considerably large database that involves measurements collected in Córdoba, Spain for 29 years; Oteros et al. (2013) introduced a model to predict olive pollen intensity. In the study, a multivariate regression model was proposed. The variables on the model were based on the five indices presented in the table below:

Index	**Description**
Thermal Index (TI)	The variable: *"Thermal Index"* is calculated using two values based on the temperature recorded in March. This index is calculated with the division of minimum temperature recorded by the range of temperature.
Pre-Flowering Hydric Index (PFHI)	The variable: *"Pre-Flowering Hydric Index"* is calculated with the sum of total rainfall in February and March.

Dormancy Hydric Index (DHI)	The variable: *"Dormancy Hydric Index"* is calculated as the division of total rainfall by the sunlight hours, both recorded from September to January.
Summer Index (SI)	The variable: *"Summer Index"* is calculated with a multiplication of the minimum temperature during the period between June and September, and the mean of hours with sunlight from June to August.
Pollen Index (PI)	The variable *"Pollen Index"* is the output that would indicate the predicted pollen amount, based on the other four indices.

Table 3 - Variables used in the multivariate regression model by Oteros et al. (2013)

The multivariate regression involving the variables listed above indicate the next season's Pollen Index, based on the variables constructed from prior data. It should be noted that the model is focused on the prediction of Pollen Index, not the amount of olive to be harvested.

Based on a significant rise of airborne pollens (including the olive pollens) in Southern Spain recently, García-Mozo et al. (2016) analyzed the pollen counts measured on a daily basis; obtained the trend component of airborne pollen data using STL method over time series data; and finally developed a linear regression model over the regular pollen trend data along with external variables. The independent variables included in the linear regression model consist of annual, quarterly and daily temperatures with mean and peak values as well as rainfall data organized similarly.

A recent study by Galán et al. (2016) stepped towards identifying the trends for airborne pollens in 12 locations in Iberia and analyzed the data collected over a period of two-decades accordingly. Linear regression analysis was used to determine slope and intercept values (thereby, a trend line function) presented in results. Moreover, Annual Pollen Indices for each of 12 locations were presented as a table in the results, based on the linear trend lines. Implicitly, the findings provide predictions for the subsequent periods through a simple calculation including the slope and intercept. Furthermore, as confirmed by the authors, climate change has a notable impact on the plant phenology (Galán et al., 2016:58). In this perspective, it can be argued that an analysis based on linear regression analysis over pollen indices might be useful to figure out the changes that might be attributed with the climate change.

DISCUSSION

In this study, prior research on the problem of olive harvest prediction has been covered, including models that estimate airborne pollens. In particular, the methodology utilized in such studies have been summarized to provide an overview of quantitative methods addressed to olive fruit harvest prediction. After the literature inquiry, it can be noticed that

most studies follow two main approaches; namely, fruit harvest prediction, and prediction of airborne pollination.

Revisiting the objective of our study, it should be mentioned that both approaches are aligned with the objective of fruit harvest prediction. Despite the fact that those approaches have different focuses, methods proposed for airborne pollination prediction are also linked to olive harvest prediction, due to the findings that nominate pollen indices as crucial indicators for olive harvest prediction. However, two approaches differ in the schedule of practice: airborne pollen prediction is conducted a few months before the pollination, and olive harvest prediction is conducted after the pollen samples are evaluated.

The methods covered so far mostly depend on derived meteorological aggregations, such as monthly average, min or max values obtained from numerous measurements. Among the models investigated, rainfall and temperature have been the parameters involved as the independent variables commonly. It was also noted that cold and heat requirements for trees were involved less frequently in olive prediction models. From a critical perspective, the form of aggregation of a measure might be labeled as subjective; one might question why meteorological data had been summarized by month, rather than week or day.

CONCLUSION

The prior research addressed in this study mostly had presented olive harvest and airborne pollen prediction based on data collected from Spain. The models were classified into two groups: olive fruit prediction models, and pollen index prediction models. Both approaches have similar outcomes since the pollen index is mostly regarded as the fundamental indicator for olive fruit harvest prediction. Besides, the models covered that predict olive harvest evaluate the pollen index as an independent variable.

The quantitative methods adopted in both approaches often depend on regression models; apparently, the dependent variable differs in both groups. The independent variables in all prediction models include meteorological measurements (rainfall, temperature) in common; however, the calculation of independent variables based on such measurements differ in models. Typically, both approaches provide insights after a considerable period with data collection.

In most studies, prediction models based on airborne pollens had been tested over data collected through large periods, and such models have been recognized with positive remarks. In this manner, various airborne pollen-based models could be tested over the data collected from olive cultivation regions in Turkey, in order to bring out a localized prediction model.

The adoption of digital technologies including image processing and recognition might lessen the challenges to be encountered during pollen collection and pollen index calculation phases. The utilization of sensors/IoT devices for data collection could result in quicker results. Moreover, insights through analysis of instant data might recommend specific actions. Furthermore, IoT devices performing as actuators might trigger actions. The real-time data flowing from numerous sensors might enable reiterated forecasts and more accurate insights as well. More generally, it might be predicted that digitalization of activities in agriculture will facilitate collection and analysis of data, and lead to better predictions.

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ROLE OF MEDIA ON FOOD CONSUMPTION: CASE OF KAHRAMANMARAS PROVINCE OF TURKEY

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ABSTRACT

Media is one of the leading environmental factors which affect consumer behaviors. Aim of this study is to reveal the effects of media on consumers' preferences when buying food. For this purpose, between November 2017 and March 2018, 385 surveys were conducted with consumers' obtained by proportional sampling method in Kahramanmaras Province of Turkey. As result of the study, most admass was children with 66.0% and 38.4% consumer affected by advertisements when buying food. Chips, chocolate and confectionery were obtained as the most purchased products and TV was determined mostly affected media channel with 60.3%. Besides, consumers should be raised awareness against deceptive advertising.

Key words: Advertisement, consumer choice, food

INTRODUCTION

All audio visual aids, which transmit all kinds of information to human and society, have 3 basic responsibilities such as entertaining, informing and education called as media. Media is a communication notion emerges from people's needs about getting and transferring news (Eskier, 2017).

Media types which broadcasting motional videos called visual media. Television and cinema are most important visual media tools. Media type which broadcast depends of audio called audial media. Radio is most common audial media tools. Media type which consists of scripts and fixed visual aids called printed media. Daily and periodically published newspapers and magazines are main tools of printed media (Aydeniz, 2012).

Social media are web-based communication tools that enable people to interact with each other by both sharing and consuming information.

The most important elements of the media tools are advertisement. Advertisement gives information to consumer about how, where and which prices goods and services can buy, and shows ways to consumer to buy right goods and products (Kaya, 2018).

Specifications required in best advertisement: (Gürsoy, 1999)

-Attractive

-Unique

-Amazing

-At least one time promotes to use

-Creativ and commercial

In recent years, some studies have been made on medias effect on food consumption in Turkey (Yılmaz et. al. 2007; Dilber and Dilber 2013; Babaogul et al. 2016; Secer and Boga, 2017). But, there is still need for study, especially in local level. Aims of this study is to determine how and to what extent consumers living in Kahramanmaraş province of Turkey

are affected by media and advertising, to examine the effects of media on consumer preferences when buying or consuming foods.

MATERIAL and METHOD

The main material of the study was the data obtained from the surveys of consumers in Kahramanmaraş province of Turkey. The survey was conducted on 385 people obtained by proportional sampling method between November 2017 and March 2018.

RESULTS

Socio-economic and demographic characteristics of consumers was showed in Table 1. According survey results average age was obtained 38.6, besides family size was 4.48 and number of the children was 2.45. Monthly income of consumers was determined as 2507 TL. 27.23% of consumers spend their income for food.

Table 1. Socio- Economic and Demographic Characteristics of Consumers

	Minimum	Maximum	Average	Standard Deviation
Age	19	77	**38.61**	9.829
Family size	1	15	**4.48**	1.641
Number of children in the family	0	13	**2.45**	1.648
Monthly income (TL/month)	0	23.000	**2507**	2211.137
Food expenditure (TL/month)	100	30000	**682.89**	490.480

It was determined 58% of consumers have undergraduate and graduate education level. It shows that the consumer's education level is high which attended survey.

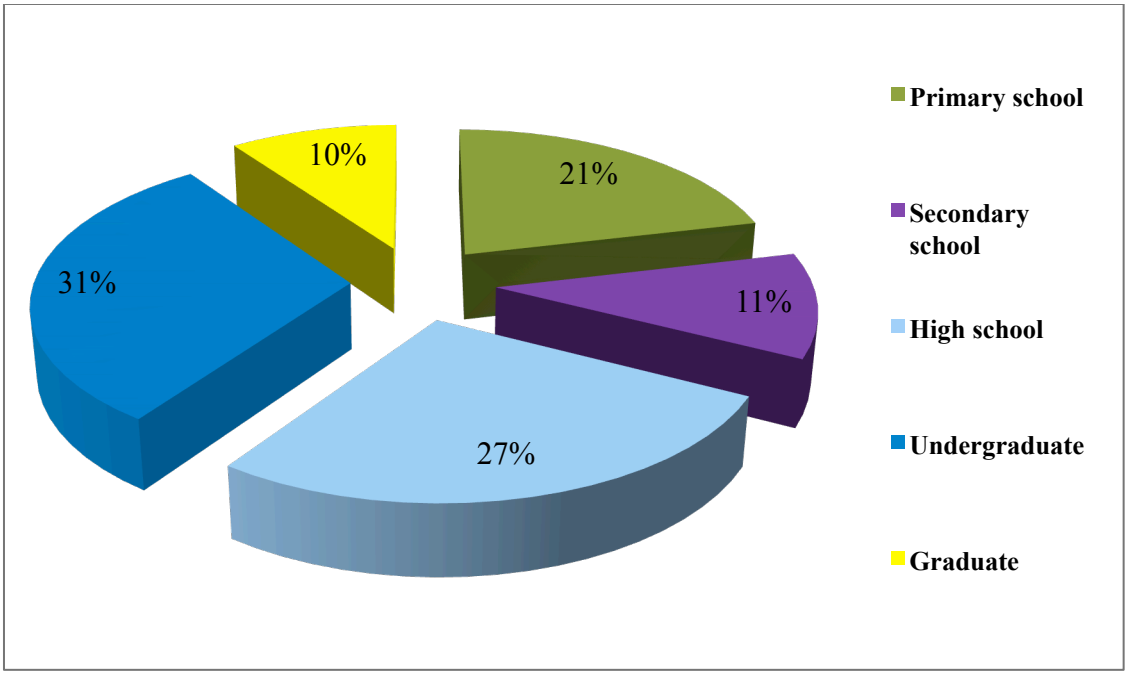

Figure 1. Educational Status of Consumers (%)

It was obtained that consumers have disagree with the ideas “It is more reliable to order food from the Internet” “Foods ads do not affect children much” and “All food products in advertising are useful for people”. Also consumers have partially agreed with the ideas “Consumers’ unconsciousness about nutrition originated from the media” and “Food products ads is often deceptive ads” (Table 2).

Table 2. Opinions of Consumers on Media

Opinions	**Average**	**Standard Deviation**	**Category of Participation**
It is more reliable to order food from the Internet.	1.74	1.073	Disagree
Foods ads do not affect children much.	1.80	1.068	Disagree
All food products in advertising are useful for people.	2.11	1.011	Disagreee
Consumers’ unconsciousness about nutrition originated from the media.	3.06	1.119	Partially agree
Food products ads are often deceptive ads.	3.33	1.179	Partially agree

It was determined that 89% consumers know the concept of media, %72.2 thought media plays role in food consumption. But 61.6% haven’t influenced advertisement on food purchase (Table 3).

Table 3. Consciousness of Consumers on Media

		(%)	**Frequency**
Do you know the concept of media?	YES	**89.4**	344
	NO	10.6	41
Will the media advertisements affect your opinion about the product?	YES	**54.0**	208
	NO	46.0	177
Do you think the media plays a role in the consumption of food?	YES	**72.2**	278
	NO	27.8	107
Have you been influenced by advertisements and buy food?	YES	38.4	148
	NO	**61.6**	237
Do you care to be a product that you hear in the media when you buy food?	YES	25.7	99
	NO	**74.3**	286

Most preferred media tools by consumers obtained as TV and Internet. %53 of consumers used TV, 44% of them Internet (Figure 2).

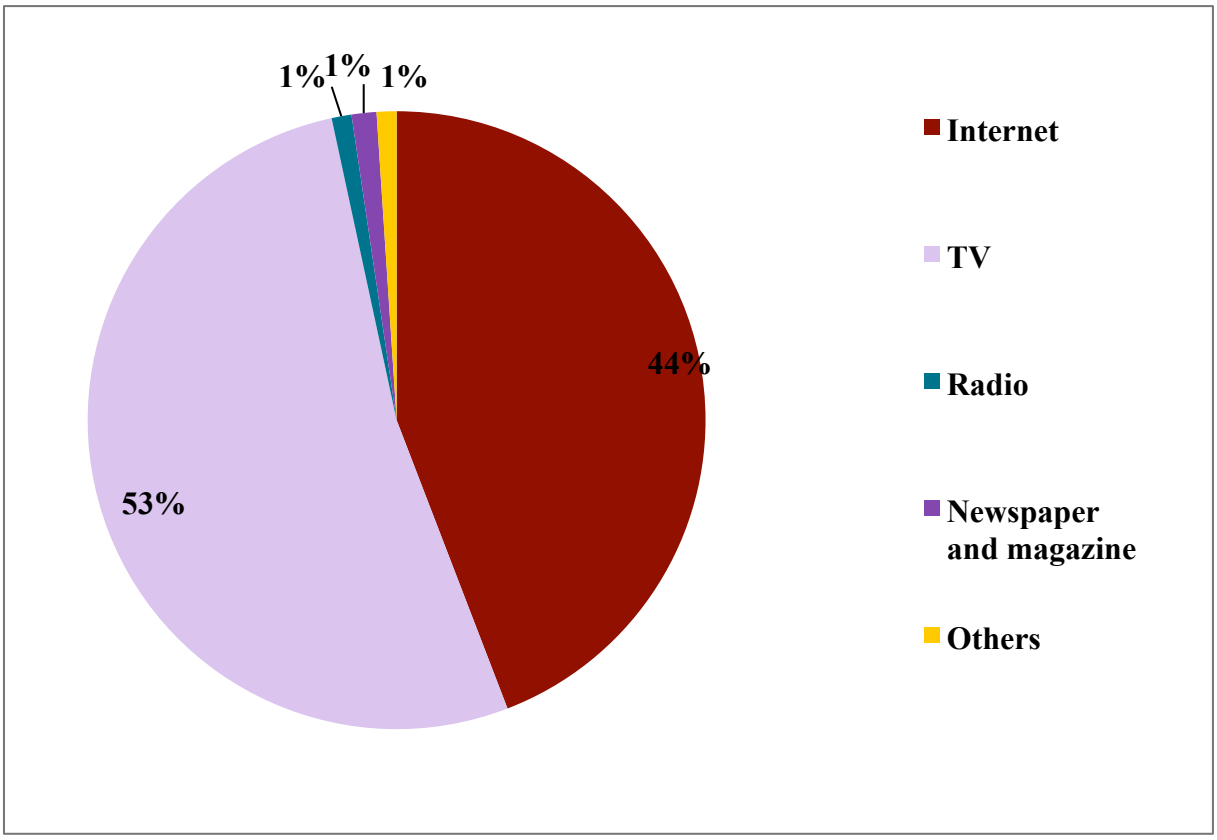

Figure 2. Percentages of Media Tools Used by Consumers

The most affected group from media in food consumption is obtained children. %66 consumer accepted that children the most affected group from media when consuming food.

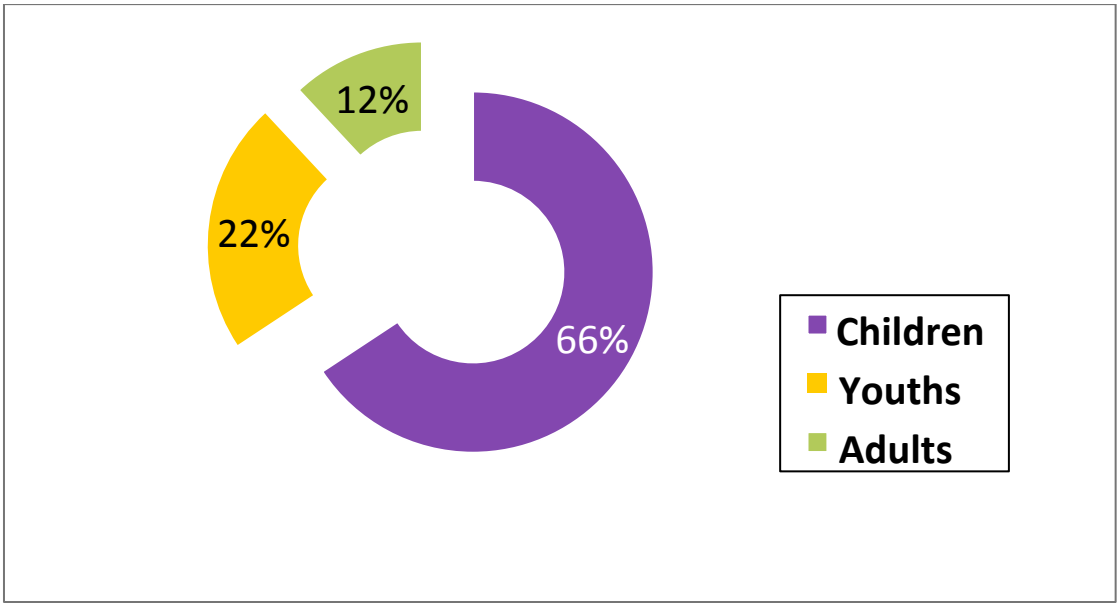

Figure 3. The most affected group from media in food consumption

Consumers with low education levels used mostly TV as media tools. On the other hand high education level consumers preferred Internet (Table 5).

Table 5. Usage of Media Tools by Educational Status

Educational Status	Internet (%)	TV (%)	Radio (%)	Newsp./Mag. (%)	Others (%)
Primary School	22	**75.6**	1.2	1.0	0.2
Secondary School	32.6	**55.8**	2.0	2.7	7.0
High school	42.9	**55.2**	1.9	0	0
Undergraduate	**58.1**	37.6	1.7	0.9	1.8
Undergraduate	**57.9**	36.8	2.6	2.6	0

Married consumer mostly preferred (55.7%) TV, but single people preferred Internet (71.4%) as media tools.

Table 6. Usage of Media Tools by Gender

Gender	Internet (%)	TV (%)	Radio (%)	Newp./Mag. (%)
Married	40.6	**55.7**	1.5	2.2
Single	**71.4**	20.0	5.8	2.9

Adult and elderly people mostly preferred TV but youth people preferred Internet as media tools (Table 7).

Table 7. Usage of Media Tools by Age Groups

Media Tools	Youth (%)	Adult (%)	Elderly (%)
Internet	**77.9**	36.2	1.7
TV	20.9	**58.0**	**82.1**
Radio	0.2	1.6	15.0
Newspaper/Magazine	1.0	2.8	1.2

I was determined that youth and adult people partially agree when elderly people agree with deceptive aspects of food product ads (Table 8).

Table 8. Evaluation of Deceptive Aspects of Food Product Ads by Age Groups

	Youth (%)	Adult (%)	Elderly (%)
I strongly disagree	7.0	9.7	7.1
Disagree	14.0	11.3	14.3
Partially agree	**40.7**	**36.2**	19.0
I agree	12.8	24.9	**42.9**
I absolutely agree	25.6	17.9	16.7

CONCLUSION

It was found that children were affected by media advertisements too much, and this affected their families in the purchase of food. Ordering foods from the Internet did not create trust in consumers. It has been seen that the food advertisements published in the media affect the opinions of consumers. It was seen that media tools were used more by singles than the married, and it was found that the most used media tool was Internet. It has been concluded that the media has a significant effect on consumers. It was determined from the survey data that consumers did not prefer food products that were not published in the media

Ads that are considered to be ineffective and incorrect may be notified to RTÜK (Radio Television Supervisory Board). Measures can be taken to ensure that children are kept away from media tools by imposing restrictions on media use. Reducing measures can be taken for the daily use of media tools such as TV and Internet and found it to be of poor quality.

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MEASURING THE LEVEL OF CONSUMER CONSCIOUSNESS ABOUT FOOD SAFETY: CASE OF KAHRAMANMARAS PROVINCE OF TURKEY

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ABSTRACT

The increase in technological development, economic and social well-being has increased the sensitivity of the majority of consumers on food consumption and has changed their purchasing behavior. The purpose of this study is to determine consumers' food consumption behaviors and determine their level of consciousness about food safety. In this context, a survey was conducted in January and February 2018 with 384 persons determined by proportional sampling method in Kahramanmaras province of Turkey. As a result of the survey, 45.6% of consumers were aware of the concept of safety and consumers mostly pay attention expiry date when purchasing food. It was also found that 56.5% of consumers' willingness to pay extra for secure food and 86.5% consumed packaged products. In addition, it was determined that when faced with spoilt (bad food) consumers complained to the place where purchased.

Keywords: Food safety, consciousness level, consumer behavior

INTRODUCTION

Food safety determined as 'in order to ensure safe food production, obey necessary rules and take measures at processing, preservation, transportation and distribution stages in food production' and include safe, health-friendly and healthy-preserved food concepts (Artık et al. 2013). Food safety according to the Food Law No. 5996; All of measures taken to eliminate the physical, chemical, biological and all kinds of damages in foods (Anonim, 2010).

There are two definitions constitute from Ministry of Agriculture. "Food safety from field to table" or "food safety from farm to fork" In the definitions, it is stated that human health reaches food by protecting from the risks arising from food consumption (Artık et al. 2017).

The Food and Agriculture Organization of the United Nations (FAO) asserts four conditions to ensure food safety. These conditions:

-Equality in access to food

- Sustainable production in food

-Access to food or budget opportunities

-Food quality (Vural, 2015).

Food safety is one of the most important issues in all countries. With the developing technology, environmental and social problems prevent access to safe food. Consumers constitute the latest ring of food security. Therefore, the consumer's purchasing power and awareness is the most important factor in ensuring food security. The low purchasing power and education level of the majority of the consumer community and the lack of consumer awareness cause the enterprises to produce unhealthy and low quality foods. The emergence of diseases caused by foods and thus the occurrence of job losses, the costs of treatment for the elimination of these diseases, the financial burden that it brings to the national economy

reaches to the dimensions that will not be underestimated. For these reasons, food safety and consumer awareness are among the most important issues to be addressed (Onurlubaş ve Gürler, 2016).

In recent years, some studies have been made on consumer consciousness about food safety in Turkey (Bal et. al. 2006; Topuzoglu et al. 2007; Uzunöz et al. 2008; Onurlubas, 2011; Yalcin, 2012; Estürk, 2013; Koc ve Uzmay, 2015). But, there is still need for study, especially in local level.

Aims of this study are determining the factors affecting the level of awareness of consumers about food safety, determination of the characteristics of food products that consumers prefer, determining whether consumers are willing to pay higher prices for reliable food products. Also it is aimed to determine the consumer profile which has information about the quality control-inspection institution.

MATERIAL and METHOD

The data obtained from surveys conducted during February-March 2018 period with 384 consumers which were determined by proportional sampling method in Kahramanmaraş province of Turkey.

RESULTS

It was determined that, 14.3% of the consumers were not literate, 20.8% were primary school graduates, 6.3% were secondary school graduates, 23.7% were high school graduates, 34.9% were a university graduates. Of the consumers surveyed, 51.3% were female and 48.7% were male. The average age of the consumers was found to be 37.86 and family size was 4.51. The average monthly income of consumers is obtained as 2747.14 TL of which 25.6% is food expenditure (Table 1).

Table 1.Characteristics of Consumers

	Min.	**Max.**	**Average**	**Std.Deviation**
Age	18	65	**37.86**	11.717
Income (TL/month)	1000	7000	**2747.14**	1033.663
Food expenditure (TL/month)	200	1500	**703.13**	222.738
Family size	2	8	**4.51**	1.299

The criteria that consumers pay attention to when purchasing food was determined respectively; price (31.5%), health (28.6%), flavor (21.6%), brand (13.3%) and promotions (4.9%) (Table 2).

Table 2. Criteria that consumers pay attention to when purchasing food

Criteria	**Frequency**	**%**
Price	121	31,5
Flavor	83	21,6

Brand name	51	13,3
Safety in terms of health	110	28,6
Promotion	19	4,9
Total	384	100,0

Among the consumers who participated in the study, the most affected tools were food discount days (24.7%), TV ads (22.1%), banner, brochure (20.3%), friends-relatives- neighbor (18.8%) and internet ads (14.1%) (Table 3).

Table 3. Tools where consumers are affected when purchasing foods

Tools	**Frequency**	**%**
TV ads	85	22.1
Discount days	95	24.7
Internet ads	54	14.1
Friends, neighbours, relatives	72	18.8
Banner, brochure	78	20.3
Total	384	100.0

Consumers stated that 45.3% of them know the Ministry of Health, 26.8% of them the Ministry of Agriculture and 25.0% of them the municipalities as the inspection institution (Table 4).

Table 4. Inspection institutions known by consumers (%)

Inspection Institutions	**Frequency**	**%**
Ministry of Agriculture	103	26.8
Ministry of Health	174	45.3
Municipality	96	25.0
Others	11	2.9
Total	384	100.0

Consumers stated that they learned the most information about food safety (35.4%) from their relatives, friends. Radio-television (27.9%), experts (17.2%), internet (16.1%), newspapers and magazines (3.4%) followed this respectively (Table 4).

Table 4. Information sources that consumers learn about food safety

Information sources	**Frequency**	**%**
Radio-television	107	**27.2**
Newspaper-magazine	13	3.4
Relatives-Friends	136	**35.4**
Experts	66	17.2
Internet	62	16.1
Total	384	100.0

It was determined that consumers, 42.2% of them were paid attention the expired date, 22.7% of them additives, 20.5% of them other criteria, 11.5% of them label contains, 3.6% of them shelf life in terms of food safety criteria (Table 5).

Table 5. Food safety criteria that consumers pay attention to

Criteria	**Frequency**	**%**
Expired date	162	**42.2**
Shelf life	14	3.6
Additives	87	**22.7**
Label contains	44	11.3
Others	77	**20.1**
Total	384	100.0

According to the research, 41.7% of the consumers have information about Alo 174 food line. It was determined that 86.5% of the consumers preferred packaged products. In terms of consumers, 54.4% of them did not hear the concept of food safety. In the research, it was determined that 57.8% of the consumers complained when they encountered a defective product (Table 6).

Table 6. Consumers' information about food safety

	Frequency	%
Do you have any information about Alo 174 food line?		
Yes	160	41.7
No	224	**58.3**
Do you prefer packaged items?		
Yes	332	**86.3**

No	52	13.4
Have you heard about the concept of food safety?		
Yes	175	45.6
No	209	**54.4**
Are you complaining when you encounter a defective product?		
Yes	222	**57.8**
No	162	42.2

The reasons of the consumers not complaining when they encountered the product, respectively, not knowing where to go (39.6%), thinking that they would not get results (29.3%), thinking that they would not be interested (21.3%), the distance of the purchased place (9.1%) (Table 7).

Table 7. Reasons why consumers do not complain when they encounter a defective product

Reasons	**Frequency**	**%**
Because the place purchased is far away	15	9,1
I don't think I can get results	48	29,3
I don't know where to go	65	39,6
I think they won't care	35	21,3
Total	164	100,0

It was determined that, 56.8% of consumers were willingness to pay extra for safe food and 43.2% were not willing's to pay extra (Table 8).

Table 8. Consumer's willingness to pay extra for safe food

Willingness to pay extra for safe food	**Frequency**	**%**
Yes	218	56,8
No	166	43,2
Total	384	100,0

CONCLUSION

It is determined that 54.4% of the consumers in the province of Kahramanmaraş do not hear the concept of food safety. Information about food safety should be given consumers and raise awareness. While the rate of hearing the concept of food safety is low in primary school graduates, it is seen that this rate increases in university graduates. People with low levels of education should be informed about this.

'Reliable Food Healthy Life' campaign was launched by the Ministry of Agriculture and Rural Affairs and ALO 174 food line was introduced. According to the survey data, it was determined that 58.3% of the consumers never heard of this line. For this purpose, consumers should be informed about the presence of this line in television programs.

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THE FACTOR AFFECTING ON WEANING WEIGHTS OF HAIR GOATS

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ABSTRACT

Hair goat is a dominant goat breed in Turkey. It has low-moderate heritability in terms of meat yield. In addition to inheritance, this trait depends on many environmental factors. Such as; nutrition, temperature, year, season, age of dam, parity, birth type, sex, birth weight, farm, size of farm, kid rearing method and therefore the farm management can be affect on weaning weight.

In this study, the data obtained from 28 hair goat farms from 2014 to 2017 in İzmir province of the national livestock breeding project. Some factors that effect on weaning weight were examined. The CRT algorithm was used to obtain decision tree with categorical (sex, year of birth, parity, age of dam, birth type and size of farm) predictors and continuous response variable (weaning weight).

The sex factor was estimated as the first subgroup variable that describes the weaning weight. It has been determined that describes weaning weight for male kids has changed with age of dam. The 3 and 4 years old dams had heavier male kids than the male kids that those of dams at 1, 2, 5 and 6 years of age. On the other hand, weaning weight of female kids have changed with year of birth. The female kids at raised in 2014 had heavier than body weight that those raised in 2015, 2016 and 2017.

Key words: Hair goat, Body Weight, Decision Tree, CRT

INTRODUCTION

In the study, Turkey Food and Agriculture and the Ministry of Forestry, Agricultural Research Directorate General as part of the university and sheep and goat province carried out in conjunction with associations of national small animal breeding projects, Izmir data taken during the 4 years of the 28 goats businesses in the province were evaluated. Izmir, Western Turkey, Mediterranean under the influence of Mediterranean climate, population density is 356 / km2, which is a province. Hair goat is the dominant goat breed in Turkey. According to TUIK data, in 2017, 10.419.027 numbers of Hair goats which establish 99% of total goat population. However, there are some differences among the regions. In this project, the effect of age, age of dam, parity, birth type, sex and farm size factors were evaluated on body weight of 8000 and at 90 d old kids. When working with such large data sets in livestock, a method used is "Data Mining". This method is a data analysis technique that helps to find the connection between them by examining the relationships within a large amount of data and to reveal the hidden information within the database systems (Kalikov, 2006).

The decision tree method in data mining is widely used. There are many algorithms used in this method. ID3, C4.5, C5.0, CART (Classification and Regression Tree), CHAID (Chi-Square Automatic Interaction Detector) and QUEST (Fast Response Active Statistical Tree) are some of them. The regression tree method is an alternative to the general linear models used in animal husbandry data evaluation (Eyduran et al., 2008).

MATERIAL AND METHODS

In the present study, total of 7990 kids obtained from 28 goat farms of the National Livestock Breeding Project between 2014 and 2017 in Izmir province were used. Factors affecting weaning weights on Hair Goats were investigated by decision tree method. CRT algorithm categorical (sex, year of birth, parity, age of dam, birth type and farm size) predictors and continuous response variable (weaning weight) are used to obtain a decision tree.

The CRT algorithm was developed by Breiman et al. (1984) which is a solution methodology. It examines the relationships between independent variables and the dependent variable in a model that can be defined as tree. In the tree model, the decision-making points are called nodes. The relationships begin with the initial node (root or family node), which contains all of the values and is the most complex node. When the entire branching is over, the most successful decision tree is determined and the objects are assigned to the relevant classes. The independent variables are divided according to the relationships with them by a double branching between each other in a heterogeneous/homogeneous sub-node (child node). Therefore, when the division of each child node from the family node occurs, the child node becomes more homogenous than the family node (Takma et al., 2017). In this way, the observations in the nodes for the regression trees are assigned to the appropriate one from the two child nodes according to the values of the independent variable they have. After the child nodes, terminal nodes with the most homogenous structure are reached. This structure is called the classification tree if the dependent variable is continuous and the regression tree is discrete (Jarošík, 2011). Since both the regression tree and the classification tree analysis are nonparametric methods, parametric analysis does not require the normality, homogeneity and linearity requirements required by the methods (Breiman et al., 1984).

In the regression tree method, the problem of reduction (minimization) applied to the separation of variables into sub-nodes is solved as follows:

$$\underset{x_j \le x_j^R,\ j=1,\ldots,M}{\arg\min} \quad [P_l Var(Y_l) + P_r Var(Y_r)]$$

Here, P_l and P_r probabilities of the left and right nodes, respectively. M is the number of variables in the training set. The variable J is shown as "x_j". x_j^R indicates the best value of the variable x_j. $Var(Y_l)$, $Var(Y_r)$ are vectors for which mutual right and left lower nodes are responsible. $x_j \le x_j^R$, j=1,…,M "means the optimal separation inquiry.

In this study, the decision tree of the sex, year of birth, parity, age of dam, birth type and farm size which are effective on weaning weight were analyzed by using IBM SPSS 20 (SPSS, 2011).

RESULTS AND DISCUSSION

The descriptive statistics of the body weight at 90 d, sex, year of birth, parity, age of dam, birth type and size of farm were given in Table 1.

Table 1. Descriptive statistics and frequencies of the response and predictor variables

Size of Farm		Frequency	Percent
	1	1942	24.3
	2	1926	24.1
	3	4122	51.6
Birth Year			
	14	1808	22.6
	15	2317	29.0
	16	2196	27.5
	17	1669	20.9
Sex			
	Male	3850	48.2
	Female	4140	51.8
Birth Type			
	Single	7079	88.6
	Twin	911	11.4
Age of Dam			
	1	182	2.3
	2	746	9.3
	3	1450	18.1
	4	1609	20.1
	5	2169	27.1
	6	1834	23.0
Parity			
	1	928	11.6
	2	1450	18.1
	3	1609	20.1
	4	2169	27.1
	5	1834	23.0

	Mean ± Std. Error	Std. Deviation	C.V (%)
Body Weight at 90 d	15.00±0.03	2.94	19.6

In this study, by The CRT algorithm all factors except birth type were found important on the body weight. The sex factor was estimated as the first subgroup variable that describes body weight at 90 d of kids. It has been determined that describes body weight at 90 d of kids for male kids has changed with age of dam. The 3 and 4 years old dam had heavier male kids than the male kids that those of dams at 1, 2, 5 and 6 years of age. On the other hand, body weight at 90 d of female kids has changed with year of birth. The female kids at raised 2014 had heavier body weight that those raised at 2015, 2016 and 2017 (Figure 1).

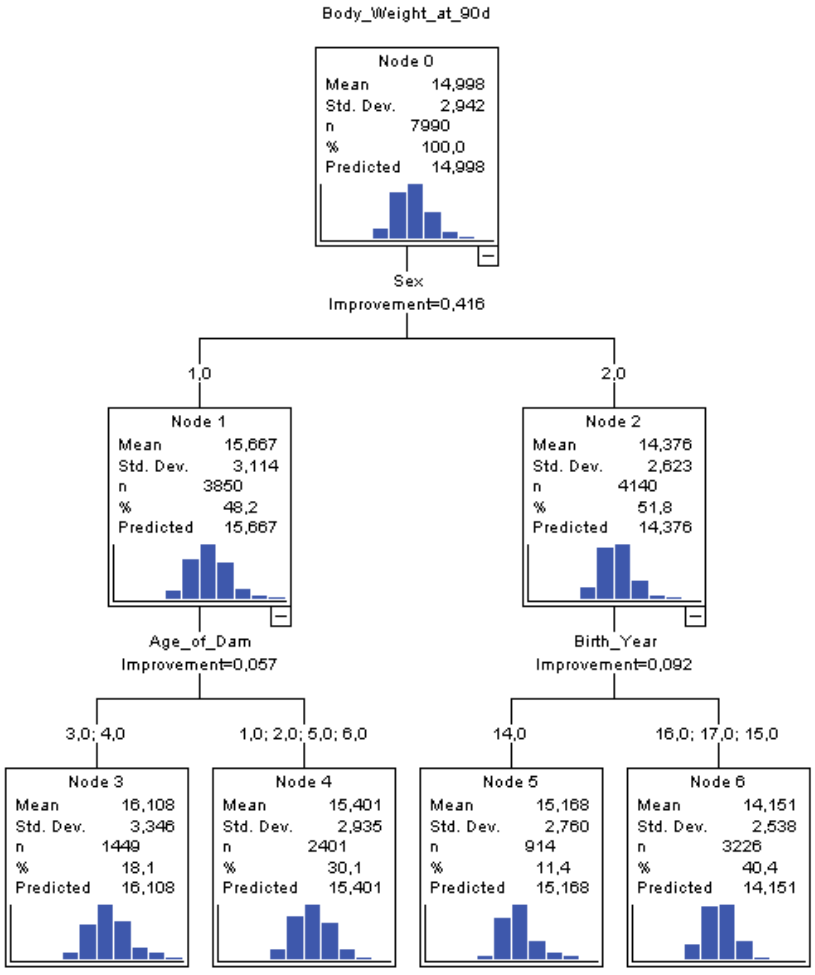

Figure 1. Decision tree diagram obtained by CRT for body weight at 90 d

Table 2. Descriptive statistics of nodes

Node	Mean	Std. Deviation	N	Percent	Predicted Mean	Parent Node	Primary Independent Variable		
							Variable	Improvement	Split Values
0	15.00	2.94	7990	100.0%	15.00				
1	15.67	3.11	3850	48.2%	15.67	0	Sex	0.42	1.0
2	14.38	2.62	4140	51.8%	14.38	0	Sex	0.42	2.0
3	16.11	3.35	1449	18.1%	16.11	1	Age of Dam	0.06	3.0; 4.0
4	15.40	2.93	2401	30.1%	15.40	1	Age of Dam	0.06	1.0; 2.0; 5.0; 6.0
5	15.17	2.76	914	11.4%	15.17	2	Birth Year	0.09	14.0
6	14.15	2.54	3226	40.4%	14.15	2	Birth Year	0.09	16.0; 17.0; 15.0

As seen in Figure 1, body weight at 90 d of kids was the root node (Node 0: 15.00±2.94 kg, n=7990) and located at the top of this Figure. The child nodes were the Nodes 1-6. In the root node, kids were divided into two nodes based on sex: Node 1 (Sex: Male, n=3850) and Node 2 (Sex: Female, n=4140). The mean of body weight at 90 d for kids in Node 1 and Node 2 were predicted as 15.67±3.11 kg and 14.38±2.62 kg, respectively. Node 1 was split into age of dam variable Node 3 (Age:3 and 4, n=1449) and Node 4 (Age: 1,2,5 and 6, n=2401). The mean and standard deviation of body weight at 90 d for Node 3 was 16.11±3.35 and Node 4 was 15.40±2.94.

On the other hand, Node 2 was split into year of birth as Node 5 (2014, n=914) and Node 6 (2015, 2016 and 2017, n=3226) with 15.17±2.76 and 14.15±2.54, respectively. The child Nodes 3, 4, 5 and 6 were not divided. Moreover, the Node 3 has the highest mean for body weight at 90 d. Also the Node 6 has the lowest mean for body weight at 90 d (Figure 1, Table 2).

As a result of the study, the sex factor influenced the birth weight on the 90^{th} d. All variables except birth type were found to be effective. This is due to the success of the project. Breeders are more attentive management conditions for twin born kids and they provide supplementary feed support. Therefore, the fact that the body weight increase due to the type of birth is not significant is an expected situation for this project.

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MODELING OF LACTATION MILK YIELD WITH SPLINE REGRESSION METHOD

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ABSTRACT

In statistics, regression analysis is an important tool for analyzing and modeling of the data. The simple regression investigates the relationship between a dependent and independent variables. On the other hand, multiple regression explains the relationship between a dependent variable and multiple independent variables. In both cases, all of the scatter diagrams of relations for dependent and independent variables are expressed by a single function. The case where the point distributions of the dependent and independent variables are examined by separating the points from the specific points (knot) is called "spline regression.

In this study 5226 milk yield records of 557 Holstein-Friesian cows from İzmir Province Cattle Breeding Association were used. The relationship between lactation milk yields in dairy cattle and independent variables was analyzed by using piecewise regressions. Determination of Coefficient (R^2), Durbin-Watson Statistic (DW), Akaike Information Criterion (AIC) and Square Root of Standard Error of Mean (RMSE) were calculated to compare spline regression models which have single, two and three-knots. R^2, DW, AIC and RMSE values were found as 0.9901, 2.51, -1.21 and 0.19, respectively in the single knot model; 0.9904, 2.65, 0.51 and 0.22, respectively in the two-knots model and also 0.9980, 3.02, -13.06 and 0.11, respectively in the three-knots model. From this results, it can be said that the use of spline regression method for modeling of lactation milk yield is the best fit method.

Key words: Spline regression, piecewise regression, Holstein-Friesian

INTRODUCTION

In the world, especially in developing countries, the increasing demand for food also increases the demand for animal products and it is important to develop animal breeding depending on the need to consume animal products for a healthy life. In our country, approximately 25% of agricultural production is composed of animal sector. Milk is the most important source of income in animal breeding. Dairy cattle are an important source of milk production (Oskay, 2016). In our country, mainly used in dairy cattle breeding is Holstein Friesian because of high milk yield and adaptation ability.

Milk yield controls can be made according to lactation milk yield and / or 305-day milking measurements. The lactation milk yield can be defined as the milk yield given by the cows until the time taken from the calving to the dry period. After the lactation period begins gradually to reach peak milk yield and milk yield falls towards the dry period occurs (Keser, 2016).

Regression analysis is an important topic of statistics. The equation of the relationship between an independent variable and an independent variable is called "simple regression", and the equation of the relationship between a dependent variable and more than one

independent variable is called "multiple regression". In both cases, the scatter diagrams are all expressed in a single function.

When the point distributions of dependent and independent variables are analyzed by dividing them from specific points (knots), the case is called "spline regression". All point distributions are expressed using range functions instead of a single function in spline regression. Spline regression is a method that allows to study the point distributions of any observation set by using the sub models created by determining the appropriate points instead of a single model. In other words, it is based on the fact that the set of observations is expressed by polynomials at smaller intervals, dividing into various intervals.

Cubic spline regression models have been used to model lactation period with test day milk yield instead of the others (White and Brotherstone (1997); Jamrozik et al.(2009); Sahin and Efe (2010); Geha et al. (2011); Koncagul and Yazgan (2011), because cubic spline regressions have high compliance excellence in modeling of lactation curves. In addition, more flexible curves can be obtained with the increase in the number of knots (Çankaya et al., 2014).

White et al. (1999), n the modeling of lactation curves of 2885 lactation milk records of 30 Holstein bulls, they used cubic spline regression and restricted cubic spline regression models. In this study, the results obtained from cubic spline and restricted cubic spline regressions obtained with different knots were compared with the results obtained with Wilmink model and they recommended the use of segmented regression models because of their more flexible nature.

Bergfelt et al. (2003), used different regressions to detect outliers for different models used in dairy cattle breeding.

Druet et al. (2003) examined four different models (polynomial, Ali and Schaffer, Wilmink and partial regression) in the French Holstein dairy cows. In this study, it is stated that the fragmented regressions are less than the required number of parameters, they have a flexible structure and they stand out from other models due to their goodness of fit.

Silvestre et al. (2006), compared 7 different models (Wood, Wilmink, Ali and Schaffer, cubic spline regression and 3 different polynomials) used in modeling lactation curves in dairy cattle. In the comparison of models, they used the coefficient of determination, standard deviation of the model and Durbin-Watson test statistic.

In this study, it is aimed to model the lactation milk yield in the Holstein Frisian cows by partial regression model.

MATERIAL AND METHODS

In this study, we investigated the relationship between lactation milk yields in dairy cattle and independent variables, and used piecewise regressions and presented it as an alternative to the models used in this area.

The study material consisted of 5226 dairy yield records of 557 Holstein-Friesian from Izmir Province Cattle Breeding Association. We used the means of the cows' milk yield and got a smooth curve.

With the Spline Regression method we divided the curve four pieces, then with the formulas analyzed this results on SAS 9.0 program.

Spline regression is a method that allows to study the point distributions of any observation set by using the sub-models created by determining the appropriate points (knots)

instead of a single model. In other words, it is based on the fact that the set of observations is expressed by polynomials at smaller intervals, dividing into various intervals.

The data obtained from the study are analyzed after the analysis; values such as total determination coefficient (R^2), Durbin Watson statistic (DW), Akaike information criterion (AIC) and square root of standard error of mean (RMSE) were calculated.

RESULTS AND DISCUSSION

As a result, R^2, DW, AIC and RMSE values were 0.9901, 2.51, -1.21 and 0.19 respectively in single knot model; 0.9904, 2.65, 0.51 and 0.22 in the two-knots model, respectively; were found to be 0.9980, 3.02, -13.06 and 0.11, respectively, in the three-knots model.

According to the results of the study, R^2 value was found as 0.9901 in single knot model. these values were 0.9904 in two knots and 0.9980 in three knots. This represents the convergence of the model's compatibility to perfection.

The value of DW always takes a value between 0 and 4, and a value greater than 2 indicates a negative relationship, a negative result for this value is a desirable feature of our model, and the values of DW were 2.51, 2.65 and 3.02 for single, two and three knots, respectively.

Normally accepted values for AIC can be expressed as the smallest possible value, and according to the results of the study, the value of -1.21 in the single-knot model and 0.51 in the two-knots model are calculated as -13.06 in the three-knots, and the compatibility of the model has been increased to the highest level.

The smaller the RMSE, the more accurate the representation of each other and the population. In this statement; 0.19 in the single-knot model and 0.22 in the two-knots model was found to be 0.11 in the three-knots model. This means that we prefer the number of three-knots.

Considering the results of this study, it is clear that the Partial Regression Method is a suitable method for modeling lactation curves.

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EFFECTS OF SPRAY-DRIED SOURDOUGH POWDER ON RHEOLOGICAL PROPERTIES OF SOURDOUGH BREAD

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ABSTRACT

The aims of this study are to produce sourdough powder and to evaluate potential use of sourdough powder in bread making industry. Type III sourdough are dried sourdough in powder form. They are convenient, simple in use and result in standardized end products. For this purpose, spray-dried sourdough powder (SDP) produced from traditional sourdough by using pilot-scale spray dryer and the chemical and microbial characteristics of the obtained sourdough powder were investigated. Also effect of different levels of SDP (3%, 6%, 9% and 15% w/w) on dough properties of wheat flour was studied. Dough properties were investigated by using Farinograph and performing dynamic oscillation test by using rotational rheometer. Water absorption was not significantly affected by SDP addition. Dough development decreased with an increase in SDP level (p<0.05). While dough stability decreased (p<0.0001), degree of softening was increased (p=0,0004). The results of oscillatory measurement showed that all samples shown gel like behavior (G'>G''). The absolute value of complex modulus (|G*|) increased with increasing frequency (p<0,0001). Control had highest |G*| value. Acidification resulted in a reduction of elasticity and firmness of the dough according to |G*| value.

Key words: Spray dried, sourdough powder, sourdough bread, rheological properties.

INTRODUCTION

The sourdough method is one of the oldest biotechnological process that is used for bread production. Due to increasing consumer demands for more natural, tasty and healthy food, the researches focus on sourdough bread production.

The use of sourdough improves the quality and flavor of breads (Corsetti et. al 2000; Thiele et al 2002). It has effect on shelf-life of bread because can retard the stalling process and prevent bread from mould and bacterial spoilage (De Valdez et al., 2010; Gerez et al., 2009). In addition, sourdough fermentation can change healthiness of cereals; it retards starch bioavailability, increase levels of various bioactive compounds and mineral bioavailability (Katina et al., 2005).

Sourdough is mixture of flour and water, in which dough acidification occurs due to the lactic acid bacteria (LAB) activities (Iacumin et al 2009). LAB is dominant microorganism in sourdough microflora. Yeast are also associated with LAB in sourdough. They are liable for dough leavening (Corsetti & Settanı, 2007). Major changes in dough characteristic occurs due to the addition of sourdough (Clarke et al., 2002; Clarke et al., 2004; Ketabi et al., 2008). Because of the variation between sourdoughs with regard to dough yield, type of starter and fermentation time used the effects are complex (Wehrle et al , 1997). Most of the effects of sourdough have been associated to a drop in pH value that occurs because of production of organic acids. However, whole fermentation process has effects on properties of the dough than simply produces acid (Wood et al. 1975; Thiele et al., 2002). Due to the growth of LAB optimum (acidic) conditions alters the gluten network. There is a positive net

charge at pH below 4.0 that increase protein solubility and stop the formation of new bond (Clarke et al., 2004; Schober et al. 2003). These conditions allow greater access by proteolytic enzymes allowing for more efficient properties (Thiele, 2002). Consequently, acidification help swelling of gluten, and increase gas retention, resulting in products with good texture and massive volume (Park et al, 2006).

A number of studies have examined the influence of sourdough on dough properties by empirical and fundamental rheological tests (Wehrle et al. 1997; Clarke et al., 2002; Angioloni et al., 2006). In comparison to dough prepared with baker's yeast, acidified dough requires shorter mixing time and have less stability than normal doughs (Hoseney, 1994). The acidification also results in a large reduction of elasticity and firmness of the dough (Clarke et al.,2004). It should be noted that sourdough addition can have a negative effect on bread quality (Armero and Collar, 1996) depending on fermentation conditions and sourdough types. If fermentation conditions were not optimized, sourdough addition would even increase bread firmness (Katina et al., 2005). Moreover, it has been reported addition of excess concentrations of proteolytic enzymes have negative effects on bread quality (Arendt et al, 2007).

Sourdoughs classified into three different group, on the basis of the technology applied (Böcker et al., 1995). Type III sourdough are dried sourdough in powder form, that are defined as starter cultures. Traditional sourdough bread making is a time-consuming process. However, dried sourdoughs are simple in use and convenient, also at end of the production standardized products obtained (De Vuyst and Neysens, 2005). They are added to bread as acidifier supplements and aroma carries. Type III sourdough associated LAB are resistant to drying and are able to survive in that form. Spray-drying is one of the most commonly used drying techniques for production of Type III sourdough (Decock and Cappelle, 2005). It is reported that dried sourdoughs increased water absorption on the other hand dough stability decreased (Tafti et al., 2013; Kulp and Lorenz 2003). According to our best knowledge effect of spray-dried sourdoughs on dough rheological properties is rare. In this study, we investigated the effect of different levels of dried traditional sourdough powder on dough rheological properties.

MATERIAL- METHODS

Material

Wheat flour was gift from Istanbul Halk Ekmek Industry and Trade Inc. and stored at 4 °C during analysis. Wheat flour was characterized by a protein content of %12,95, an ash content of 0,637 and moisture content of 13,89%. Sourdough was supplied from Oğuzlu district in Turkey.

Methods

Determination of Chemical Properties of Sourdough and Sourdough Powders

The total titratable acidity and pH of sourdough and sourdough powder were measured following the method of Savic et. al (2007). 10 g of sourdough, and 90 ml distilled water was mixed and homogenized. pH was determined in this suspension using pH meter (STARTER300). For TTA determination, in the same aliquot 3% fenolfitalyn was added approximately 3 drops as an indicator, then titrated against 0.1 N NaOH until stable light red color was obtained. TTA was expressed as the amount (mL) of NaOH used. The analyzes were carried out in triplicate. To determine of moisture of sourdough (RADWAG MA 50.R) moisture analyzer was used. 1 g of powders was weighted and placed into device. The analyzes were carried out in triplicate.

Determination of Microbiological Properties of Sourdough and SDP

Lactic acid bacteria and yeasts were counted before and after drying of sourdough. 10 g of sourdough was added in 90 ml of sterile 0.1% peptone water, homogenized and diluted in series. The number of microorganisms were determined by surface spread method on triplicate MRS agar with 0.01 cycloheximide and triplicate SDA. MRS agar and SDA were used to determine respectively; amount of lactic acid bacteria and yeast. Enumeration was carried out after incubation at 30 °C for 3 days. Lactic acid bacteria were incubated at micro aerobic condition.

Spray-drying

Spray-drying process was conducting using a pilot scale spray dryer with a centrifugal atomizer. The inlet and outlet air temperature were 160 °C and 90 °C. The spray-dried powder was stored in a sterile jar at 4 °C for further analysis.

Preparation of Flour Blends

Spray-dried sourdough powder were added to flours at different concentrations (3%, 6%, 9% and 15% w/w flour basis) (Tafti et al., 2013). Sourdough powder was added to the formulation instead of flour.

Rheological Measurements

Flour rheological properties including water absorption, dough stability, dough development time and degree of softening were determined using Farinograph (E-Brabender). Farinograph was calibrated and reached to 30 □, after that average 300 g samples of wheat flour were weighed and placed into corresponding Farinograph mixing bowl. Water was added in mixing bowl until a graph about 500 FU line was drawn. The analyzes were continued for 20 minutes and carried out in duplicate.

Doughs for rheological measurement were prepared by adding 300 g of wheat flour, water equal to two minus of water absorption capacity (%) that determined before, 2% dry instant active yeast and 1.5% salt. All ingredients were mixed in the mixer (Oztiryakiler), for 3 minutes at 2-speed and then 9 minutes at 5-speed. 5 g portion of obtained dough took into covered petri dishes.

Dynamic oscillation tests were performed on rotational rheometer (Antonpaar MCR 302, Austria) using parallel-plate geometry (25 mm plate diameter and 2 mm plate gap). An amplitude sweep test was used to identify the linear viscoelastic region and found to be 0.1%. A frequency sweep test was used to characterize the doughs. Oscillation frequencies were 0.1-10 Hz and 11 measuring points were recorded at 25°C. Elastic modules (G´), viscous modulus (G´´) and absolute value of the complex dynamic modulus (G*) were determined. The analyzes were carried out in duplicate.

Statistical Analysis

Determinations were carried out duplicate or triplicate. Mean values and standard deviations were calculated. Data were analyzed using JMP 6 software. Analysis of variance was performed to determine significant differences (p<0.05) between means.

RESULTS AND DISCUSSION

The spray-dried sourdough powder had a moisture content of 5.285±0.113. The pH and total titratable acidity of the sourdough powder was 3.796±0.005 and 18.933± 2.025 respectively. Spray drying reduced lactic acid bacteria and yeasts populations of sourdough to $3{,}06.10^5$ CFU/g and $8{,}36.10^4$ CFU/g compared to initial value of $5{,}2.10^9$ CFU/g and $5{,}63.10^9$ CFU/g respectively (p <0.005).

Dough properties were investigated using Farinograph (Table 1). Water absorption was not significantly affected by sourdough powder addition. Similar findings were also reported by Tafti et al. (2013). They reported that there was no significant difference among the levels of SD sourdough except control. Also, Clarke et al. (2002), reported that chemically acidified dough had no effect on water absorption. Dough development significantly decrease with an increase in sourdough level except 3% levels of sourdough powder addition (p<0.05). While dough stability (p<0.0001) significantly decreased, degree of softening (DOS) was increased with an increase in sourdough powder level (p=0,0004). It was agreement with Tafti et al. (2013) who found that the addition of SD sourdough reduced stability and increased level of dough softening. Koceva Komleni et al. (2010) and Clarke et al. (2002) also reported that addition of different type of sourdough caused reduction in dough stability and increased level of DOS. Wehrle et al. (1997), reported that acid addition resulted in firmer dough with lower stability. It is also reported acidified dough requires shorter mixing time and have less stability than normal doughs (Hoseney, 1994).

	WA%	**Development time (DT) (mm:ss)**	**Stability (mm:ss)**	**DOS (FU)**
Control	57,65±0,92a	05:37±0,03a	13:33±0,02a	34,5±2,12a
3% SDP	57,55±0,35a	05:49±0,02a	09:13±0,03b	52±7,07b
6% SDP	57±0,28a	04:47±0,02ab	06:50±0,002c	74±9,89bc
9% SDP	56,65±0,07a	04:20±0,01ab	05:51±0,00c	93±4,24cd
15% SDP	56,2±0,56a	03:44±0,002b	04:03±0,002d	139,5±13,43d

Table 1. Farinograph Mixing Characteristics of Doughs

WA- water absorption; DOS- degree of softening; means with similar letters within the same row are not significantly different *(*p<0.05)

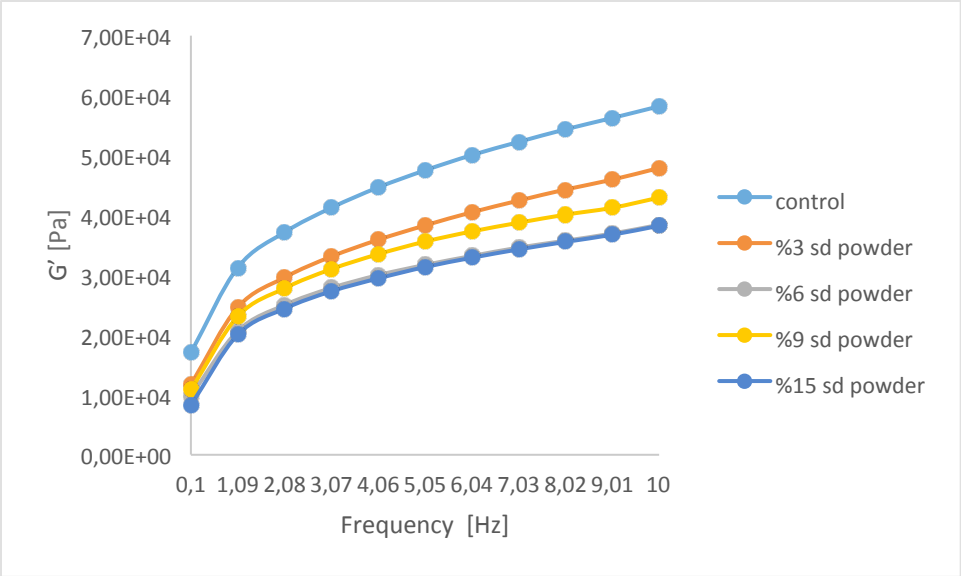

Figure 1. Value of Elastic Modulus (G´) of Dough Samples

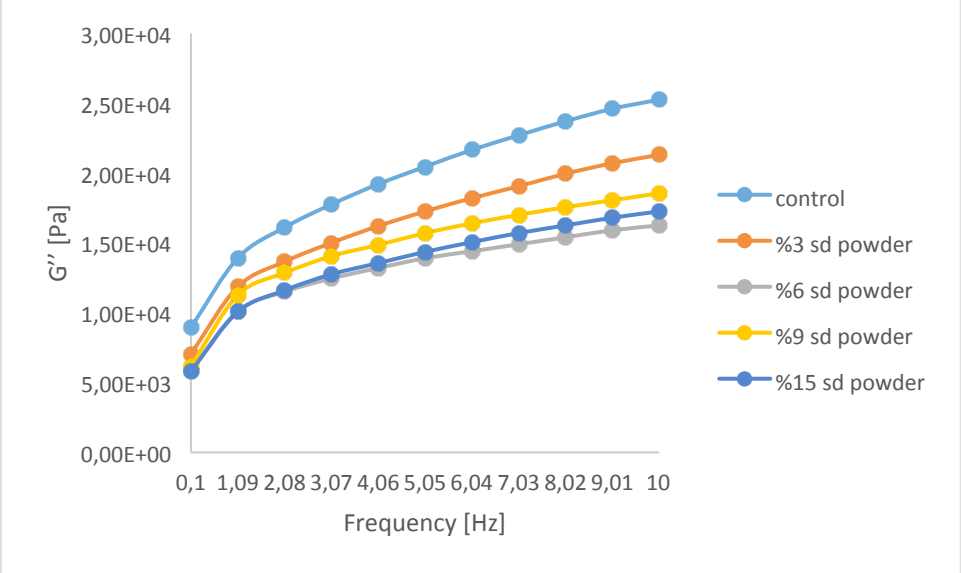

Figure 2. Value of Viscous Modulus (G´´) of Dough Samples

The results of rheological measurements showed that in the whole range of frequency all samples shown gel like behavior since elastic modulus (G´) was higher than viscous modulus (G´´) (Figure 1 and 2). The absolute value of complex modulus (|G*|) significantly increased with increasing frequency (p<0,0001), and shape of curves for all doughs tested was similar (Figure 3). Control dough had a highest |G*|value over the whole frequency range, and also |G*| value significantly decrease with an increase in sourdough powder level except 6% and 15% levels of dough addition had same results (p<0.0001). Higher values for |G*| indicated that dough was firmer. Our findings were similar with Clarke et al. (2002) that found control dough had highest |G*| value over the whole frequency range, indicating that the addition of lactic acid or sourdough reduced |G*|. Also, Angioloni et al. (2006), reported that addition of sourdough causes lower elastic modulus (G´). Acidification resulted in a reduction of elasticity and firmness of the dough. It may be hypothized that physicochemical changes in the protein network induced by addition of SDP may have been responsible for the

greater expansion. Because at the low pH values there is a sizeable positive net charge and proteins are more soluble and causes stop the formation of new bond (Clarke et al., 2004; Schober et al. 2003). Also, these conditions allow greater access by proteolytic enzymes (LAB enzymes and wheat flour enzymes) allowing for more efficient properties (Thiele, 2002).

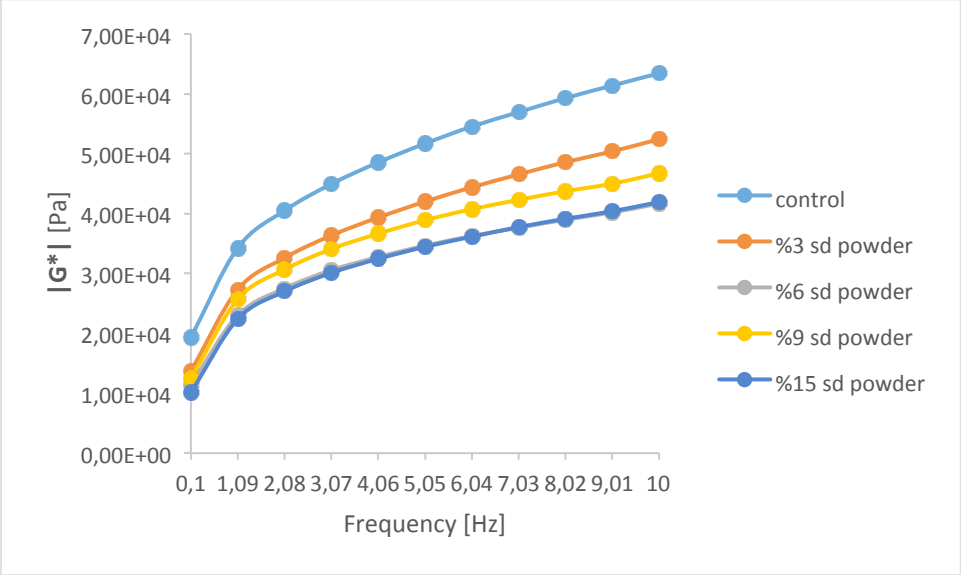

Figure 3. Value of Complex Modulus (|G*|) of Dough Samples

CONCLUSIONS

The addition of SDP had a significant impact on dough rheological properties. The obtained data showed that water absorption was not significantly affected by sourdough powder addition. However, dough development significantly decreased with an increase in SDP level. While dough stability significantly decreased, degree of softening was increased. Acidification resulted in a reduction of elasticity and firmness of the dough according to |G*| value. This indicated major changes in the dough structure that were caused by low pH.

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CONSUMPTION TRENDS OF READY TO EAT BREAKFAST CEREAL AMONG SECONDARY AND HIGH SCHOOL STUDENTS IN MANISA PROVINCE: A COMPARISON BY AGE AND GENDER

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ABSTRACT

499 students (314 female, 185 male; 355 between age 11-14 and 144 between age 15-18) from secondary and high schools in Manisa province (Hedef collage, Hedef high school, MY collage, İsmet İnönü Girls' Vocational School) were subjected to a questionnaire including 28 questions related to ready to eat breakfast cereal consumption and buying trends. Effect of age (11-14, 15-18) and gender on breakfast cereal consumption trends were evaluated by SPSS Chi Square Test. 48.5% of participants (48.4% of female participants, 48.6% of male participants) consumed ready to eat breakfast cereal while 51.5% did not prefer to. 54.9% of participants between 11-14 ages and 32.6% of participants between 15-18 ages preferred to consume breakfast cereals. The main reason for breakfast cereal consumption was defined as 'finding delicious' by both female (34.2%) and male (46.1%) participants while the secondary reason was 'finding practical'. 38.7% of the participants between 11-14 ages and 38.3% of the participants between 15-18 ages also consumed breakfast cereals because they found delicious. 85.8% of the participants stated that they usually consumed breakfast cereals with milk. 5.9% always added fresh fruits, 2.1% always added dried fruits, 7.9% always added nuts, 5.9% always added sugar and 11.3% always added honey.

Key words: Ready to eat breakfast cereals, students, consumption trends

INTRODUCTION

Ready-to-eat breakfast cereals (RTEC) have been popular among children and adolescents and also people on diet in the last years as they are delicious, easy to prepare and have a wide range of flavour. Most of the cereals are fortified with vitamins and minerals and contain dietary fiber. Therefore, RTEC consumption has been reported to improve macro and micronutrient and dietary fiber intake (Morgan et al., 1981; Nicklas et al., 1993; Stanton and Keast 1989; Gibson 2003). Moreover, wholegrain breakfast cereals are linked with lower cardiovascular disease, total mortality, diabetes, hypertension risk and lower weight gain in men (Bazzano et al., 2005; Kochar et al., 2007; Liu et al., 2003). Children eating cereals are reported to consume significantly less fat and cholesterol (Albertson et al., 1992; Albertson et al., 2003; Morgan et al., 1981; Stanton and Keast 1989)

RTEC consumption is associated with improved overall diet quality (Albertson et al., 2008; Gibson and Gunn 2011; Nicklas et al., 1998a; Williams, 2007; Wilson et al., 2006) and improved mental and physical performance (Nicklas et al., 1998b; Rampersaud et al., 2005) by several researchers. On the other hand, regular consumption of RTEC was related with lower body weight (Albertson et al., 2003; Deshmukh-Taskar et al., 2010; Kafatos et al., 2005; Kosti et al., 2008; Panagiotakos et al., 2008). Our former study (Savlak et al. 2016) investigated RTEC consumption trends of university students in Manisa province. However,

RTEC consumption trends of secondary and high school students were not examined. In this study, RTEC consumption trends of secondary and high school students were examined through a questionnaire and a comparison by age (11- 14, 15 - 18) and gender was carried out.

MATERIALS AND METHODS

Randomly selected and volunteer 499 students (314 female, 185 male; 355 between age 11-14 (secondary school students) and 144 between age 15-18 (high school students)) from secondary and high schools in Manisa province (Hedef collage, Hedef high school, MY collage, İsmet İnönü Girls' Vocational School) were subjected to a questionnaire including 28 questions related to ready to eat breakfast cereal consumption trends. Gender and age were the independent variables in the study and results were analysed statistically by Pearson chi-square test using PASW Statistics Ver.18. (SPSS, 2009).

RESULTS AND DISCUSSION

Age and gender profile of participants were given in Table 1.

Table 1. Age and Gender Profile of Participants

Age	N	%	Gender	n	%
11-14	355	71.14	Female	314	62.93
15-18	144	29.86	Male	185	37.07

Breakfast and RTEC Consumption Trends of Participants

Participants were first asked if they had breakfast regularly in the mornings. The effect of both gender and age were statistically significant on breakfast consumption ($p<0.05$). 48.40% of the female participants stated that they had breakfast regularly while 72.4% of the male participants had breakfast in the mornings. When the effect of age was considered, 67.3% of the participants aged between 11-14 had breakfast regularly, while only 32.6% of the participants aged between 15-18 had breakfast regularly. As a result, male and secondary school students were more accustomed to have breakfast with respect to female and high school students.

Participants were asked if they consumed RTEC. 242 of 499 participants (48.5%) consumed RTEC while 257 participants (51.5%) did not. Gender did not affect RTEC consumption ($p>0.05$) while the effect of age was statistically significant ($p<0.05$). Table 2 displays RTEC consumption in terms of age. 54.9% of the participants aged between 11-14 consumed RTEC. However, only 32.6% of participants aged between 15-18 consumed RTEC. Participants who did not consume RTEC were asked for reasons not to consume RTEC. As seen in Table 2, the main reason for not consuming RTEC was being not accustomed to followed by finding not healthy and nutritious for both male and female students.

Table 2. Effect of age on RTEC consumption

Age	I consume RTEC	I do not consume RTEC

11-14	54.9% (195)	45.1% (160)
15-18	32.6% (47)	67.4% (97)
Total	48.5% (242)	51.5% (257)

Ongoing survey questions were directed to 242 RTEC consuming participants. Participants who consumed RTEC stated the reasons primarily as delicious taste (%38.6) and secondarily as practical use (29.9%). Participants were asked for their favourite RTEC type and results showed that chocolate (36.4%) was the most popular RTEC type followed by plain (cornflakes) RTEC (19.0%) among participants. Students usually consumed RTEC at breakfast (70.1%), and snack time (17.8%). Participants were also asked how often they consumed RTEC. 13.7% of the students consumed RTEC every day, 27.0% consumed several days in a week and 59.3% did not state a regular time. Neither gender nor age affected RTEC consumption frequency statistically ($p>0.05$). Participants were asked when they especially preferred to consume RTEC. 45.4% stated that they did not have a special time, 37.5% stated that they preferred to consume RTEC when they had limited time or are late for school, 11.7% preferred when there was nobody to prepare breakfast. Only 5.4% of the participants preferred when they were on diet. However, this is not surprising as the participants are children and adolescents. The effect of gender and age was not statistically important on RTEC consumption preferences ($p>0.05$).

Participants usually consumed RTEC with milk (85.8%) while 7.9% preferred plain, 3.8% with cream and 2.1% with yogurt. 74.2% of the participants believed that they met their milk need by RTEC consumption while 25.8% did not. The effect of gender and age was not statistically important ($p>0.05$). Many researchers (Bertrais et al., 2000, Crawley 1993; Gibson and Sullivan 1995; McNulty et al., 1996; Nicklas et al., 1998b) stated that dairy products and Ca intake increased with increasing levels of RTEC consumption. This result is not surprising when it is taken into consideration that RTEC are mostly consumed with milk just as our present and former study (Savlak et al., 2016).

Participants were also asked if they added some nutrients to their RTEC. Results are given in Table 3. It can be concluded that participants generally are not accustomed to adding nutrients to their RTEC.

Table 3. 'Do you add nutrients to your RTEC?'

	Always	**Sometimes**	**Never**
Do you add fresh fruit to your RTEC?	5.9	26.9	67.2
Do you add dried fruit to your RTEC?	2.1	26.3	71.6
Do you add nuts, walnuts, almonds to your RTEC?	7.9	33.3	58.8
Do you add sugar to your RTEC?	5.9	25.6	68.5
Do you add honey to your RTEC?	11.3	33.5	55.2

73.8% of the consumers found RTEC nutritious and 31.9% stated that they consumed with weight reducing diet. This ratio was low in comparison to university students (52.45%) in our former study (Savlak et al., 2016) due to younger ages of secondary and high school students in the present study. Answers to the question 'Do you consume RTEC with weight

reducing diet?' were significantly related with gender and age ($p<0.05$). 38.7% of the participants consuming RTEC with diet was female while 20.5% of the male participants consumed RTEC with weight reducing diet. This was compatible with Savlak et al. (2016) in which female participants preferred RTEC with weight reducing diet. Age was also an important factor. Participants aged between 15-18 (46.8%) had rather preferred RTEC with weight reducing diet in comparison to participants aged between 11-14 (28.3%).

Ready - to - Eat Breakfast Cereal Buying Trends

72.9% of the consumers bought RTEC from supermarkets, while 7.1% supplied it from grocery and 1.3% from wholesaler. 18.8% of the consumers stated that the place to buy RTEC did not matter. Age and gender were not statistically related with place of RTEC supply ($p>0.05$). Participants also stated that they found RTEC economical (83.4%) regardless of age and gender ($p>0.05$).

Brand (34.75%), variety (24.3%) and label information (18.5%) were the most important factors which the participants minded before buying RTEC. Gender was not related with the answers ($p>0.05$) while age was ($p<0.05$). Figure 1. displays the answers to the question 'What do you mind while buying RTEC?' on the basis of age.

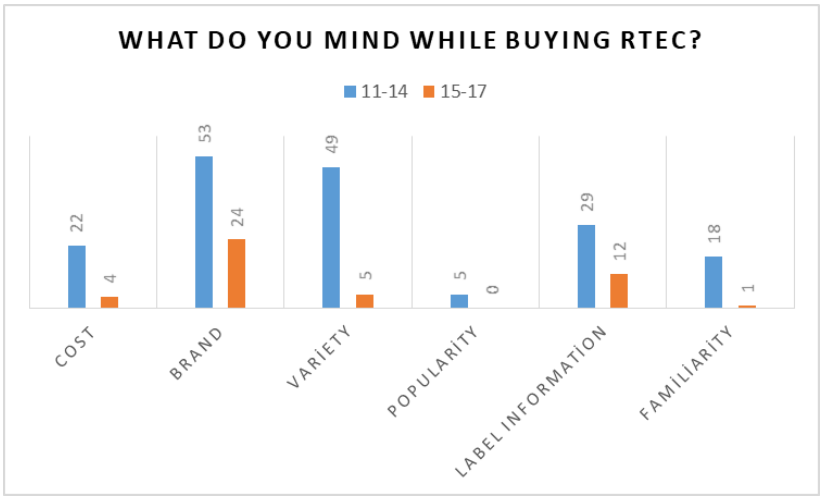

Figure 1. Effect of age on the factors while buying RTEC

Participants were asked if they minded label information. Regardless of age and gender 80% of the participants stated that they minded label information of RTEC. Participants who minded label information was asked what they minded in the RTEC label. 49.0% of the participants minded production and expiry dates in the first place. Ingredients (23.2%), brand (8.2%), Turkish Standards Institute (T.S.E.) mark (7.2%), nutritional value (6.7%), calorie (2.6%) and storage conditions (2.1%) came after. Age and gender did not affect label information priorities ($p>0.05$).

CONCLUSION

Breakfast cereals are a common breakfast replacer in the U.S.A and European countries. Although traditional Turkish breakfast is still popular among Turkish people, breakfast cereal consumption increased as a result of developing breakfast cereal market in the recent years in Turkey. 48.5% of the participants consumed RTEC in the present study. RTEC were more popular among secondary school students than high school students. 54.9% of the participants aged between 11-14 consumed RTEC. However, only 32.6% of participants aged between 15-18 consumed RTEC. The main reason for breakfast cereal consumption was defined as 'finding delicious' by both female (34.2%) and male (46.1%)

participants while the secondary reason was 'finding practical'. 85.8% of the participants stated that they usually consumed breakfast cereals with milk. When other nutrients were considered; 5.9% always added fresh fruits, 2.1% always added dried fruits, 7.9% always added nuts, walnuts and almonds, 5.9% added sugar and 11.3% always added honey.

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EFFECTS OF VOLATILE AND NON-VOLATILE COMPOUNDS OF *Trichoderma harzianum* AGAINST VARIOUS PHYTOPATHOGENS

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ABSTRACT

Volatile and non-volatile compounds of *Trichoderma* spp. with antifungal effects can become a suitable alternative for synthetic fungicides in agro-industries as natural fungicides against phytopathogens. Natural fungicides are acquiring increasing interest because of their relatively safe status, wide acceptance by consumers and utilization for multi-purpose functional uses. In this context, the assessment of antifungal potential of volatile and non-volatile metabolites from some *Trichoderma harzianum* strains against to six different phytopathogens was aimed in this study.

In order to assess the inhibitor activities of volatile compounds of *T.harzianum* strains against to various pathogens both the cultures were firstly inoculated seperately onto petri and incubated for 3 days at 28 °C. After incubation time, lids were removed and plates containing pathogens were placed over a plate containing the *T. harzianum* and enclosed with Parafilm^{TM} then left to incubation for 5 days more. The average diameters of two treatments were measured. Assays for non-volatile compounds were performed by inoculating the *Trichoderma* cultures in liquid media. After incubation the filtrates were seperated and sterilized by filtration and mixed into PDA medium. Mycelial discs of each pathogen were placed in the center of petri plates. The colony measurements were done and the inhibition rates were calculated.

The results indicate that volatile metabolites from petri plates and non-volatile metabolites produced in liquid cultures were shown good inhibiton activities against to all of the pathogens tested.

Key words: *Trichoderma*, volatile compounds, non-volatile compounds, biocontrol, phytopathogen

INTRODUCTION

Fungi release wide spectrum of volatile compounds (VOCs) that belong to several chemical groups with different biochemical origins such as monoterpenes, sesquiterpenes, alcohols, aldehydes, aromatic compounds, esters, furans, ketones, sulfur and nitrogen compounds. Due to thier volatility and ability to diffuse across cellular membranes, VOCs are ideal communication molecules even over long distances. (Zeilinger et al. 2016:83). Up to now, approximately 500 VOCs have been detected in fungal metabolites. From more than 100 000 species of described fungi, only about 100 species have been studied for VOC production (Hung *et al*., 2015:1).

Antibiosis is the mechanism by which certain microorganisms respond to the presence of others, secreting compounds or metabolites capable of inhibiting or preventing their development (Benítez et al. 2004:250). According to Dennis & Webster (1971a, b), antibiotic compounds may be Volatile Metabolites (VMs) and Non-Volatile Metabolites (NVMs). Although these molecules are not vital, they are important for the selective survival of organisms under certain conditions eliminating microbial competition and consequently, leading to greater availability of scarce food sources in the soil (Benítez et al. 2004:254). These metabolites consist of mixtures of compounds resulting from primary or secondary

metabolism (Yamaguchi, 1996:4).

Antibiosis is based on the generation of secondary metabolites, which exhibit an inhibitory or lethal effect on a parasitic fungus which is occurred by specific mechanism of antagonistic interactions between fungal species *Trichoderma* and other pathogenic fungi. *Trichoderma* Persoon is a hyperparasite fungus that uses different mechanisms of biological control, which include: parasitism, antibiosis, competition, induction of resistance and growth promotion (Kumar, 2013:3). Three kinds of compounds are mainly produced by strains of *Trichoderma* i.e. paptaibols, polyketides and terpenes. Some of them have antifungal activity (Kumar et al. 2014: 2).

From the genus *Trichoderma*, over 180 secondary metabolites have been characterised up to date, representing different classes of chemical compounds (Gams and Bisset 1998:2; Reino et al. 2008:2). *Trichoderma* species are well-known producers of volatile compounds also the most studied fungal biocontrol agents and are succesfully used as biofungicides and biofertilizers in greenhouse and field. The VOC s profile of a known species of strain will vary depending on the substrate, duration of incubation, type of nutrients, temperature and other environmental parameters.

In the context of the selection of these biocontrol agents, *in vitro* assays are used as indicative of the mode of action of the antagonist (Carvalho Filho et al. 2008:12). The evaluation of NVMs produced by fungi under laboratory conditions, as well as dual culture, is an initial step in the prospection of metabolites for both biological control and other purposes and can not be overlooked.

Although this biocontrol agent studies have been known for a long time, the industry still needs new isolates with potential for use in Integrated Pest Management programs (IPM) therefore these studies continues to hold the great attention.

MATERIALS and METHODS

Fungal Isolates

In this study three native strains of *Trichoderma* which were previously isolated from soil and characterized according to *tef* gene sequences (KY7844147, KY769056, KY76905) were used The sequences of the strains were deposited at NCBI GeneBank. All fungal strains were maintained on potato dextrose agar (PDA) slants at -20 C. *Botrytis cinerea, Alternaria alternata, Ilyonectria liriodendi, Botryosphaeria dothidea, Phomopsis viticola, Fomitoporia sp., Fusarium oxysporum* were used as test pathogens.

Growth Conditions and Antifungal Assay for VM and NVM

The dual culture technique described by Morton and Stroube (1955:2) was used to test the antagonistic ability of VMs of *Trichoderma* spp. against pathogens; *Botrytis cinerea, Alternaria alternata, Ilyonectria liriodendi, Botryosphaeria dothidea, Phomopsis viticola, Fomitoporia sp., Fusarium oxysporum*). The pathogens and *Trichoderma* were grown on PDA for a week at room temperature (28 °C). Small blocks of the target fungi cut from the periphery of the colony were transferred to the Petri dish previously poured with PDA. After 2 days of growth, the *Trichoderma* spp. was transferred aseptically in the same plate of opposite end and were incubated at room temperature with alternate light and darkness for 7 days and observed periodically. The experiment was replicated twice and percent growth inhibition was calculated by the formula of $I = (C - T)/C \times 100$, where C is mycelial growth in control plate, T is mycelial growth in test organisms inoculated plate and I is inhibition of mycelial growth.

Cultures were firstly activated on PDA at 28 °C for 5 days. From actively growing margins of PDA cultures, a 5 mm diameter plug of each *Trichoderma* species was placed on the centre of petri plates.

To obtain the liquid phase with the non-volatile metabolites, the *Trichoderma* isolates were grown in PD medium (Potato dextrose without addition of agar) in an orbital shaker at 150 rpm at 28 °C for 10 days. After this period the liquid part was collected by filtration on filter paper and centrfiuged for removal of fungal spores. The liquid phase was filtered through cellulose membranes of 0.22 µm diameter and incorporated into the PDA medium (50 °C) in a proportion of 25% (v/v). Three replicates were prepared with agar discs (5 mm diameter) taken from pathogen cultures. Mycelial agar discs were deposted in the center of each Petri plate containing PDA medium, supplemented with the respective antagonist culture filtrates. Control plates consisted of mycelial agar discs of aech pathogen deposited in PDA medium, with sterile distilled water added (Marques et al. 2018: 2-3).

The evaluation of the radial mycelial growth of the pathogen was carried out by taking the measurements of the diameter of the colonies in milimeters. These measurements were used to calculate the inhibiton index of mycelial growth (Menten et al. 1976:3), using the equation: IMG (%): $[(D_{ctreat} - D_{treat})/ D_{ctreat}]x100$, where D_{creat}= diameter of the radial mycelial growth of the pathogen in the control treatment without filtrates; D_{treat}= diameter of the radial mycelial growth of the pathogen in the treatment with the filtrates. These evaluations were performed when the entire surface of the medium, in the control treatment was colonized by the pathogen.

RESULTS

Results from the dual culture test showed that all isolates of *Trichoderma* inhibited mycelial growth of pathogens more than 50%. Different inhibition indices of mycelial growth of were observed in the treatments with NVM produced by the filtered culture of isolates of *Trichoderma* (Table 1).

All *Trichoderma* isolates tested produced VM and NVM that were effective against to *F. oxysporum, A. alternata, B. cinerea*. (Table 1 and 2). Among the filtrates of the isolates of TR41 presented the broadest antifungal spectrum as shown in the Table.

Table 1. Mycelial growth inhibition* (%) of *T. harzianum* isolates against to test pathogens

Collection Number	**Plant Pathogenic Fungi**					
	B. cinerea	***A. alternata***	***I. liriodendri***	***B. dothidea***	***P. viticola***	***F. oxysporum***
TR39	**3.8**	**3.4**	**3.7**	**2.4**	**2.6**	**4.3**
TR40	**3.6**	**3.8**	**3.5**	**3.2**	**3.4**	**4.1**
TR41	**4.0**	**3.4**	**3.0**	**2.6**	**2.3**	**4.4**

*: values are mean of twice replications

Table 2. Inhibition Index of Mycelial Growth (IMG %) of test pathogens after being confronted with filtrates from cultures of isolates of *Trichoderma harzianum*

Collection Number	Plant Pathogenic Fungi					
	B. cinerea	*A. alternata*	*I. liriodendri*	*B. dothidea*	*P. viticola*	*F. oxysporum*
TR39	**7.2**	**5.4**	**3.2**	**2.4**	**2.6**	**4.3**
TR40	**6.8**	**5.6**	**3.4**	**3.2**	**3.4**	**4.1**
TR41	**6.7**	**5.6**	**3**	**2.6**	**2.3**	**4.4**

The *Trichoderma* metabolites obtained from the soil originated native *Trichoderma* isolates were found effective against some plant pathogenic under experimental conditions. The greater depth of the antagonistic fungi should be studied for the identification of bioactive metabolites for industrial interest.

In some studies on major secondary metbolites produced by *Trichoderma* species reported that isolates are more effective and show excellent control of several pytopathogens. Filtered cultures of the isolates of *T. brevicompactum*, (CEN1245 and CEN1274), presented a broad antifungal spectrum, although isolates from other species were also prominent in the production of active metabolites with specificity against the plant pathogenic fungi (*Sclerotium rolfsii, Colletotrichum gloesporioides*, *Verticillium dahliae*, *Fusarium oxysporum* and *Cylindrocladium* sp.) used in the experiments (Marques *et al.* 2018: 1).

The *Trichoderma* metabolites obtained from different soil samples cultivated with agricultural products were effective to plant pathogenic fungi belonging to other patosystems such as forest or fruit trees, which could broaden their application in the biological control of plant diseases. In addition, the antagonistic fungi should be studied in greater depth for the identification of bioactive molecules of industrial interest or in commercial formulations of products for biological control of plant pathogens.

Several studies, such as those developed by Ajith *et al*. (2010:267), Jaspal *et al*. (2009:153) and Martins *et al*. (2007:10) reported the production of *T. viride* and *T. harzianum* metabolites as those with the highest antifungal potential of different species of *Colletotrichum*, among several other species tested. There are reports of greater inhibition of *F. oxysporum* with metabolites of *T. harzianum* (Farah , Nasreen 2013:58, Saxena *et al*. 2014:63). Marques *et al*. (2016:4) had a greater inhibition was observed with the use of the culture filtrates than in the direct comparison between pathogen and antagonist.

During evolution, the species of *Trichoderma* have evolved many special mechanisms allowing the *Trichoderma* species to compete with other fungal species (Monte 2000:2). Genes responsible for these mechanisms are involved in mycoparasitism, antibiosis, inactivation of enzymes produced by pathogens or they help *Trichoderma* to solubilise inorganic nutrients and to compete with other microorganisms for nutrients and space (Blaszczyk *et al*. 2014: 314).

CONCLUSIONS

Our results support that the antibiosis between the *Trichoderma harzianum* strains and some plant pathogenic fungi. Since *T. harzianum* strians are well-known producers of cell wall degrading enzymes, probably synergistic action with the metabolites can be occurred. Also the isolates of *Trichoderma* have been reported as excellent control in some plant

diseases such as groundnut rot. Therefore the isolates of the species can be promising biocontrol agents against several fungal diseases of plants.

The crude extracts of *Trichoderma* contain a mixture of secondary compounds, which may show antibiotic effect, and has been used for the prospect of this fungus for biological control and other industrial purposes. To study of volatile and non-volatile compounds from*Trichoderma* spp. against important fungal pathogens for development of the new antifungal agents to control serious fungal diseases in plants as well as purposes of chemotaxonomy is suggested.

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BEEF MARKETING STRUCTURE AND MARKETING MARGIN IN IZMIR, TURKEY

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ABSTRACT

The main objective of this study was to analysis the beef marketing structure and beef marketing margin in Izmir. To do this, districts Buca, Kemalpasa, Odemis, Menderes and Menemen in Izmir province were included in the study. The main material of the study was the information which gathered from the specialized cattle fattening farms through questionnaires in 2013. The number of interviewed farms was determined as 62 according to proportional sampling method. According to survey results, the brokers located between breeders and consumers in Izmir were local collectors, drovers, wholesaler butchers and retailer butchers, integrated meat processing firms, restaurants and supermarkets. The average marketing margin was calculated as 31.15%. It was observed that as the farm size expanded, the marketing margin increased and the breeder's share of profits has been reduced. It has been determined that the breeders who got the whole of the price paid by the consumers were the breeders who made sacrificial sales[1] and the breeders who had own sale place. The highest marketing margin was at the sales which made to both the integrated meat processing firm and the wholesaler butcher. The lowest marketing margin belonged to the sales which made to drovers.

Key words: Beef cattle farms, beef marketing structure, beef marketing margin, Izmir/Turkey

INTRODUCTION

By the end of 2017 the number of cattle in Turkey is 15 million 944 thousand heads, number of slaughtered cattle is 3 million 602 thousand heads and beef production is 987 thousand tons (TSI, 2018). Whereas, there is a significant difference between the red meat production amounts and the red meat amount required for healthy-balanced nutrition of the existing population. The livestock sector has lost its competitive power and incurs losses significant production and revenue in our country due to insufficient supports for animal production, input prices over world prices and live animals and meat import. The breeders are having big problems because of the increase of costs in cattle breeding and the low prices which occurs against the breeders in free market.

One of the provinces with the highest potential of cattle fattening in Turkey is Izmir province. According to data of 2017; Izmir province has about 4% of total cattle number of Turkey, slaughtered cattle presence and beef production (694 thousand heads, 113 thousand heads, 31 562 tons respectively) (MFAL, 2018). The proportion of cultured breed and their hybrids in cattle population in the province is 95.5%.

Prices for many goods and services in Turkey compose according to free market conditions. Beef prices in the research area as well compose in a market which is confronted

[1] The Sacrifice Feast in Turkey is a four-day religious festival. The Sacrifice Feast traditions in Turkey include sacrificing an animal in a special ritual, visiting relatives and helping the poor.

by a large number of unorganized producers and a small number of buyers who act together on price. This structure weakens the bargaining power of the producers.

It has been many studies in Turkey about beef marketing structure and marketing margins. Kaygısız (2000), calculated beef marketing margins between the years 1990-1998 based on the data of Istanbul Commodity Exchange. Topcu (2004) and Cukur (2006)" analyzed beef marketing margins in non-specialized cattle fattening farms in Erzurum and Izmir provinces. Yazici (2011) determined the beef marketing margins for 2003-2006 period according to the data of Samsun Commodity Exchange. Aral et al. (2016) calculated beef and lamb meat marketing margins according to the data of Ankara Commodity Exchange, in the period of 2008-2011. This study has an importance because it is one of the few studies determining the marketing margin at the specialized cattle fattening farms.

The main purpose of this study was to reveal beef marketing structure and marketing margin in cattle fattening farms in İzmir province and to offer solutions to the structural problems in the marketing system.

MATERIALS AND METHODS

The main material of the study consists of the data gathered from the cattle fattening farms through questionnaires. This study involves the districts of Buca, Kemalpasa, Odemis, Menemen and Menderes in Izmir province. The study area can represent cattle fattening farms in Izmir because 89.6% of the beef production in İzmir is supplied by the farms in these districts.

There were totally 862 cattle fattening farms in Izmir province in 2013 (MFAL, 2013). Number of breeders interviewed was determined through proportional sampling method (90% confidence interval and 10% error ratio were taken into consideration) (Newbold, 1995).

$$n = \frac{Np\,(1-p)}{(N-1)\,\sigma^2_{px} + p\,(1-p)}$$

n : Sample volume
N : Population (862)
σ^2_{px} : Variance (0.06079)

P : Proportion of cattle fattening farms (This value was taken as 0.5 in order to reach the maximum sample size)

Sixty two breeders from the study area were interviewed; the data belongs to the year 2013. In the analysis of the data, SPSS (1999) statistical package program was used. While the collected data were analyzed, the farms were divided into 3 groups according to animal numbers (Table 1).

Table 1: Number of animals in groups, sample volume and Ratio of farms within total

Farm size groups	Number of animal	Sample volume	Ratio of farms within total (%)
1.Grup	1-100	34	54.8

2.Grup	101-400	23	37.1
3.Grup	401+	5	8.1
Total		**62**	**100.0**

To calculate of the family labor force in the examined farms; firstly the population in the farms has been converted to the male labor force unit (MLU). Therefore, for males and females among 7-14 ages, 0.50; for males among 15-49 ages, 1.00; for females among 15-49 ages, 0.75; for males among 50-64 ages, 0.75; for females among 50-64 ages, 0.50 coefficients were used. (Aras, 1988). Then an adult male worker, for 300 working days in a year and 10 hours in a day, was accepted as a labor unit. The family labor potential has been converted to male labor day (MLD) according to this measure.

A cattle and beef sales price was converted to dollar rate of the year of the survey according to data from the Central Bank of the Republic of Turkey (CBRT, 2013).

RESULTS AND DISCUSSION

Characteristics of Examined Farms

Within the handled farms, the average age of the breeders was 49; average education level was 8 years; average cattle fattening experience was 19 years. 24.2% of the breeders interviewed were members to an agricultural cooperative. The rate of breeders who were members of the Chamber of Agriculture was 91.9% rate of the breeders who were members of the Association of Red Meat Producers was 72.6%. Total labor force potential in the same farms was 2.32 MLU (696 MLD)

It is determined that 16.1% of the surveyed farms had no farmland and they have bought whole of the fodders. The average farmland of the farms was determined as 134.20 acres and the average number of parcels was 3.79. In the same farms, it was observed that the fodder crops area had a significant share (47.6%) within the total farmland. Maize production for silage was very common in farmland and, also the farmers produced barley, wheat, corn, vetches, oats, clover and rye as fodder.

In the farms included in the study, the average number of cattle was 156.94 heads. The average number of fattening cattle ranged from 58.24 to 618.00 according to the farm size. In contrast to our study, the average number of cattle was found as 27.19 heads in a study conducted in Erzurum province (Topcu, 2004) and as 14.78 heads in the other study in Izmir province (Cukur, 2006). The reason of this was that only specialized cattle fattening farms was studied in this study.

The farms have bought the fattening cattle from especially Odemis district and the other districts of Izmir province. The proportion of the breeders who imported the cattle from abroad was 4.8%.

The average feeding period was 250.16 days in the cattle farms investigated. Similarly, the average feeding period was found as 267.08 days in a study by Cukur (2006). In contrast to these results, Yanar et al (1990) determined the feeding period as 210 days; Ozkan and Erkus (2003), as 176 days; Topcu (2004) as 195,11 days, Aydin and Sakarya (2012), as

225.8 days. The reason of which our finding was higher than the other studies was that live weight at the beginning of the feeding was lower.

Amongst the farms surveyed, 64.52% both have produced and bought the fodder, 35.48% have only bought fodder from the market. There was no farm that produced the whole of the fodder in own farm.

The average daily live weight gain of the same farms was 1.35 kg. It was reported that in some surveys the live weight gain of beef cattle was determined as 1.09-1.11 kg by Yanar et al. (1990); as 0.61-0.92 kg by Yildirim (2000); as 1.30-1.42 kg by Baspinar (2001); as 1.05 kg by Ozkan and Erkus (2003); as 1.29 kg by Topcu (2004); as 1.08 kg by Cukur (2006); as 1.12 kg by Aydin and Sakarya (2012).

Beef Marketing Structure in the Examined Farms

In the farms included in the study, 56.4% of the breeders were selling the cattle to only one broker (Table 2). Amongst these farms, 22.6% preferred the integrated meat processing firms, 22.6% the sacrificial sale, 4.8% the breeders' own sale places (retail butcher shops, restaurants or supermarkets), 3.2% the retailer butchers and 3.2% the drovers. The other farms (43.6%) have sold the cattle to more than one broker.

Table 2: Sale places of the cattle in the examined farms

	Number of farms	The ratio of the farms within total (%)
IMPF(*)	14	22.6
Sacrificial	14	22.6
Breeders' own sale place	3	4.8
Retailer butcher	2	3,2
Drover	2	3.2
Total	**35**	**56.4**
Sacrificial and Breeders' own sale place	8	12.9
Sacrificial and retailer butcher	7	11.3
IMPF and wholesaler butcher	6	9.8
IMPF and breeders' own sale place	3	4.8
IMPF and sacrificial	2	3.2

Sacrificial and wholesaler butcher	1	1.6
Total	**62**	**100.0**

(*)IMPF: Integrated meat processing firms

Considering sale methods, 72.1% of surveyed farms were selling the cattle as carcass, 14.8% as live and 13.1% both as live and carcass (Table 3). When the sale methods analyzed according to the groups, it was observed similar trends.

Table 3: Methods of sale the cattle in the examined farms

	Group 1		Group 2.		Group 3		Mean	
	Number	%	Number	%	Number	%	Number	%
Live sale	5	14,7	4	17,4	-	-	9	14,8
Carcass sale	23	67,6	17	73,9	4	100,0	44	72,1
Live sale and carcass sale	6	17,6	2	8,7	-	-	8	13,1
Total	**34**	**100,0**	**23**	**100,0**	**5**	**100,0**	**62**	**100,0**

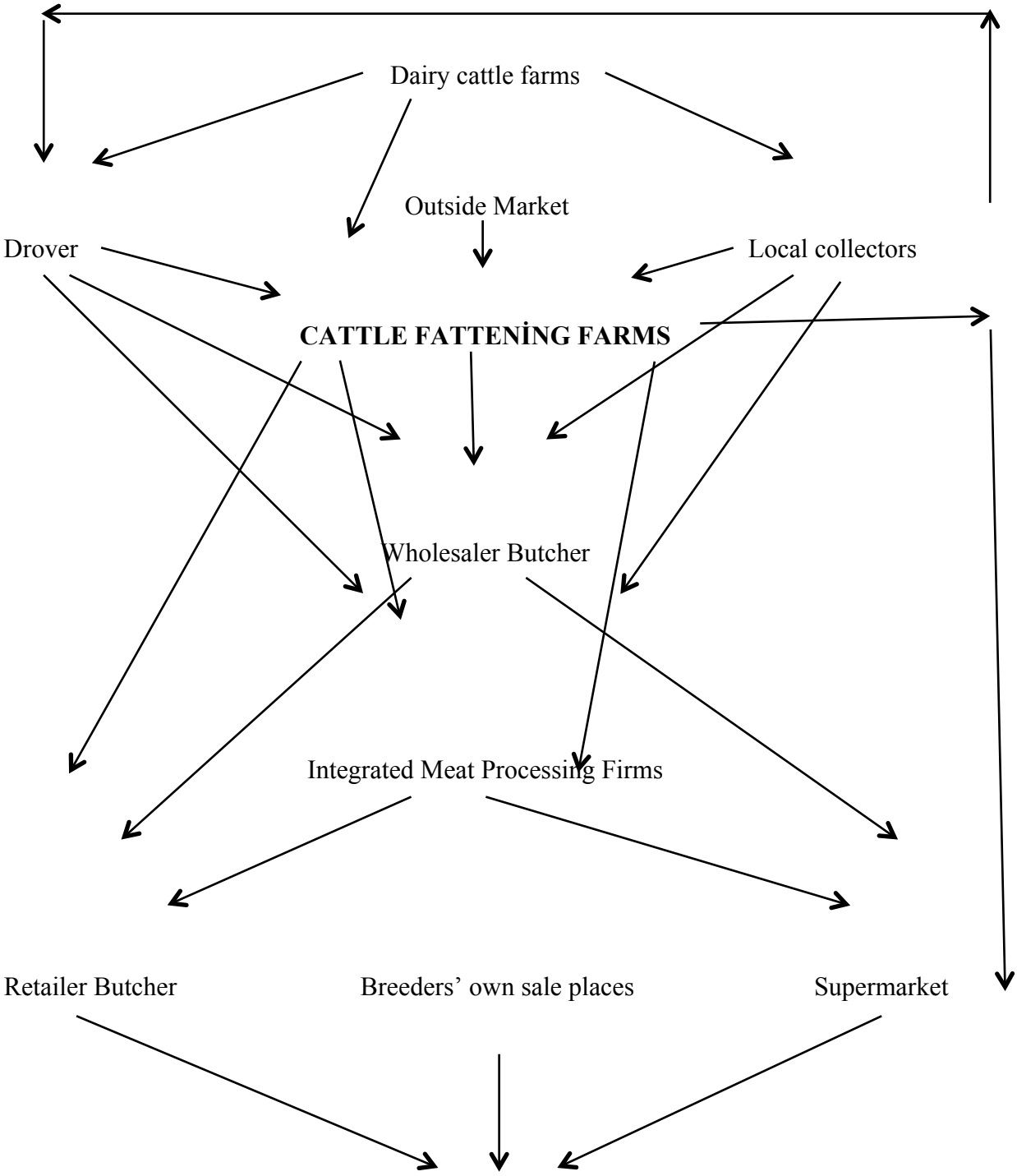
The marketing channels of beef in İzmir province are showed in Figure 1. As it can be seen from the figure, local collectors have bought the animals from the dairy cattle farms and were selling them to drovers, integrated meat processing firms and wholesaler butchers on the local markets. The drovers have sold the cattle which they had bought from dairy cattle farms or local collectors to wholesaler butchers, cattle fattening farms and integrated meat processing firms.

The cattle fattening farms were buying the cattle from dairy cattle farms, local collectors, drovers or imported from abroad. After the feeding period, the cattle have been sold to the integrated meat processing firms, to the final consumer before sacrifice feast, to wholesalers and retailer butchers. Also, they have been sold in breeders' own sale places (retail butcher shops, restaurants or supermarkets).

Wholesaler butchers have sold the cattle to retailer butchers or supermarkets. Integrated meat processing firms have cut the cattle at their own plants and selling them as meat and meat products to retailer butchers and supermarkets.

The retailer butchers and supermarkets, which constitute the last ring of the marketing chain, were brokers that meat and meat products delivered to the final consumer. Also, there

were some brokers who were both the wholesaler butcher and the cattle breeder. On the other hand, some wholesaler butchers had retailer butcher shops or supermarkets.



CONSUMER ←

Figure 1: Beef marketing channels in Izmir province

When the payment methods in the cattle sales were studied, it was determined that 58.06% of farms preferred cash sale, 33.87% term sales and 8.07% both cash sale and term sale.

The cattle sales prices of the examined farms are given in Table 4. In live animal sales, the price of the cattle was 4902.94 TL/head ($2580.50). In carcass sales, term sale price was 15.81 TL/kg ($8.33) and cash sale price was 18.22 TL/kg ($9.59). When analyzed according to farm size, it was remarkable that big size farms preferred only carcass sales.

It was seen that term sale price was lower than cash sale price in carcass sales (Table 4). This was caused by the cash sale was mostly valid for sacrificial sales and the sacrificial sale prices were higher than other sales prices. For the same reason, small farms' carcass cash sale prices as well were higher than the other farms.

Table 4: Sale prices of the cattle in the examined farms

	Group 1		Group 2.		Group 3		Mean	
	TL	$	TL	$	TL	$	TL	$
Live cash sale price (head)	5150.00	2710.53	4450.00	2342.11	-.	-	4902.94	2580.50
Carcass term sale price (kg)	15.82	8,33	16.08	8.47	15.83	8,34	15.81	8.33
Carcass cash sale price (kg)	18.91	9,96	17.97	9.46	17.38	9.15	18.22	9.59

Beef Marketing Margin in the Examined Farms

The average supply price of meat as live weight was 16.98 TL / kg in the farms (Table 5). During the same period, the average beef market price was 24.66 TL/kg (MMB, 2014). Therefore, the average total marketing margin was calculated as 31.15%.

In the some other survey results showed that the total marketing margin was calculated as 32.86% by Topcu (2004); as 37.87%, 39.63%, 34.42%, 41.25% for 2003-2006 years, respectively by Yazici (2011). On the other hand, Cukur (2006) determined that the marketing margin varied between 19.61% and 25.44% according to various marketing channels. In contrast, it was reported that the red meat total marketing margin was 70.00% in Turkey (Gunes, 1998) and 77.90% in United States (Altman, 1994). The reason of the lower marketing margins in the research area was that the marketing chain between the producer and the consumer was very short and the fattening activities in the region were intense.

When analyzed according to farm size, it is noteworthy that as the farms expanded, marketing margins increased. Relative margins were 30.30% for group 1; 31.80% for group 2 and 34.11% for group 3 (Table 5). The reason of this was that small farms have generally produced and selling for the sacrifice fest. In contrast, big size farms have usually sold the cattle to the integrated meat processing firms.

Table 5: The total marketing margin for one kilogram of beef according to farm size

	Breeders' price	Consumers' price	Marketing margin (TL)	Marketing margin (%)
Group 1	17.19	24.66	7.47	30.30
Group 2	16.82	24.66	7.84	31.80
Group 3	16.25	24.66	8.41	34.11
Mean	**16.98**	**24.66**	**7.68**	**31.15**

When studied the marketing margins according to sales locations (Table 6), it was seen that the marketing margin was zero at the sacrificial sales except breeders' own sale place. On the other hand, the highest marketing margin (38.85%) was originated from the sales both the integrated meat processing firm and the wholesaler butcher. The breeders who got the whole of the price paid by the consumers were the breeders made sacrificial sales and the breeders who had own sale place. Also, the lowest marketing margin (8.31%) was belonging to the sales which made drovers.

Table 6: The total marketing margin for one kilogram of beef according to sale places

	Breeders' price	Consumers' price	Marketing margin (TL)	Marketing margin (%)
Sacrificial	18.28	18.28	0	0
BSP(*)	16.67	16.67	0	0
IMPF(**)	15.89	24.66	8.77	35.56
Retailer butcher	16.88	24.66	7.78	31.55
Drover	22.61	24,66	2.05	**8.31**
Sacrificial and BSP	17.11	17.11	0	0

Sacrificial and retailer butcher	16.85	24.66	7.81	31.67
IMPF and wholesaler butcher	15.08	24.66	9.58	**38.85**
IMPF and BSP	15.50	24.66	9.16	37.15
IMPF and sacrificial	17.42	24.66	7.24	29.36
Sacrificial and wholesaler butcher	18.50	24.66	6.16	24.98

(*)BSP: Breeders' own sale place

(**)IMPF: Integrated meat processing firm

CONCLUSION

In this study, beef marketing structure and marketing margins were examined in total 62 specialized breeding cattle operations in İzmir. The brokers located between beef producers and consumers in Izmir were local collectors, drovers, wholesaler butchers and retailer butchers, integrated meat processing firms, restaurants and supermarkets.

The total marketing margin was calculated as 31.15%. It was emerged that as the farms expanded, marketing margins increased. When studied the marketing margins according to sales places, it was seen that the marketing margin was zero at the sacrificial sales except breeders' own sale place. On the other hand, the highest marketing margin was arising when sales were made to meat integrated companies.

As a result, in the research region, farms that sell directly to consumers obtain a higher price. As the marketing chain grows, producer prices decrease. In that case, the necessity of reducing intermediaries between producer and consumer arises. This makes it necessary for the producers to merge horizontal or vertical.

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WATER QUALITY MAPPING USING GEOSTATISTICAL ANALYSIS (CASE STUDY IN JIROFT DAM, IRAN)

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ABSTRACT

Agriculture largely depends on water resources of case Geostatistical interpolation methods such as Kriging, IDW. Knowing the temporal and spatial variation of water quality is a necessary factor for implementing the optimal management of water resources.

Taking soil, water and agriculture samples at different locations are expensive and time consuming. Geostatistical interpolation methods produce predictions for locations where samples were not taken and help to reduce time and money in a project.

Jiroft Dam is a hydroelectric dam in Kerman Province, Iran. The dam coordinates are X = 545481 and y = 3192597, and it is located 40 km from North West of Jiroft. It is located on Halil River (Halilrood) upstream of Jiroft (North-East of the city) in the narrow valley of Narab. Its reservoir capacity is around 410 million cubic metres up to the normal level (1185 metres above sea level), the maximum height of the dam is 134 m and the crest length is 277 m.

Samples collected from six different hydrometric stations and chemical qualities of samples were measured. Samples from all stations were gathered each month in 2016. Physical and chemical water factors, Such as: water temperature, air temprature, pH (potential of hydrogen) , Total dissolved solids (TDS), Dissolved Oxygen (Do), Carbon dioxide (Co2), ammonia, nitrate, Phosphate, Nitrate, Salt, Opacity, are taken by the Fisheries Organization in Iran.

Kriging and IDW are an advanced geostatistical procedure that generates an estimated surface from a scattered set of points with z-values (Input point features). We create a prediction surface map with using Geostatistical Analysis in Jiroft Dam region.

Key words: Water Quality Mapping, Geostatistical Analysis,Jiroft Dam

INTRODUCTION

Geostatistics is a class of statistics used to analyze and predict the values associated with spatial or spatiotemporal phenomena(Olea,2006). Geostatistical interpolation approaches can be adopted to fill in missing values. Kriging and inverse distance weighted average approaches have been applied frequently for the spatial interpolation (Cressie, 1990).

Many geostatistical tools were originally developed as a practical means to describe spatial patterns and interpolate values for locations where samples were not taken. Those tools and methods have since evolved to not only provide interpolated values, but also measures of uncertainty for those values. The measurement of uncertainty is critical to informed decision

making, as it provides information on the possible values (outcomes) for each location rather than just one interpolated value (Isaaks and Srivastava, 1990)

Interpolation is the process of using points with known values or sample points to estimate values at other unknown points. It can be used to predict unknown values for any geographic point data, such as elevation, rainfall, chemical concentrations, noise levels, and so on.

Kriging and IDW are an advanced geostatistical procedure that generates an estimated surface from a scattered set of points with z-values (Input point features). We create a prediction surface map with using Geostatistical Analysis in Jiroft Dam region.

Study area

Jiroft Dam is a hydroelectric dam in Kerman Province, Iran. The dam coordinates are X = 545481 and y = 3192597, and it is located 40 km from North West of Jiroft. It is located on Halil River (Halilrood) upstream of Jiroft (North-East of the city) in the narrow valley of Narab. Its reservoir capacity is around 410 million cubic metres up to the normal level (1185 metres above sea level), the maximum height of the dam is 134 m and the crest length is 277 m.

Fig 1. Jiroft Dam, Kerman Province, Iran

The Fisheries Organization Agency is responsible for monitoring Jiroft Dam in Kerman Province, Iran.

Samples collected from six different hydrometric stations and chemical qualities of samples were measured. Samples from all stations were gathered each month in 2016. Physical and chemical water factors, Such as: water temperature, air temprature, pH (potential of hydrogen) , Total dissolved solids (TDS), Dissolved Oxygen (Do), Carbon dioxide (Co2), ammonia, nitrate, Phosphate, Nitrate, Salt, Opacity, are taken by the Fisheries Organization in Iran.

MATERIAL AND METHODS

Geostatistical Analyst provides tools that make optimal predictions possible by examining the relationships between all the sample points and producing a continuous surface of TDS concentration, standard errors (uncertainty) of predictions, and probabilities that critical values are exceeded.

The Geostatistical Analyst extension provides the capability for surface modeling using deterministic and geostatistical methods (Ruiz-Arias et al., 2011).

Deterministic Methods: Deterministic techniques have parameters that control either (1) the extent of similarity (for example, inverse distance weighted) of the values or (2) the degree of smoothing (for example, radial basis functions) in the surface. These techniques are not based on a random spatial process model, and there is no explicit measurement or modeling of spatial autocorrelation in the data. The Inverse Distance Weighting interpolator is one branch of Deterministic techniques.

Inverse Distance Weighted (IDW): IDW interpolation explicitly implements the assumption that things that are close to one another are more alike than those that are farther apart. To predict a value for any unmeasured location, IDW will use the measured values surrounding the prediction location. Those measured values closest to the prediction location will have more influence on the predicted value than those farther away. Thus, IDW assumes that each measured point has a local influence that diminishes with distance. The IDW function should be used when the set of points is dense enough to capture the extent of local surface variation needed for analysis. IDW determines cell values using a linear-weighted combination set of sample points. It weights the points closer to the prediction location greater than those farther away, hence the name inverse distance weighted (Rehman and Ghori, 2000).

Geostatistical Methods: Geostatistical techniques assume that at least some of the spatial variation observed in natural phenomena can be modeled by random processes with spatial autocorrelation and require that the spatial autocorrelation be explicitly modeled. Geostatistical techniques can be used to describe and model spatial patterns (variography), predict values at unmeasured locations (kriging), and assess the uncertainty associated with a predicted value at the unmeasured locations (kriging).

Kriging: Kriging is a geostatistical interpolation technique that considers both the distance and the degree of variation between known data points when estimating values in unknown areas. A kriged estimate is a weighted linear combination of the known sample values around the point to be estimated (Zelenka et al., 1992).

Kriging assumes that the distance or direction between sample points reflects a spatial correlation that can be used to explain variation in the surface. The Kriging tool fits a mathematical function to a specified number of points, or all points within a specified radius, to determine the output value for each location. Kriging is a multistep process; it includes exploratory statistical analysis of the data, variogram modeling, creating the surface, and (optionally) exploring a variance surface. Kriging is most appropriate when you know there is a spatially correlated distance or directional bias in the data. It is often used in soil science and geology.

Inverse Distance Weighted (IDW) and Kriging:

Kriging is similar to IDW in that it weights the surrounding measured values to derive a prediction for an unmeasured location. The general formula for both interpolators is formed as a weighted sum of the data:

$$\hat{Z}(s_0) = \sum_{i=1}^{N} \lambda_i Z(s_i)$$

where:

Z(si) = the measured value at the ith location

□i = an unknown weight for the measured value at the ith location

s0 = the prediction location

N = the number of measured values

In IDW, the weight, □i, depends solely on the distance to the prediction location. However, with the kriging method, the weights are based not only on the distance between the measured points and the prediction location but also on the overall spatial arrangement of the measured points. To use the spatial arrangement in the weights, the spatial autocorrelation must be quantified. Thus, in ordinary kriging, the weight, □i, depends on a fitted model to the measured points, the distance to the prediction location, and the spatial relationships among the measured values around the prediction location. The following sections discuss how the general kriging formula is used to create a map of the prediction surface and a map of the accuracy of the predictions (Goodale and Aber, 1998).

Total Dissolved Solids (TDS)

Total Dissolved Solids (TDS) comprise inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides and sulfates) and some small amounts of organic matter that are dissolved in water (U.S. Environmental Protection Agency, 1986)

In general, TDS is the sum of the cations and anions in water. Ions and ionic compounds making up TDS usually include carbonate, bicarbonate, chloride, fluoride, sulfate, phosphate, nitrate, calcium, magnesium, sodium, and potassium, but any ion that is present will contribute to the total (U.S. Environmental Protection Agency, 1986)

TDS in drinking-water originate from natural sources, sewage, urban runoff, industrial wastewater, chemicals used in the water treatment process and the nature of the piping or hardware used to convey the water, i.e., the plumbing.

The mean salinity of the world's rivers is approximately 120 mg/ L(Wetzel, R.G., 1983).

The Fisheries Organization Agency is responsible for monitoring Jiroft Dam in Kerman Province, Iran.

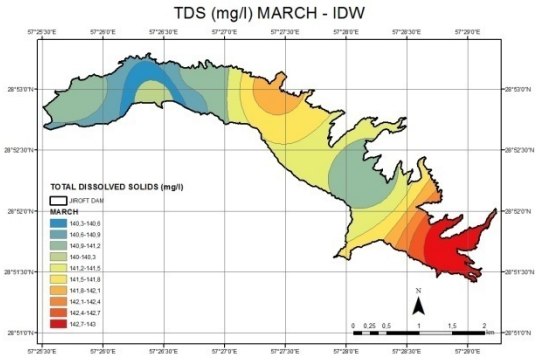
Water samples collected from six different hydrometric stations and Total Dissolved Solids TDS of samples were measured. Samples from all stations were gathered each month in 2016.

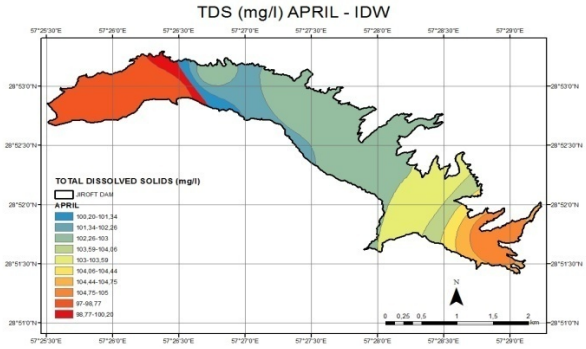
The study was conducted from March, 2016 to February, 2016, at Jiroft Dam in Kerman Province, Iran. The amount of TDS indicates in Table 1 and Table 2.

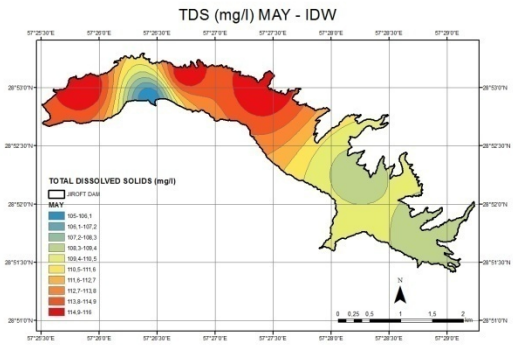
Table 1: Water samples collected from six different hydrometric stations in six months

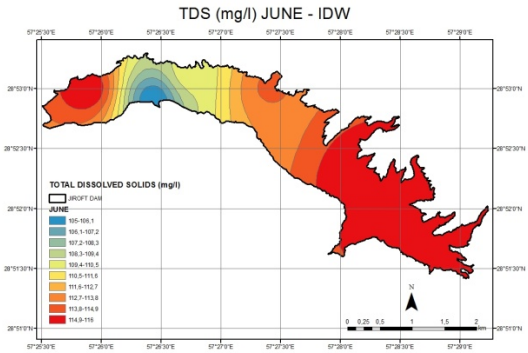
TDS(mg/lit) / Stations	March	April	May	June	July	August

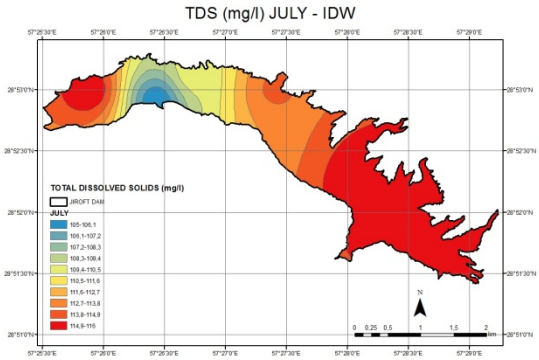
1	141	96.5	115.5	115.9	115.9	110.1
2	140	96.5	105	105	105	112.2
3	141	103	115.9	115.9	110.2	109.9
4	142	103	115.9	115.9	113.7	115.4
5	141	103	109.4	109.4	115.5	115.7
6	143	105	109.4	110.2	115.5	116.8











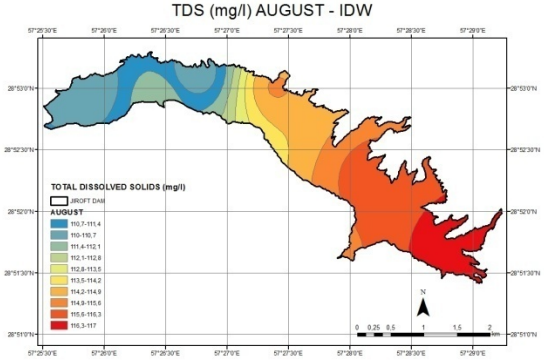
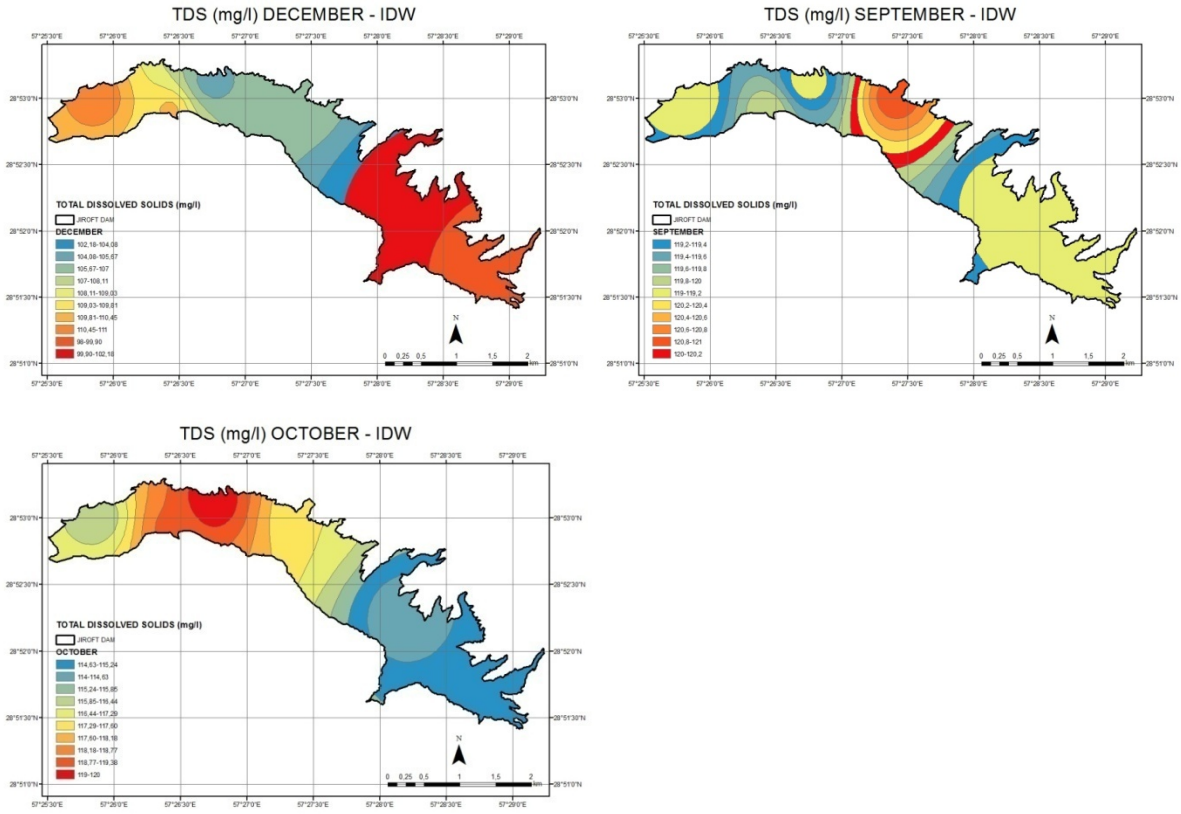


Fig 2. Total Dissolved Solids (TDS) in six different months

Table 2: Water samples collected from six different hydrometric stations in six months

TDS(mg/lit) / Stations	September	October	November	December	January	February
1	119.2	115.5	110	111	110	114
2	120.1	118.5	115	110	112	110
3	118.5	120.1	120	105	95	113
4	120.5	114.5	117	107	98	112
5	118.5	114	114	100	115	113
6	119	111.2	115	98	110	110



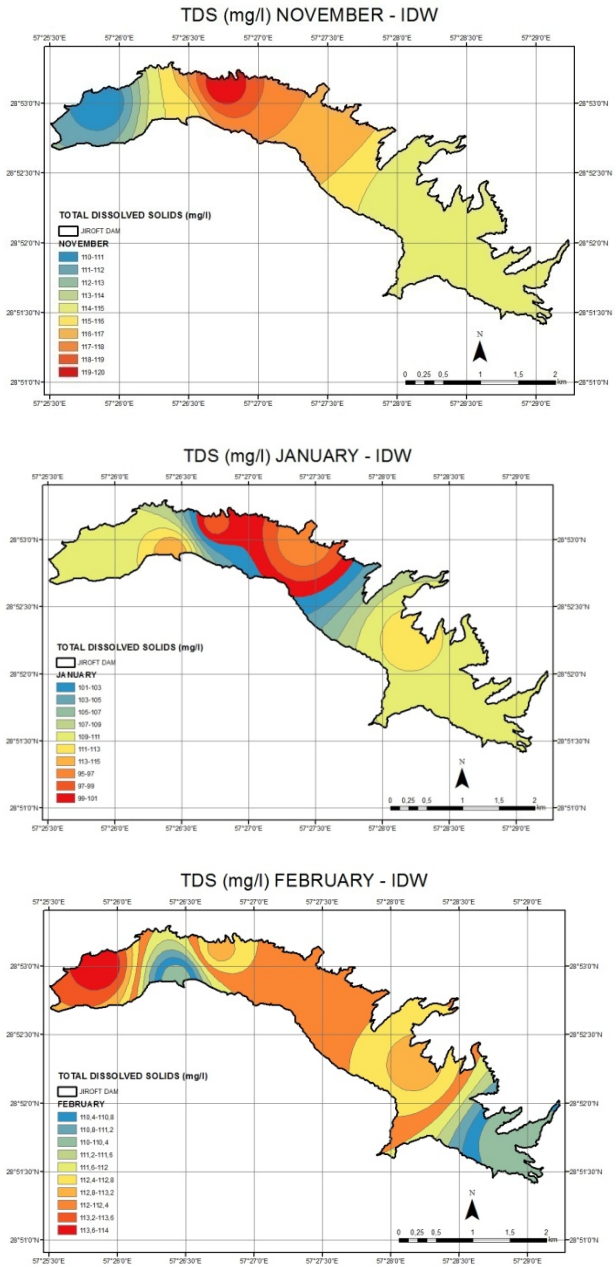


Fig 3. Total Dissolved Solids (TDS) in six different months

Saline waters may adversely impact animal health by several possible mechanisms. One of the most important biological functions of water in mammals is as a solvent for nutrients, waste products, etc. The presence of extraneous solutes decreases the ability of water to serve this function by decreasing its ability to dissolve additional solutes.

RESULTS

For spatial autocorrelation in certain locations, kriging requiresat least 10-12 and maximum 26-32 measurement values.

The values must show normal distrubition in order to use kriging interpolation.

To use kriging interpolation, experts need to interpret the values and determine the model.

The output value for a cell using inverse distance weighting (IDW) is limited to the range of the values used to interpolate. Because IDW is a weighted distance average, the average cannot be greater than the highest or less than the lowest input.

The best results from IDW are obtained when sampling is sufficiently dense with regard to the local variation you are attempting to simulate. If the sampling of input points is sparse or uneven, the results may not sufficiently represent the desired surface.

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SOLVENT-FREE EXTRACTION OF ESSENTIAL OILS FROM PEELS OF CITRUS FRUITS BY MICROWAVE: AN EVALUATION OF VOLATILE AND BIOACTIVE COMPOUNDS

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ABSTRACT

Citrus fruits are consumed gladly in especially cold winter months in our country. But, after eating these fruits, great amounts of peels exist and those cause serious environmental problems. Gaining added value for peels is significant for waste management. In this study, microwave assisted (by using Arçelik MD 574 oven as heating source at 340 W with Clevenger apparatus) essential oil extraction from the peels of bitter orange, grapefruit, orange and lemon were conducted. Yields of oils were 0.43%, 0.57%, 0.33% and 0.40% for bitter orange, grapefruit, orange and lemon respectively. The volatile and aromatic compounds of samples were determined by GC-MS with flame ionization detector (FID). D-limonene was the most abundant organic molecule in oils. Also, the total phenolic contents and antioxidant activities (by DPPH method) of both initial peels and essential oils were determined and peel (22476.07 ppm gallic acid equivalent, GAE) and essential oil (249.69 ppm GAE) of bitter orange had the maximum phenolics in comparison to others on dry basis. Bitter orange peel showed the highest antioxidant activity (78.37 mM trolox equivalent, TE), however its essential oil was in the third rank (0.90 mM TE). Orange essential oil was the superior (3.66 mM TE) in terms of performing as an antioxidant.

Key words: Citrus, fruit, essential oil, volatile compound, microwave.

INTRODUCTION

The citrus family can be classified into two groups; non-hybrids and hybrids. Pomelo, mandarin, citron, key lime and finger lime are non-hybrids and the others are in hybrid citrus category (Anonymous, 2010). Easy availability and low cost of residues of these fruits are ought to be regarded as nutraceutic resources and dietary supplements.Bioactive compounds, dietary fibers and essential oil placed in peel wastes add a value to product (Rafiq et al. 2016). A scientific interest has been started to exist about essential oils which are known as their antimicrobial and antifungal activities (Velázquez-Nuñez et al. 2013).

Conventional distillation techniques require some chemicals and lots of time. Therefore, nowadays rapid and green extraction methods of essential oils become to be available like microwaves. Microwaves generate heat inside the material, hence duration of process reduces.

In this study, the essential oils of bitter orange, grapefruit, orange and lemon procured from Osmaniye region were extracted by microwave assisted extraction procedure without using a solvent. Also, chemical compounds, total phenolics and antioxidant activities (by DPPH method) of oils were determined.

MATERIAL AND METHOD

Material

Bitter orange, grapefruit and lemon samples were collected from the gardens of Osmaniye Korkut Ata University in spring, 2018. Oranges were bought a local market that were harvested in Osmaniye province. The peels were obtained by manually with a knife.

Microwave assisted green extraction

A microwave oven (Arçelik MD 574) was combined with a Clevenger apparatus. Nearly 400 grams of peel was put into a 1 L flask and 340 W microwave power was applied without using any chemical or water. Extraction process continued for 30 min for all citrus types. Yields of oils were 0.43%, 0.57%, 0.33% and 0.40% for bitter orange, grapefruit, orange and lemon respectively.

GC/MS analysis

The volatile constituents of essential oils were identified with the aid of gas chromatography/mass spectrometry. The GC/MS conditions are illustrated in Table 1.

Table 1. Gas chromatography/mass spectrometry (GC/MS) conditions

GC conditions	Equipments and running conditions
System	Agilent 7000 Series Triple Quad GC/MS
Column	HP-5MS, 30 m lenghth x 0.25 mm diameter x 0.25 μm Film thickness, 5 % phenyl methyl poly siloxane
Column Temperature	Initial temperature 50 °C, followed by increasing to 240 °C at 3 °C / 1 min
Injector	Gerstel multipurpose sampler
Injection volume	1μL (1 : 100 v/v sample : dichlorometan)
Inlet temperature	250 °C
Carrier Gas	Helium (flow rate, 1 mL/min)
FID properties	
Detector	A flame ionization detector (FID, Thermo Scientific Focus GC)
Split Flow	40 ml/min
Split ratio	20
Mass spectrum	
Source temperature	290 ^{o}C

Electron Energy	70 eV

Total phenolics and antioxidant activity (by DPPH method)

The extraction of bioactive compounds from essential oils was conducted according to Güzel et al. (2009). Total phenolics was determined by Folin-Ciocalteu method (Li et al. 2015). Dpph method for antioxidant activity was modified from Aghraz et al. (2018).

RESULTS AND DISCUSSION

Chemical composition of essential oils

Table 2 shows the results of GC/MS analysis of essential oils. Totally 23 compounds were successfully identified and D-limonene was the most abundant organic molecule in oils.

Table 2. Chemical composition of essential oils

No	*Compounds*	*RI*	*LEO*	*GEO*	*OEO*	*BEO*
1	□-Thujene	891	0.58	—	—	—
2	□-Pinene	897	2.05	1.22	0.83	1.51
3	Sabinene	935	1.91	1.84	1.53	0.71
4	□-Pinene	938	7.95	0.13	0.08	2.49
5	□-Myrcene	953	2.04	3.68	2.97	4.75
6	Octanal	1001	0.22	0.77	0.98	0.48
7	□-Terpinene	1017	0.47	—	—	—
8	p-cymene	1021	0.64	—	—	—
9	D-Limonene	1022	48.45	85.82	81.86	80.99
10	(E)-□-Ocimene	1050	0.08	0.56	—	1.37
11	□-Terpinene	1060	12.60	—	—	—
12	Terpinolene	1063	0.92	—	—	—

13	Linalool	1104	0.65	0.52	2.61	2.32
14	Nonanal	1105	0.36		0.10	—
15	Citronellal	1142	0.21	0.17	—	—
16	Terpinen-4-ol	1170	0.69	—	—	—
17	□-Terpineol	1190	1.66	0.37	0.52	0.54
18	Decanal	1200	0.08	0.53	0.39	0.42
19	(Z)-Neral	1242	3.26	—	—	—
20	Citral	1269	4.45	—	—	—
21	Neryl acetate	1365	1.26	—	—	—
22	Caryophyllene	1417	0.62	1.02	—	0.47
23	Valencene	1484	0.47	—	4.41	—

LEO: Lemon essential oil, GEO: Grapefruit essential oil, OEO: Orange essential oil, BEO: Bitter orange essential oil, RI: Retention indices.

Total phenolics and antioxidant activity (by DPPH method)

Table 3 express the results of total phenolics and antioxidant activity of both peel and oil samples on dry basis. Peel (22476.07 ppm GAE) and essential oil (249.69 ppm GAE) of bitter orange had the maximum phenolics. Bitter orange peel showed the highest antioxidant activity (78.37 mM TE), however its essential oil was in the third rank (0.90 mM TE). Orange essential oil was the superior (3.66 mM TE) in terms of performing as an antioxidant.

CONCLUSION

Microwave assisted extraction is thought a promising technique and succesfull for recovering essential oil from citrus peels with high yield. It is a time reducing method and green technology which are not harmful to environment because of not using a inorganic solvent.

Table 3. Results of bioactive compounds in essential oils as dry matter

Sample	***Total***	***Antioxidant***

	phenolics (ppm GAE)	*activity (mM TE)*
Lemon peel	6403.92 ± 0.00	64.36 ± 4.05
LEO	204.03 ± 0.00	1.51 ± 0.11
Grapefruit peel	14060.70 ± 2784.75	65.12 ± 1.15
GEO	110.25 ± 3.19	0.89 ± 0.38
Orange peel	14847.21 ± 3959.25	55.67 ± 0.79
OEO	219.41 ± 22.36	3.66 ± 0.69
Bitter orange peel	22476.07 ± 302.20	78.37 ± 10.28
BEO	249.69 ±7.74	0.90 ± 0.64

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THE EFFECT OF DIETARY CUMIN ESSENTIAL OIL ON RELATIVE ORGAN WEIGHTS OF BROILERS REARED IN FREE-RANGE SYSTEM

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ABSTRACT

In this study, it was evaluated the effect of cumin essential oil supplementation to the diet on relative organ weights of broilers reared in free-range system. A total of 450 Hubbard Red JA one-day-old male and female broiler chicks were randomly divided into 3 treatment groups consisting of 5 replicates each. The slow-growing broilers were placed in an open-sided, naturally ventilated broiler house. The house had holes that were opened after 1 week, giving free access to the outdoor area approximately 13 hours daily (from 7:00 a.m to 8:00 p.m). Fattening of the broilers lasted 56 days.

During the experimental period, birds were fed on maize-soybean based diets without (control) or with cumin essential oil (200 and 400 mg/kg). All experimental diets and water were provided ad-libitum. From day 3, the photoperiod was limited to natural daylight, which was 16 hours of light and 8 hours of dark per day.

The supplementation of cumin essential oil did not affect relative weights of digestive (liver, pancreas, proventriculus, gizzard, small intestine, large intestine and cecum) and immune (spleen and bursa of Fabricius) organs. Relative heart weight significantly increased in birds fed diet with 200 mg/kg cumin essential oil. In addition, it was determined that there were no significant sex effects on relative organ weights.

Key words: Broiler, free-range, cumin essential oil, relative organs weight.

INTRODUCTION

In recent years, multifunctional herb and spice products as phytogenic additives, instead of antibiotics, have been used to support productivity and health of animals. In poultry nutrition, the beneficial effects of plant products (extract, essential oil, complete plant substances) or their bio-active components, which have antioxidant, antibacterial, antifungal, antiviral, anticoccidial, anti-inflammatory and immunomodulatory properties, can include to the improvement of flavour and feed intake, the stimulation of endogenous digestive enzyme secretion and the enhancement of immune response (Lee et al., 2004; Jamroz et al., 2005; Kırkpınar et al., 2011; Zeng et al., 2015).

The spice cumin (*Cuminum cyminum Linn*.) belonging to the *Apiaceae* (*Umbelliferae*) family is extensively cultivated in Mediterranean region. Cumin seed contains most dietary nutrients such as carbohydrates, fats, proteins, minerals and vitamins (Al-Kassi, 2010). In addition, cumin seeds have exhibited antioxidant, anti-inflammatory, anticholesterol and antimicrobial properties which are generally attributed to their pharmacologically active chemical compounds such as cuminaldehyde, terpinenes, polyphenols and flavoids (Dhaliwal et al., 2016). Results from *in vivo* and *in vitro* studies showed that cumin enhanced the excretion of bile acids (Platel and Srinivasan, 2000a) and increased the activity of digestive

enzymes such as amylase, trypsin, chymotrypsin and lipase (Platel and Srinivasan, 2000b; Ramakrishna Rao et al., 2003; Muthamma et al., 2008). The oral consumption of cumin powder significantly decreased gastrointestinal transit time and increased retention time in rats (Platel and Srinivasan, 2001). In this context, cumin products are traditionally recommended to use as growth and immune enhancers in poultry nutrition.

Generally, the relative weights of internal organs are associated with the development of digestive and immune systems. However, there are discrepant results about the effect of feeding herbal products on digestive and immune (Hernández et al., 2004; Al-Kassie, 2009; Toghyani et al., 2010; Tollba, 2010).

The aim of this study was to describe to the effects of dietary inclusion of cumin essential oil on the relative weights of internal organs (heart, liver, pancreas, proventriculus, gizzard, small intestine, large intestine, cecum, spleen and bursa of Fabricius).

MATERIAL AND METHODS

A total of 450 Hubbard Red JA one-day-old male and female broiler chicks were individually weighed, wing-banded, and randomly divided into 3 treatment groups consisting of 5 replicates each. The slow-growing chicks were placed in an open-sided, naturally ventilated broiler house. In the first week, all chicks were housed indoors only. The indoor pens were measured 3.0 m x 2.5 m (0.25 m^2/chick). The house had holes that were opened after 1 weeks, giving free access to the outdoor area approximately 13 hours daily (from 7:00 a.m to 8:00 p.m). The out-of-shelter (2 m^2/bird) area was surrounded by wire mesh, and covered with nets over the area.

Fattening of the broilers lasted 56 days. Birds were fed on maize–soybean based diets without (control) or with cumin essential oil (200 and 400 mg/kg). During the experimental period, a 4-phase feeding program was used, which diets contain 23.91% crude protein (CP) and 12.64 joule metabolizable energy (ME)/kg from 0 to 10 days, 22.19% CP and 12.81 joule ME/kg from 11 to 28 days, 21.58% CP and 12.82 joule ME/kg from 29 to 48 days, and 20.72 % CP and 12.93 joule ME/kg from 49 to 56 days.

Cumin (*Cuminum cyminum L*) essential oil from seed was provided by a commercial company (İzmir, Turkey), which produces by steam distillation. The essential oil was kept in brown glass vials covered with aluminium foil at -18 °C in the dark during the study. The chemical composition of cumin essential oil was identified using gas chromatography–mass spectrometry (GC/MS, HP 6890 GC/5973 MSD) at the Ege University, Research and Application Center of Drug Development and Pharmocokinetics, Environmental & Food Analysis Laboratories-Food Control Laboratory (Bornova, İzmir, Turkey) according to the United States Pharmacopeia and the National Formulary (USP, 1995). The major compounds of cumin essential oil are 1-phenyl-5-hexen-1-ol (29.25%), γ-terpinene (19.65%), β-pinene (16.01%) and cuminaldehyde (13.35%).

All experimental diets and water were provided ad-libitum. From day 3, the photoperiod was limited to natural daylight, which was 16 hours of light and 8 hours of dark per day.

At the end of this study, 10 birds (5 male + 5 female) each group were slaughtered. The heart, liver, pancreas, proventriculus, gizzard, small intestine, large intestine, spleen and bursa of Fabricius were weighed and their weights were expressed as g/100 g body weight of the birds.

The values were evaluated to one way ANOVA using the General Linear Model Procedure of SAS (1986). Means were compared using the Duncan's multiple range test *(α = 0.05*).

RESULTS AND DISCUSSION

The relative weights of heart, liver, pancreas, proventriculus, gizzard, small intestine, large intestine, spleen and bursa of Fabricius are presented in Table 1.

The supplementation of cumin essential oil did not cause significant differences in the relative weights of digestive (liver, pancreas, proventriculus, gizzard, small intestine, large intestine and cecum) and immune or lymphoid (spleen and bursa of Fabricius) organs. However, dietary treatment significantly affected the relative heart weight. Birds fed diet with 200 mg/kg cumin essential oil had higher relative heart weight than those of control group. In addition, it was determined that there were no significant sex effects on the relative organ weights.

In previous studies, Aami-Azghadi et al. (2010) found that the inclusion of cumin essential oil at 0.2, 0.4 and 0.8 g/kg did not affect relative weights of gastrointestinal tract, liver, cecum and heart of broilers at 49 days, and Habibi et al. (2016) showed that dietary supplementation of cumin essential oil at 100, 200 and 300 ppm had no effect on relative weights of liver, intestine, gizzard and heart in broilers at 42 days. In heat stressed slow-growing chicks, cumin supplementation did not cause significant differences in liver, heart, gizzard, pancreas and proventriculus percentages at 84 days (Ali et al., 2010). Various levels of cumin seed and cumin seed meal supplementation to starter and grower diets did not result in significant alterations in relative weights of heart, liver, gall bladder and gastrointestinal tract (Golian et al., 2010). Moreover, Hernández et al. (2004) revealed that there was no difference in relative weights of digestive organs of broilers fed diets containing plant extract mixtures (essential oil extract from oregano, cinnamon, and pepper and Labiatae extract from sage, thyme, and rosemary). Toghyani et al. (2010) reported that relative weights of digestive organs (heart, liver, gizzard, pancreas, proventriculus, small intestine and cecum) were not markedly affected by dietary inclusion of 5 and 10 g/kg thyme powder. On the contrary, Al-Kassie (2009) indicated that broiler fed diet containing 200 ppm of oil extract from thyme and cinnamon had significantly higher liver and gizzard percentages. According to Mellor (2000a, 2000b), enhancement of the metabolism of oil, carbohydrates and proteins in the major organs would increase growth rate of these organs.

In agreement with our findings, Aami-Azghadi et al. (2010) indicated that different levels of cumin essential oil supplementation did not significantly influence relative spleen weight and bursa of Fabricius size in broilers at 28 days, and Ali et al. (2010) found that dietary cumin supplement did not significant change bursa of Fabricius percentage of slow-growing chicks under heat stress condition. Berrema et al. (2017) also reported that dietary cumin seed power supplementation did not significantly affected lymphoid organ (thymus, bursa, and spleen) relative weights in chronically heat exposed chickens. In addition, Toghyani et al. (2010) observed non-significant differences in the relative lymphoid organs' weight in broiler by feeding of thyme powder. On the other hand, Habibi et al. (2016) noted that the addition of cumin essential oil (200 and 300 mg/kg) to diet resulted in a significant increase in bursa of Fabricius relative weight but not in spleen relative weight. Likewise, Elagib et al. (2013) determined that feeding cumin powder at level of 2% had increased only bursa of Fabricius weight among immunological organs. In a study conducted by Tollba (2010), it was stated that the dietary supplements of rosemary had a positive effect

on lymphoid organs relative weights (bursa and thymus) either under normal or high temperature conditions.

In poultry production, it is very important to improve immunity so as to prevent infectious diseases. Organ weight is a good indicator of health status of birds. Rising body weight and bursa of Fabricius relative weight may reflect higher immunity. Sellaoui et al. (2012) reported that an excellent immune status can be reached in a broiler flock, if the relative weight of bursa of the Fabricius is above 0.2% of the total body weight. In contrast, it has been proposed that immune-stimulation may have adverse effects on growth performance, because more nutrients will be repartitioned to synthesize antibodies and develop the immune organs, thereby decreasing the nutrients available for growth (Henever et al., 1999; Takahashi et al., 2000).

In conclusion, the cumin essential oil supplementation to diets at the level of 200 and 400 mg/kg during fattening period for slow-growing broilers did not adversely affect the development of the digestive and immune system organs.

Table 2. Relative organ weights of birds fed diets with different level of cumin essential oil (g/100 g body weight)

	Heart	Liver	Spleen	Pancreas	Bursa Fabricius	Proventriculus	Gizzard	Duodenum	Small intestine	Large intestine	Cecum
Group											
Control	0.56[b]	2.30	0.17	0.36	0.27	0.52	2.53	0.68	2.73	0.21	0.49
200 ppm cumin essential oil	0.68[a]	2.73	0.16	0.35	0.27	0.53	2.69	0.71	2.78	0.20	0.42
400 ppm cumin essential oil	0.65[ab]	2.14	0.16	0.33	0.24	0.52	2.62	0.60	2.58	0.18	0.44
SEM	0.03	0.31	0.01	0.03	0.03	0.04	0.17	0.05	0.15	0.01	0.03
Sex											
Female	0.64	2.50	0.17	0.36	0.24	0.55	2.70	0.68	2.73	0.20	0.47
Male	0.62	2.28	0.15	0.34	0.26	0.50	2.53	0.65	2.67	0.19	0.43
SEM	0.03	0.31	0.01	0.03	0.03	0.04	0.17	0.05	0.15	0.01	0.03
Source of variation	**Probabilities (P values)**										
Group	0.0100	0.1795	0.6149	0.5618	0.6108	0.9280	0.6522	0.1469	0.3917	0.2266	0.2066
Sex	0.5642	0.4105	0.1331	0.3895	0.3632	0.1562	0.2664	0.5048	0.5947	0.4082	0.3090
Group*Sex	0.8492	0.6798	0.4772	0.1467	0.0345	0.1263	0.7673	0.3560	0.2081	0.7402	0.7417

[a,b] Means within a column in each variable with no common superscript differ significantly ($P<0.05$).

SEM: standard error of means (pooled).

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THE EFFECT OF DRIP IRRIGATION AND DIFFERENT IRRIGATION APPLICATIONS ON SOIL MOISTURE CHANGE IN THE ROOT AREA OF MAIZE

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ABSTRACT

This research was carried out in Menemen Plain in 2009-2010 in order to determine the effect of different irrigation practices on soil moisture content of root area of maize. Drip irrigation system was used in the study and the irrigation was based on evaporation from the A-class evaporation vessel at intervals of 7 days. In the drop irrigation, the laterals are placed as one lateral in a row and one lateral in two rows. 100%, 75, 50, 25% of the 7 days total evaporation was applied as irrigation water, and non irrigated subject was also investigated. Irrigation water applied to the subjects in the study ranged from 60 to 371 mm in 2009 and 51 to 313 mm in 2010 while water consumption varied between 160 to 482 mm in 2009 and 204 to 475 mm in 2010. In the study, soil moisture changes were observed in the root area of the plant due to precipitation, irrigation water and water consumption of the plant from sowing to harvest. Moisture values in the root area of the plant of all subjects varied between field capacity and fading point. According to the irrigation subjects, the moisture exchange in the root area of the plant is shown graphically.

Key words : Drip irrigation, maize, water consumption, soil moisture

INTRODUCTION

One of the most important problems faced by countries today is the increase in demand for agricultural products in parallel with the increase in population and therefore the need for water.

As the demand for drinking water for urban and industrial sectors increases, the water resources used for agricultural purposes will also decrease. In this case it is necessary to increase the efficiency of water and land use for higher production. To achieve this, the irrigation method must aim the optimum use of water and soil resources. The efficient use of resources is possible by knowing the current use and presenting bottlenecks and generating solutions. For this reason, it is necessary to use methods that provide optimum utilization of irrigation water which is a very important input in agricultural production.

There are several ways to get optimum benefit from irrigation water. These are generally methods and systems that use irrigation water in a controlled manner. However, these methods and systems should not cause significant loss in yield while reducing water loss or water consumption.

Nowadays, it is known that one of the methods that provide this condition is the drip irrigation method. With this method, the water is given to the root zone of the plant to provide

minimum evaporation and depth percolation losses, furthermore, when the root zone has low humidity tension, the plant undergoes less stress. Since the amount of water applied in drip irrigation is controlled, there is no surface flow and losses, water saving and efficiency are increased, and the yield of product per unit water is increased.

Numerous research were conducted regarding the irrigation of maize in Turkey and other countries. While Ul (1990) studied under conditions of Menemen Plain and Çetin (1996) under Haran Plain to determine the water consumption of second crop maize, Beyazgül (1997) studied the four different developmental periods of maize plant(A-non irrigated, B-top tassel, C-top tassel + milk stage, D-earthing up + cob tassel pollinating, E-top tassel + cob tassel pollinating + milk stage, F- earthing up + top tassel formation + cob tassel pollinating + milk stage) on his study to determine the water consumption of second crop maize under conditions of Menemen Plain. According to the results of the research, when F subject is suggested, it is indicated that irrigation water requirement is 515 mm and water consumption is 636 mm except for temper water.

Degirmenci et al. (1998), analyzed the effects of water constraints on the yield in different developmental periods of maize in their studies where they investigated water-yield relationship of second crop maize under Harran plain conditions

In the study, the seasonal yield- response factor ky of maize was determined to be 1,582. The researchers also calculated the ky values of maize at different developmental periods.

Gündüz et al. (2008) stated that in the study carried out in Balıkesir conditions, 4 times of irrigation should be done when the plant height of the corn is 40-45 cm., in the period of top tassel, cob formation and milk stage, in case of water restriction, it is appropriate to water twice in the top tassel and milk stage periods.

Balçın (2004) found the effect of different planning criteria on performance in furrow irrigation, Özyurt et al. (2009) investigated the form of sequental furrow irrigation on maize, Degirmenci et al. (2012) investigated different furrow operating techniques in second crop maize in Harran Plain conditions.

Gündüz et al. (2009) on vineyard , Gündüz et al. (2011 a) on peach, Gündüz et al. (2011 b) on wheat, Gündüz and Korkmaz (2013) examined the moisture changes in the root area of the cotton irrigated with drip irrigation and made graphs of the temporal change of the soil moisture.

MATERIAL AND METHOD

The research was carried out in 2009-2010 in the area of the International Agricultural Research and Training Center located in Menemen Plain.

Menemen Plain, which includes aluvial lands and the coluvial piedmonts, surrounded by steep sloping hills from the east and north. Gediz aluvial basin is at 0-6 m, side aluvials are 6-30 m height and the height of the surrounding mountains is about 1100 m. There are 16 land groups in the 5 land territory (Topraksu, 1971).

Mediterranean climate is prevalent in Menemen Plain, the summers are hot and dry, and the winters are warm and rainy. According to average climate data for many years; total annual rainfall is 545 mm, average temperature is 16.9 ^{o}C, the warmest month is July with the average of 27.0 ^{o}C and the coldest month is January with the average of 7.9 ^{o}C. As seen in Table 1, in 2009-2010 years when the survey was conducted, the average temperature was measured as 17.5-18.1

^{o}C, total annual rainfall as 640.2-707.4 mm and mean relative humidity as 63.8-66.4% (MGM, 2016).

Table 1. Menemen District 2009 and 2010 years and average years climate data

Months	Average Temperature (°C)			Precipitation (mm)			Evaporation (mm)			Relative Humidity (%)		
	2008-2009	2009-2010	1954-2015	2008-2009	2009-2010	1954-2015	2008-2009	2009-2010	1954-2015	2008-2009	2009-2010	1954-2015
October	18.5	19.6	17.4	13.4	17.0	38	85.4	81.8	99.2	63.9	66.9	60.8
November	14.4	13.3	13.0	75.2	70.0	75	47.4	43.2	57.0	73.5	75.4	65.0
December	9.8	11.8	9.6	58.6	165.8	108	40.4	40.4	43.8	72.9	76.9	68.0
January	9.0	9.4	7.9	148.4	108.8	91	42.5	43.7	43.8	74.2	74.3	66.6
February	9.2	11.6	8.8	114.2	199.6	74	44.7	48.1	49.1	73.9	74.4	63.9
March	10.6	11.7	11.0	131.8	20.2	62	67.8	74.0	77.6	72.2	69.5	62.2
April	15.1	15.7	15.0	46.6	51.0	43	93.2	107.8	109.7	70.0	63.6	59.2
May	20.5	20.6	20.0	9.6	23.4	27	158.2	151.1	167.3	55.5	58.5	55.7
June	25.2	24.2	24.7	7.6	16.6	9	194.2	152.9	218.6	51.3	61.4	49.3
July	27.9	27.6	27.0	-	7.0	2	216.8	185.6	258.2	50.6	55.4	47.3
August	26.9	28.6	26.4	-	-	3	202.5	170.6	226.8	47.2	58.3	49.0
September	22.3	23.1	22.3	34.8	28.0	13	119.6	117.0	159.1	60.9	62.5	55.0
Annual	17.5	18.1	16.9	640.2	707.4	545	1312.7	1216.2	1510	63.8	66.4	58.5

Table 2. Some physical and chemical properties of the test field soil

Soil Depth (cm)	Texture	Field Capacity (P_w%)	Wilting Point (P_w%)	Volume Weight (g/cm^3)	EC (dS/m)	$CaCO_3$ (%)	Organic Matter (%)	pH
0-30	L	24.8	11.8	1.40	0.78	4.1	1.4	7.6
30-60	L	23.6	10.8	1.31	1.18	4.5	1.3	7.5
60-90	CL	23.5	12.5	1.24	1.11	6.4	1.1	7.8

The experimental grounds are loamy texture and some physical and chemical properties are given in Table 2. The quality of the irrigation water used in the study is T_2 (1,01 dS / m) according to the Wastewater Treatment Facilities Technical Procedures Communiqué and its harm level in the irrigation is low and moderate.

In the drip irrigation system used in the research, on-line drippers with 3,75 l / s flow pressure regulator were placed on 20 mm PE pipes . In the design of the irrigation system, soil texture and infiltration rate (8 mm / h) was considered and the system was operated at 1.5 atm pressure.

The study was conducted with three replications in randomized blocks in a split parcel test design. The main subjects in the experiment are L_1: one lateral in each row, L_2: one lateral in two rows; sub-subjects, $Kp_{1.0}$: application of 100% of 7 days total evaporation as irrigation water, $Kp_{0.75}$: application of 75% of the water given to subject $Kp_{1.0}$ as irrigation water, $Kp_{0.50}$: application of 50%

of the water given to subject $Kp_{1.0}$ as irrigation water, $Kp_{0.25}$: application of 25% of the water given to subject $Kp_{1.0}$ as irrigation water, Kp_{0} : Non irrigated subjects.

The amount of irrigation water is calculated by Equation 1 (Yıldırım and Madanoğlu, 1985).

$$I= A.E_{pan}. K_p. P_{ıo} \quad (1)$$

In Equation; I: amount of irrigation water (l), A: parcel area(m^2), E_{pan}: the total amount of evaporation in the irrigation area (mm), Kp : pan coefficient, Pio: wetting rate. Evaporation values were measured from the A-class evaporation chamber placed in the study area.

As the entire surface of the land is wet in the L_1 subjects where one lateral is placed in each row, $P_{ıo}$ is taken as 1; as 65% of the land surface is wet in the L_2 subjects where one lateral is placed in two rows, $P_{ıo}$ is taken as 0,65

Plant water consumption is calculated with the following water balance equation (Equation 2) for 0-90 cm soil depth (James, 1988).

$$ET= I+P\pm\Delta SW-D_p-R_f \quad (2)$$

In the equation; ET: evapotranspiration (mm), I: irrigation water (mm), P: precipitation (mm), ΔSW: change in soil water content (mm), D_p: Depth Percolation(mm) and R_f: Surface flow(mm).

Since the R_f value and the depth percolation can not be detected because the irrigation is made with the drip irrigation system, the D_p value is taken as zero.

Physical analyzes such as field capacity, fading point, volume weight and soil texture and chemical reactions such as soil reaction, electricity permeability, organic matter, phosphorus, potassium and lime in the samples taken at 0-30, 30-60, 60-90 cm depth from the test field soil were made with the methods given at Tüzüner et al. (1990) and Richards (1954).

Tillage and fertilization: The field where the test will be set up was plowed every fall. When the soil conditions were appropriate in the spring, soil fertilization was carried out with sweeping tools after required fertilizers were applied. The amount of fertilizer to be given was determined by analyzes made with soil samples taken in January.

All phosphorus fertilizer (P_2O_5,43% triple super phosphate) and half of the nitrogenous fertilizer (N, 21% ammonium sulfate) were added to the soil in the form of ammonium sulphate before the first soil treatment. The other half of the nitrogenous fertilizer (N, 26% ammonium nitrate) was applied to the rows with the fertilizer before the first hoe.

Agricultural operations: After the preparation of the soil in the spring, it was planted in May as 25 cm on the row and 70 cm between the rows. Pioneer 3167 maize type was used in the research. This type recommended as the main product in the Aegean and Mediterranean regions is appropriate for machine harvest(Köseoğlu Agriculture, 2011). After the completion of the first leaf collar, the second half of the nitrogenous fertilizer was applied and land was hoed. Harvests were made in the first days of September and the grain yields were corrected according to 15% humidity.

Irrigation: The amount of evaporation from the class A pan in the study area was taken into account in the irrigation. The irrigation started at the beginning of June, when approximately

40% of the available moisture at 0-90 cm soil layer was consumed, and 8 irrigation was carried out in every 7 days until the end of July.

The accumulated water consumption of test subjects is calculated according to the method of decreasing humidity (Beyce and Madanoğlu, 1978).

ANOVA was applied in evaluating the analysis and measurement results of maize yield (Yurtsever, 1984).

RESULTS AND DISCUSSION

Irrigation water amount, water consumption and maize grain yield productivity of the irrigation subjects

Irrigation water applied to the subjects during the survey conducted in 2009 and 2010 is given in Table 3 and monthly water consumption in Table 4. The averages of seasonal irrigation water, water consumption and yield values are given in Table 5. The irrigation started at the beginning of June, when approximately 40% of the available moisture at 0-90 cm soil layer was consumed, and 8 irrigation was carried out within every 7 days by the end of July. The total evaporation amounts for 7 days in the irrigation were corrected by wetting rates(L_1= 1,00, L_2= 0,65) in the drip irrigation system.

As can be seen from the table, irrigation water applied to the topics in 2009 varied between 60($L_2K_{p\ 0.25}$) and 371 mm ($L_1K_{p\ 1.00}$) and water consumption of the subjects varied between 160 (S_0 non-irrigated) -482 mm($L_1K_{p\ 1.00}$). In 2010, irrigation water applied to the subjects ranged from 51($L_2K_{p\ 0.25}$) to 313 mm ($L_1K_{p\ 1.00}$) and the water consumption of the subjects ranged from 204 (S_0 non-irrigated) to 475 mm($L_1K_{p\ 1.00}$). The average corn grain yields obtained ranged from 495 (S_0 non-irrigated) to 1174 kg / da ($L_1K_{p\ 1.00}$)

Table 3 Irrigation dates and amounts of irrigation water applied to the subjects, mm

Year	Irrigations	Irrigation Water									
		Date	$L_1K_{p1.00}$	$L_1K_{p0.75}$	$L_1K_{p0.50}$	$L_1K_{p0.25}$	$L_2K_{p1.00}$	$L_2K_{p0.75}$	$L_{12}K_{p0.50}$	$L_2K_{p0.25}$	S_0
2009	1st	08.06.2009	38.9	29.2	19.5	9.7	25.3	19.0	12.6	6.3	-
	2nd	15.06.2009	50.9	38.2	25.5	12.7	33.1	24.8	16.5	8.3	-
	3rd	22.06.2009	52.2	39.2	26.1	13.1	33.9	25.4	17.0	8.5	-
	4th	29.06.2009	40.9	30.7	20.5	10.2	26.6	19.9	13.3	6.6	-
	5th	06.07.2009	41.6	31.2	20.8	10.4	27.0	20.3	13.5	6.8	-
	6th	13.07.2009	43.7	32.8	21.9	10.9	28.4	21.3	14.2	7.1	-

	7th	20.07.2009	47.9	35.9	24.0	12.0	31.1	23.4	15.6	7.8	-
	8th	27.07.2009	55.2	41.4	27.6	13.8	35.9	26.9	17.9	9.0	-
		Total	371	278	186	93	241	181	121	60	-
2010	1st	07.06.2010	33.2	24.9	16.6	8.3	21.6	16.2	10.8	5.4	-
	2nd	14.06.2010	35.8	26.9	17.9	9.0	23.3	17.5	11.6	5.8	-
	3rd	21.06.2010	43.4	32.6	21.7	10.9	28.2	21.2	14.1	7.1	-
	4th	28.06.2010	30.7	23.0	15.4	7.7	20.0	15.0	10.0	5.0	-
	5th	05.07.2010	37.7	28.3	18.9	9.4	24.5	18.4	12.3	6.1	-
	6th	12.07.2010	42.2	31.7	21.1	10.6	27.4	20.6	13.7	6.9	-
	7th	19.07.2010	47.1	35.3	23.6	11.8	30.6	23.0	15.3	7.7	-
	8th	27.07.2010	42.6	32.0	21.3	10.7	27.7	20.8	13.8	6.9	-
		Total	313	235	156	78	203	152	102	51	-

In 2009, a total of 371 mm irrigation water was applied to the $L_1K_{p1.00}$ subject which was the most irrigated subject in the range of 38.9-55.2 mm for 8 times in total, a total of 60 mm irrigation water was applied to the $L_2K_{p0.25}$ subject which was the less irrigated subject in the range of 6.3-9.0 mm for 8 times in total. In 2010, a total of 313 mm irrigation water was applied to the $L_1K_{p1.00}$ subject which was the most irrigated subject in the range of 30.7 – 47.1 mm for 8 times in total , a total of 51 mm irrigation water was applied to the $L_2K_{p0.25}$ subject which was the most irrigated subject in the range of 5.0-7.7 mm for 8 times in total.

The minimum monthly water consumption of the $L_1K_{p1.00}$ subject which was the most irrigated subject in 2009 was in May with 59 mm and the maximum water consumption was in July with 180 mm, while in 2010 the minimum monthly water consumption was in May with 57 mm and the maximum water monthly water consumption was in July with 187 mm.

The minimum monthly water consumption of the Non Irrigated S_0 subject in 2009 were in July and August with 23 mm and the maximum water consumption was in May with 59 mm, while in 2010 the minimum monthly water consumption was in August with 9 mm and the maximum water monthly water consumption was in June with 70 mm.

Table 4 Monthly water consumption of irrigation subjects, mm

Year	Months	Monthly Water Consumption								
		$L_1K_{p1.00}$	$L_1K_{p0.75}$	$L_1K_{p0.50}$	$L_1K_{p0.25}$	$L_2K_{p1.00}$	$L_2K_{p0.75}$	$L_{12}K_{p0.50}$	$L_2K_{p0.25}$	S_0
2009	May	59	59	59	59	59	59	59	59	59
	June	163	125	98	72	117	92	81	62	55
	July	180	142	113	61	128	111	75	59	23
	August	80	68	43	48	59	48	44	33	23
	Toplam	482	394	313	239	363	309	259	213	160
2010	May	57	57	57	57	57	57	57	57	57
	June	151	125	106	88	118	107	93	84	70
	July	187	142	104	65	126	104	76	59	32
	August	66	74	62	54	74	64	59	42	36
	September	15	12	12	15	12	15	15	13	9
	Total	475	410	341	279	345	345	300	255	204

Table 5. 2009-2010 Average irrigation water, water consumption, yield values,

Subjects	Irrigation water (mm)	Water Consumption (mm)	Yield (kg/da)
$L_1K_{p1.00}$	342.0	479	1174
$L_1K_{p\ 0.75}$	256.5	402	1135

$L_1K_{p\ 0.50}$	171.0	327	959
$L_1K_{p\ 0.25}$	85.5	260	780
$L_2K_{p1.00}$	222.0	375	1097
$L_2K_{p\ 0.75}$	166.5	329	989
$L_2K_{p\ 0.50}$	111,5	280	883
$L_2K_{p\ 0.25}$	55,5	234	739
$K_{p\ 0.0}$	0	182	495

Temporal change of soil moisture content in plant root area according to irrigation subjects

Soil moisture measurements were made at the date of planting, before each irrigation, on the first day of each month and on harvest date. The soil moisture content in the plant root area (0-90 cm) in the years of study was observed in all the subjects and the temporal change in the soil moisture content in 2009 are shown in Figure 1 and the temporal change in the soil moisture content in 2010 are shown in Figure 2. There was a total of 61 mm of rainfall in the study, which was 17.2 mm in June 2009 and 40 mm in June and 14 mm in September 2009.

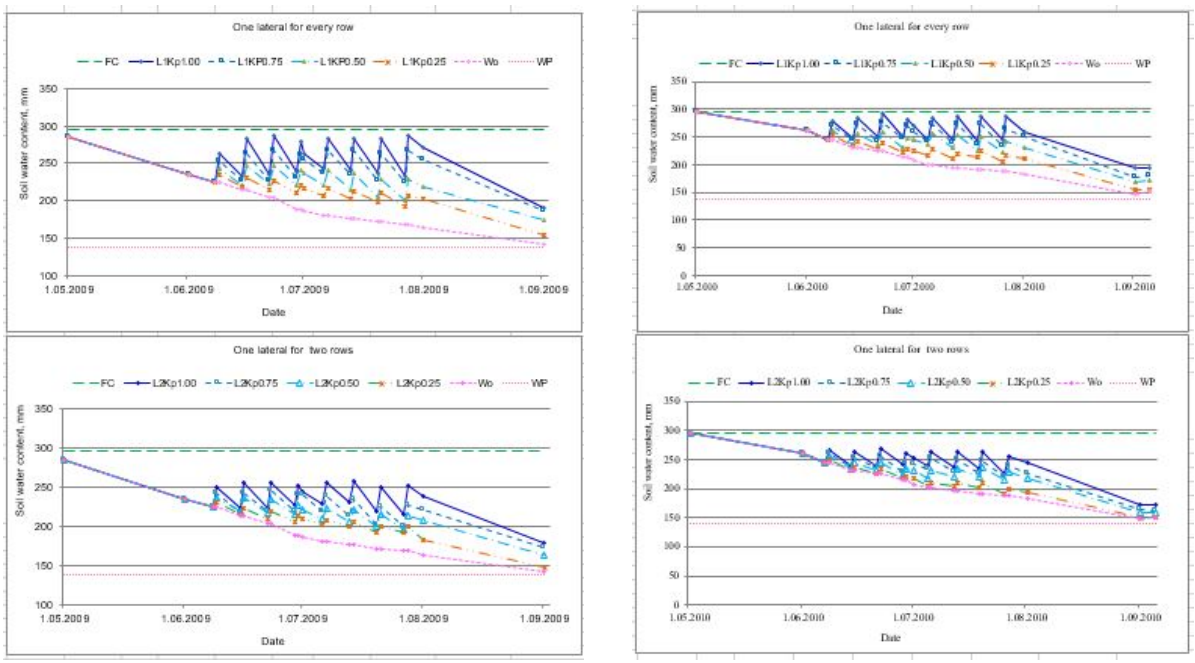

Figure 1. Variation of soil moisture content of test subjects in 2009

Figure 2. Change of soil moisture content of test subjects in 2010

The amount of moisture in the root area of the subjects was changed depending on irrigation water applications according to the irrigation made in relation to the total evaporation for 7 days during each two years when the study was carried out. Soil moisture contents vary according to the subjects, but the moisture content of the much irrigated subjecs is higher than the less irrigated ones. Moisture in the effective root area of the non irrigated subject was steadily decreased and fell to the wilting point at harvest time. The soil moisture content of the subjects never fell under the wilting point during the growing season. During the study, the level of the ground water at the test field was observed and it was seen that the maximum level was 170-180 cm in July and August. Due to the fact that there is less humidity change in the 60-90 cm soil layer than other layers; it is thought that there may be a feed from the watertable.

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PATOGENIC CONTAMINATION ON LETTUCE AND SOIL IRRIGATED BY TREATED DOMESTIC WASTE WATER

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ABSTRACT

The Research was conducted at International Agricultural Research and Training Centre in Menemen, located in Western Turkey, in the late summer period in 2014. In this research, lettuce was irrigated by 3 different irrigation methods, drip irrigation, subsurface drip irrigation and furrow irrigation, with treated domestic waste water. Anion-cation, pollution analyses and fecal coliform tests were run. Also soil samples, from plots from the depth of 0-20 cm, were taken and analyzed in order to monitor the status of the pathogens in soil. Water's pH values were 7,59-7,79, EC values were 2,7-3,9 dS/m, fecal coliform values were between 1,456x10^3 and 2,568 x10^3 cfu/100 ml. According to the analyses of soil samples before irrigation by treated waste water, salmonella was also uncounted beforehand. It is thought that, this case can be a result of the feces of the winged living around the trial area. According to the pathogenic analyses run on harvested lettuce *E. coli* values were found respectively 2x10^1 cfu/100g for sub-surface drip irrigation, 3 x10^1 cfu/100g *E.* for drip irrigation and 4,4 x10^2 cfu/100g for furrow irrigation. As a conclusion, it was found that pathogenic contamination in subsurface drip irrigation is less than the other methods.

Key words: Waste water, reuse, lettuce, pathogen, *E. coli*

INTRODUCTION

Nowadays, as the water resources getting lesser and more limited, it is necessary to use marginal water resources such as wastewater instead of potable water for irrigation. Domestic and industrial wastewaters, animal origin wastewaters, drainage waters that return from irrigation are sources of reusable wastewater. It is estimated that 80% of the wastewater from cities in developing countries is used for continuous and seasonal irrigation. India uses 25% and South Africa uses 24% of treated wastewater for irrigation. Unplanned indirect use of wastewater is more common (Blumenthal et al., 2000). In Tunisia, which is located in arid and semi-arid regions, 6500 ha of agricultural area is being irrigated with recycled wastewater, and in the future it is thought that 20000 hectares of area will be irrigated (Bahri and Brissaud, 1996). Israel recycles more than 65% of the wastewater, it considers to be a new source of water. This ratio is planned to be increased over 90% in next ten years (Friedler, 2001).

Developing countries, especially in the arid regions, need low-cost reliable technologies to acquire new water resources and protect existing ones from pollution. As the demand for water increases, the recycling of wastewater has become an important water resource (Asano, 1994, Kukul et al., 2009).

Places where wastewater is mostly used are agricultural and non-agricultural irrigation (park, garden, green areas, golf course etc.) and groundwater supplies. Treated wastewater can be reused as industrial cooling or process water. Reuse of wastewater in Turkey has been implemented in plenty of water-consuming sector such as; textile, paper and metal industries. Especially the fact that there is lack of sufficient water in Istanbul and its industrial establishments, the rapid increase in water and wastewater prices, made the reuse of wastewater become a current issue (Korkmaz et al., 2012).

Waste water should be used with caution and protective measures should be applied when it is used because it can threaten the health of human and animal which may affect soil, plant, surface and groundwater quality negatively. In this study, three different irrigation methods were used to determine whether pathogenic contamination was caused by the use of treated domestic wastewater in the irrigation of raw consumed lettuce. Furrow, drip and subsurface drip irrigation methods were used and the contamination of the lettuce plant which was irrigated with these waters was evaluated.

MATERIAL AND METHODS

This research was conducted in Menemen International Agricultural Research and Training Center in 2014. The experiment was set up in the design of random blocks with three replications.

Domestic wastewater treated at Menemen Biological Wastewater Treatment Plant was used as irrigation water. Experimental subjects are irrigation methods. These are; furrow irrigation, drip irrigation and subsurface drip irrigation. The plant material of the research is Kassam variety summer lettuce. The lettuce was planted at the beginning of September and was harvested at the end of October. This plant has been specifically chosen because it is thought to be a critical plant regarding contamination since its leaves are consumed raw.

2.09.2014	Planting
9.09.2014	First irrigation
12.09.2014	Vegatative stages
3.10.2013	Lettuce heart
21.10.2014	Last irrigation
5.11.2014	Harvest

Irrigations were applied, when the available soil moisture was decreased 30% from the field capacity for drip and subsurface drip irrigation and decreased 50% for the furrow irrigation. For drip irrigation, 241 mm, 233 mm for subsurface drip irrigation and 301 mm irrigation water for furrow irrigation were applied.

The treated wastewater was brought from the wastewater treatment plant to the field with PVC tank before each irrigation application and irrigation immediately started. Standard irrigation water, pollution parameters and some microbiological analyzes were run at laboratory of Microbiology Department of Ege University Faculty of Science and UTAEM. EC, pH and fecal coliform analyzes were performed weekly.

Soil samples for microbiological analysis were taken before panting and after the harvest from the depth of 0-20 cm of the soil where the microbiological activity is most intensive and the population of the pathogenic microorganism in the soil was examined. When the samples were

taken, sterilization was emphasized, in this regard gloves and sterilized bags were used, and samples were brought to the laboratory in conditions that would provide + 4 °C.

The pathogenic contamination analysis for lettuce; samples were taken from 9 parcels randomly and were brought to the laboratory with the condition + 4 °C.

FINDINGS AND DISCUSSION

The effluent of Menemen Wastewater Treatment Plant used as irrigation water, fecal coliform values varied between 1,456 $x10^3$ – 2,254 $x10^3$ cfu/100 ml. These values were above the limit values stated in the Wastewater Treatment Facilities Technical Procedures Communiqué (AATUT, 2010).

Table 0.1. pH, EC and fecal coliform values of treated wastewater

Date	pH	EC (ds/m)	Fecal coliform (cfu/100 ml)
05.09.14	7,67	3,160	1,785 $x10^3$
11.09.14	7,14	2,107	1,456 $x10^3$
14.09.14	7,48	3,030	1,985 $x10^3$
19.09.14	7,24	3,028	2,254 $x10^3$
29.09.14	8,57	3,400	1,962 $x10^3$
11.10.14	7,65	3,680	1,547 $x10^3$

EC values were in the range of 2,107-3,680 dS / m. These values were also categorized as low to moderate damage in the use according to the Wastewater Treatment Facilities Technical Procedures Communiqué (2010).

Table 0.2 Water pollution analyses (2014, mg/l)

Dater	COD	BOD_5	SS	TN	NO_3-N	TP
05.09.2014	85	50	3,6	70	21,1	□0,5
28.09.2014	48	40	21,2	120	6,5	0,8
23.10.2014	□15	45	12,4	120	13,7	1,25

COD: chemical oxygen demand, BOD: biological oxygen demand, SS: suspended solids

Biological oxygen demand analysis results varied between 40 mg l^{-1} and 50 mg l^{-1}. According to the Wastewater Treatment Facilities Technical Procedures Communiqué, the BOD_5 value should be <20 mg / L. The need for biological oxygen and chemical oxygen gives an idea of the presence of water pollution. The higher these values are, the higher the presence of microorganisms that consume oxygen in the water. When nitrogen (N) values are taken into account, high values are obtained as expected and this shows that the water is rich in terms of plant nutrient element.

Table 0.3 Potential toxic elements of treated wastewater (ppb)

Date	Fe	Cu	Zn	Mn	Pb	Cd	Cr	Co	Ni
05.09.2014	0,21	0,37	22,20	3,30	2,28	4,97	10,48	1,62	34,82
28.09.2014	0,41	0,42	19,84	6,94	3,02	2,68	9,31	2,32	13,34
02.10.2014	0,58	0,04	77,15	2,55	1,54	0 ,40	12,57	3,81	16,23
23.10.2014	0,32	0,68	22,98	6,73	20,78	2,21	13,53	2,17	92,21
Reference values	**5000**	**200**	**2000**	**200**	**5000**	**10**	**100**	**50**	**200**

Due to the domestic origin of the treated wastewater, as expected, the values seen in Table 3.3 were found to be below the reference values and it was found that there was no inconvenience for using in the irrigation.

Table 0.4 Microbiological analyses results of soil

Sampling	Subjects	Total viable bacteria (cfu/100g)	Coliform bacteria (cfu/100g)	*E. Coli* (cfu/100g)	*Salmonella spp.*	Helminth eggs and protozoon
Before sowing	Drip irrigation	$3,2x10^6$	$4,5x10^3$	$1\ x10^1$	+	-
	Sub-surface drip irrigation	$4,8\ x10^6$	$2,8\ x10^3$	$1\ x10^1$	+	-
	Furrow irrigation	$2,4\ x10^6$	$1,1\ x10^3$	$1\ x10^1$	+	-
After harvest	Drip irrigation	$2,8x10^7$	$6,3\ x10^3$	$3,3\ x10^3$	+	-
	Sub-surface drip irrigation	$2,4\ x10^7$	$4,4\ x10^3$	$1,4\ x10^3$	+	-
	Furrow irrigation	$3,1\ x10^7$	$6,4\ x10^3$	$8\ x10^3$	+	-

Microorganism analyzes in samples taken from 0-20 cm soil depth before planting and after harvest are given in Table 3.4. As shown in the table, it is normal to have 10^6 cfu / 100 g viable bacteria in any field's soil (Ateş et al., 2012). The fecal coliform group, feces originates, from these viable bacteria can cause disease in humans.

The increase in the number of these bacteria is remarkable when appropriate environments are established for the life of these bacteria after irrigation with treated wastewater.

The positive / negative tests for Salmonella were positive in both periods. Salmonella is a type of bacteria, especially founded in poultry feces. Menemen Plain is very close to İzmir Bird Paradise and it is also a frequent spot for heron birds. Salmonella infection is thought to originate from the feces of these birds. Helminth egg cysts and protozoon (Giardia lamblia) were not found in pre-planting and post-harvest soil samples.

Table 0.5 Microbial contamination values of lettuce

Subjects	**E.coli (cfu/100g)**	**Salmonella**	**Helminth eggs and protozoon**
Drip irrigation	$3x10^1$	+	-
Subsurface drip irrigation	$2x10^1$	+	-
Furrow irrigation	$4,4x10^2$	+	-

The results of pathogenic microorganism analysis in lettuce samples, randomly selected at harvest, are shown in Table 3.5. *E. coli* contamination appears to be the most common in the furrow irrigation system with $4.4x10^2$ cfu / 100g. The least contamination was achieved with $2x10^1$ cfu 100-1 g for subsurface drip irrigation. Despite the lack of Salmonella in the irrigation water, Salmonella was found on the lettuce leaves. It is thought to be the Salmonella which was already in the soil. Helminth egg cysts and protozoon (Giardia lamblia) were not found in lettuce leaves.

RESULTS

In recent years, the need for fresh water has been steadily increasing with the increasing world population, global warming-related water scarcity and rapid industrialization. Preservation of freshwater resources and the treatment and reuse of water constitute one of the most important issues of our time. Wastewater treatment plants have been established in almost all of the municipalities with a population exceeding 100,000 in our country and these facilities have been opened to operate within the framework of watershed protection action plans. Especially domestic sourced wastewater should be discharged to the receiving environment in a controlled manner because they can contain bacteria and viruses which could cause intestinal system diseases. If these waters are applied for irrigation, drip irrigation practices should be chosen especially in raw vegetables, but it should never be forgotten that there may still be contamination, for this reason farm workers should continue their work after taking the necessary precautions, persons who come into contact with the water should be informed and pass the necessary health checks

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EFFECTS OF IRRIGATION WITH WATER FROM DIFFERENT SOURCES ON SOME CHEMICAL PROPERTIES OF THE SOIL

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ABSTRACT

This study was conducted to determine the effect of irrigation with water from different sources on some chemical properties of the soil. The study was conducted for three years with three replications in randomized plot experimental design. Experimental topics consist of "Treated Domestic Wastewater", "Gediz River Water" and "Well Water". According to soil analysis results, soil pH in all subject soils have slightly decreased; Electrical conductivity (EC), exchangeable sodium percentage (ESP) and boron (B) have increased in soils treated with Treated Domestic Wastewater; The CaCO3 value has not changed. Electrical conductivity, exchangeable sodium percentage, boron and CaCO3 values have not changed much in soils irrigated with Gediz River Water and well water.

Key words: domestic waste water, Gediz River, well water, irrigation, water properties, soil properties

INTRODUCTION

Turkey is among the countries in risk group of which the water resources will be adversely affected due to global climate change. Therefore, efficient use of water resources in Turkey is extremely important.

In Turkey, the average annual rainfall is 643 mm, which corresponds to an average of 501 billion m3 of water per year. While a large part of this water is removed by evaporation, evapotranspiration and river currents, about 7 billion m3 of water per year comes from neighboring countries. In this case, the total surface water potential is 193 billion m3 (DSİ, 2013).

Urban waste water is 3.7 $km^3 year^{-1}$ and industrial waste water is 3.0 $km^3 year^{-1}$ in Turkey and it is understood that the waste water potential is inadequate. However, the shortages of the amounts are partly due to the lack of available data. Urban wastewater is not yet fully purified and cannot be supplied to the receiving environment.

By using the waste water in irrigation; positive effects such as solving the problem of water shortage, elimination of bad quality water in large quantities with minimum environmental risks, economic benefit due to the content of plant nutrients and possibility of use of clean water used in agriculture in other areas are obtained (Aşık et al., 2001).

In addition to the global warming, the average annual rainfall of 537 mm in recent years in the research area has been decreasing gradually and it has decreased up to 219 mm in 2007 which lead to increased use of wastewater in irrigation. The diversity of the quality and content of wastewater, the uncertainty of the effect of the use of these waters in irrigation on the soil and vegetation is an issue to be confronted.

In studies on the lands irrigated with wastewater in Turkey and some other countries, some researchers have determined that the electrical conductivity(EC) increases, some other researchers have determined that EC and exchangable sodium percentage(ESP) increase. (Elkiey, 1993; Şener, 1993; Çiftçi et al. 1995; Altınbaş et al. 2004; Malla et al.2007; Mohamed et al. 2007; Kızıloğlu et al. 2008; Melgar et al. 2009; Al-Omran, 2010; Liu ve Haynes, 2010; Ladwani et al. 2012; Çay ve Kanber, 2013; Bedbabis et al. 2014; Gündüz et al. 2014, Gündüz et al. 2015).

With this study, the effects of irrigation with water from different sources on the chemical properties of the soil were investigated.

MATERIAL AND METHOD

The research was carried out on loam and silty loam soils on Menemen Plain which is located in the west of Turkey. According to average climate data for many years; total annual precipitation is 537 mm, evaporation is 1513 mm, average temperature is 17 ^{o}C and average relative humidity is 58% (Utaem, 2013).

Polyester tanks with dimensions of 100x140x140 cm were used in the study. These tanks were placed at a depth of 120 cm so as the first 20 cm to remain on the soil surface. To the inside of the tanks at40 cm depth, 3 cm wide water flow breakers are replaced so that irrigation water does not flow from the side of the tank. The soil inside the tanks is in its intact natural structure.

The study was conducted for three years with three replications in randomized plot experimental design. Experimental topics consist of “Treated Domestic Wastewater", "Gediz River Water" and "Well Water".

Cotton and vetch were cultivated in the study. The vetch was watered 1 time in March and cotton was watered 4 times except for temper water and 105 mm water was given in each irrigation (Gündüz and Korkmaz, 2007).

Water samples were taken prior to each irrigation and were analyzed for total and fecal coliform bacteria counts, COD (Chemical Oxygen Demand), BOD (Biological Oxygen Demand), NO_3-N, total N, NH_4-N,, total P, suspended solids, EC (Electrical Conductivity), pH, B (Boron), Na%, soluble ion. Total and fecal coliform bacteria counts in irrigation water were also performed.

Soil specimens were taken twice a year after vetch and cotton harvests from the layers where profiles were defined from soil profiles at 0-120 cm depth. In the samples taken; EC, pH, ESP (Exchangeable Sodium Percentage), B and $CaCO_3$ analyzes were performed.

Table 1. Improved interpretation guidelines for the assessment of chemical quality of irrigation water (FAO 29 - FAO 47 - AATTUT)

Potential irrigation problem	Restriction on use		
	None	Medium	Heavy
EC, dS/m	<0.7	0.7-3.0	>3
Total salt, mg/l	<450	450-2000	>2000
Na, me/l			
Surface irrigation	<3	3-9	>9
Sprinkling irrigation	<3	>3	
Cl, me/l			
Surface irrigation	<4	4-10	>10
Sprinkling irrigation	<3	>3	
B, mg/l	<0.7	0.7-3.0	>3

Nitrogen, NO_3-N (mg/l)	<5	5-30	>30
Bicarbonate, HCO_3 (me/l)	<1.5	1.5-8.5	>8.5
Magnesium, Mg (me/l) –FAO 29	0	-	5

Generally in Turkey AATTUT(Wastewater Treatment Facilities Technical Procedures Communiqué) is used for treated wastewater to be used for agricultural purposes, in which the quality criteria and technical limitations are defined(Official Gazette 2010). In this study, evaluation was primarily conducted according to AATTUT and FAO 47 (Table 1). Classification of the chemical properties of the soil was made according to the values indicated in Table 2.

Table 2 Classification of some chemical properties of soil samples according to their limit values, (Anonymous, 2008)

Soil Properties	Limit Values	Evaluation	Soil Properties	Limit Values	Evaluation
pH	<4.5	Strong acid	$CaCO_3$, %	<1.0	Less Calcareous
	4.5-5.5	Medium acid		1.0-5.0	Calcareous
	5.5-6.5	Light acid		5.0-15.0	Medium Calcareous
	6.5-7.5	Neutral		15.0-25.0	Over Calcareous
	7.5-8.5	Slightly alkaline		>25.0	Too Much Calcareous
	>8.5	Strongly alkaline			
EC, dS/m	<2	Salt-free	B, mg/kg	<0.7	Low boron
	2-4	Slightly salted		0.7-1.5	Medium boron
	4-8	Salty		1.5-3.75	High boron
	8-16	Very salty		>3.75	Very high boron
	>16	Too salty			

RESULTS AND DISCUSSION

Characteristics of irrigation waters

The pre-irrigation analyzes of the treated wastewater, Gediz river water and well water used in the study were conducted and the three-year general averages of the obtained results are given in Table 3.

The pH values of the water used in the experiment did not show much change according to the research subjects. According to the three-year general average values, these waters are within the boundaries of AATTUT and FAO 47 and do not pose any problems.

When the irrigation issues are evaluated according to AATTUT and FAO 47, it is seen that in terms of electrical conductivity, well water will not cause problems and other waters are at a level to cause moderate problems. In terms of B, there are no restrictions in all subjects on the use of water in irrigation. Gediz river water with 2.2 me/l and well water with 1.9 can be used in the

surface and sprinkling irrigation without problems, while the treated domestic wastewater can be a serious problem when used in surface water me/l Na with 9.3 me/l Na content and moderate in sprinkler irrigation. Gediz river water and well water can be used without problems in the surface and sprinkler irrigation in terms of Cl content, while the treated domestic wastewater can cause moderate problems when used in the surface and sprinkling irrigation

When some pollution values of treated wastewater are considered, these values are within the discharge limits stated in AATTUT.

When BOD_5 values from pollution parameters according to AATTUT and U.S.EPA are evaluated, treated domestic wastewater (27 mg/l), Gediz river water(15 me/l) and well water (12 me/l) cannot be used in irrigation of non-processed food products, an can only be used in irrigation of agricultural products processed before consumption. trees and vineyards by surface irrigation.

According to FAO 29, it has been determined that domestic wastewater can cause serious problems when used in water regarding the amount of Mg, but other issues will not pose a problem.

According to FAO 47, the amount of NO_3-N is at such a level that Gediz river water does not cause any problems, while the treated domestic wastewater and well water are at a moderate level of problem. Domestic wastewater treated according to HCO_3 content can be a serious problem when used in irrigation with 8.6 me/l HCO_3 while other issues can be a problem at a moderate level.

Given the number of fecal coliform bacteria, according to U.S.EPA, well water can be used in irrigation of plants that are processed before consumption, while Gediz river water and treated domestic wastewater cannot be used for irrigation. According to the World Health Organization (WHO, 1989), well water can be used in irrigation of grains, industrial plants, meadows, pastures and trees, but cannot be used for irrigation of raw consumed plants, public parks and sports areas.

Table 3. Three-year general averages of some chemical properties of the waters used in the experiment

Irrigation water quality parameters	Subjects		
	Treated Domestic Wastewater	Gediz River Water	Well Water
pH	7.8	7.6	7.7
EC (dS/m)	1.69	0.72	0.61
SAR	6.4	1.3	1.9
Na (%)	48	27	28
Bor (mg/l)	0.68	0.59	0.26
Na (me/l)	9.3	2.2	1.9
K (me/l)	0.5	0.3	0.2
Ca (me/l)	4.4	2.9	2.1
Mg (me/l)	5.4	2.9	2.1
HCO_3 (me/l)	8.6	5.6	4.5
Cl (me/l)	8.4	2.3	1.6
SO_4 (me/l)	2.6	0.3	0.4
BOI_5 (mg/l)	27	15	12
SS (mg/l)	10	4	3
NO_3-N (mg/l)	14	3	5

Total P (mg/l)	2.6	0.8	0.2
Total N (mg/l)	38	19	15
Total coliform (CFU/100ml)	$2.4*10^5$	-	$8.6*10^2$
Fecal coliform (CFU/100ml)	$5.9*10^3$	$24.0*10^2$	$4.4*10^1$

The effect of waters used in research on some chemical properties of soil

In order to investigate the effect of the subjects on the chemical properties of the test soil, soil samples were taken from the pedon identified layers at the beginning of the experiment, after the harvest of each plant and at the end of the experiment.

The pH-related analysis results of the test soil are shown in Fig.1. The pH values of the test soil during the project period ranged from 7.60 to 8.23 and were slightly alkaline. In the treated domestic wastewater and well water subjects and all soil layers (except for 86-120 cm soil layer), a slight decrease has occurred over time. In Gediz river water, the changes occurred irregularly. Malla et al. (2007), Kızıloğlu et al. (2008), Ladwani et al. (2012) Bedbabis et al. (2014) stated that PH level in soils irrigated with treated wastewater has decreased; Çay and Kanber (2013) stated that it hasn't changed, Skousen et al. (1998), Altınbaş et al., (2004), Liu and Haynes (2010) stated that it has increased.

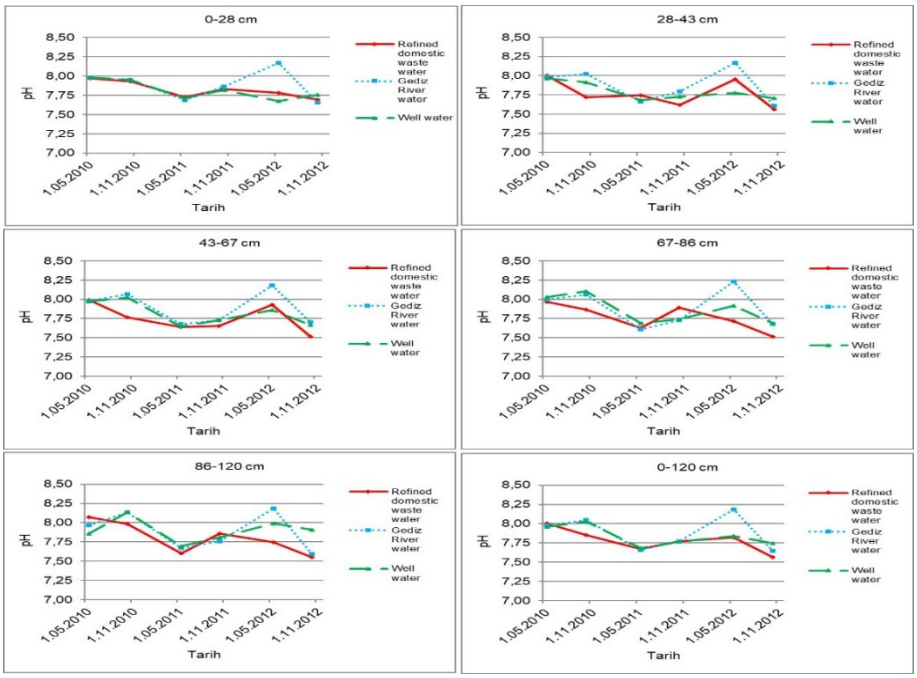

Figure 1. Temporal variation of pH value according to research subjects and layers of test soil

The electrical conductivity (EC, dS/m) and exchangeable sodium percentage (ESP,%) values of the test soil are shown in Figures 2 and 3. EC and ESP values tend to increase in all layers of the soil irrigated with treated wastewater, while there is no significant change in EC and ESP values in Gediz river and well water irrigated soils. However, these increases were not continuous but an increase in samples taken at the cotton harvest at 0-28, 28-43 and 43-67 cm soil layers and a decrease occurred in the samples taken after harvest of vetch grown as winter plants. The increase in EC and ESP in these soil layers was even higher in soil samples taken after the subsequent cotton harvest. In 67-86 and 86-120 cm soil layers, the increase after cotton harvest and the decrease in samples taken after harvest of vetch in spring were not regular. The

EC values of the test soil throughout the project period are generally below 2 dS/m and are in the "salt-free" soil class. However, the EC value at 28-43 and 43-67 cm soil layers of treated domestic wastewater irrigated soils after the 2011 cotton harvest has risen above 2 dS/m and entered the "slightly salty" soil class. The EC value at 6-120 cm soil layer of treated domestic wastewater irrigated soil after the 2010 cotton harvest and 2012 vetch harvest has risen above 2 dS/m and entered the "slightly salty" soil class. This situation can be explained by the fact that autumn and winter rains are sufficient to wash away the salts that accumulate during the summer (Melgar et al, 2009). At the same time, it can be considered that the fact that the soil is not heavy also contributes positively to this process (Bedbabis et all, 2014). Çay and Kanber (2013) determined that irrigation with wastewater increased EC value in the upper and middle layers of the soil, Altınbaş et al. (2004) determined that the percentage of total salt in soil irrigated with wastewater has increased to the level of 0.34 from 0.05. Şener (1993), in the study conducted with water with a salinity of 7.7 dS/m in İzmir, found that the soil salinity in the upper layer was 7.8 in the Gediz series soil, 9.6 dS/m in the Süzbeyli series soil and Al-Omran (2010) stated that the salinity of the soils in Saudi Arabia irrigated with wastewater for a long time varied between 3.6 and 20.7 dS/m, while Elkiey (1993) stated the EC value increased in the lands irrigated with wastewater.

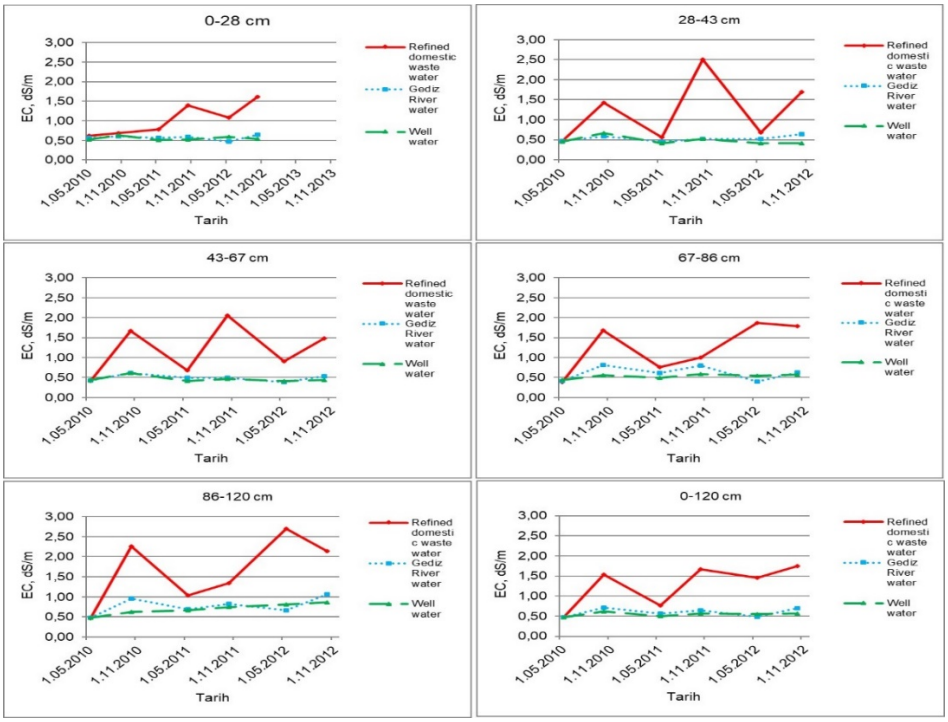

Figure 2 Temporal variation of EC value of test soils according to the research subjects and layers

The ESP values of the test soils during the project period are generally less than 6% and are in the "soil without sodium problem" class. However, at 86-120 cm after the cotton harvest in 2011, after the vetch harvest in 2012; and at 67-86 cm after the cotton harvest in 2012, they were in the class of "soil without a sodium problem" with an ESP value of over 6%. This change in

ESP values, which decreased with the influence of winter precipitation but increased due to the irrigations in summer, can be explained by the relationship between soluble ions and precipitation conditions. Because rainfall increases Na and K ion leaching more than Ca and Mg ion leaching (Sarah, 2004).

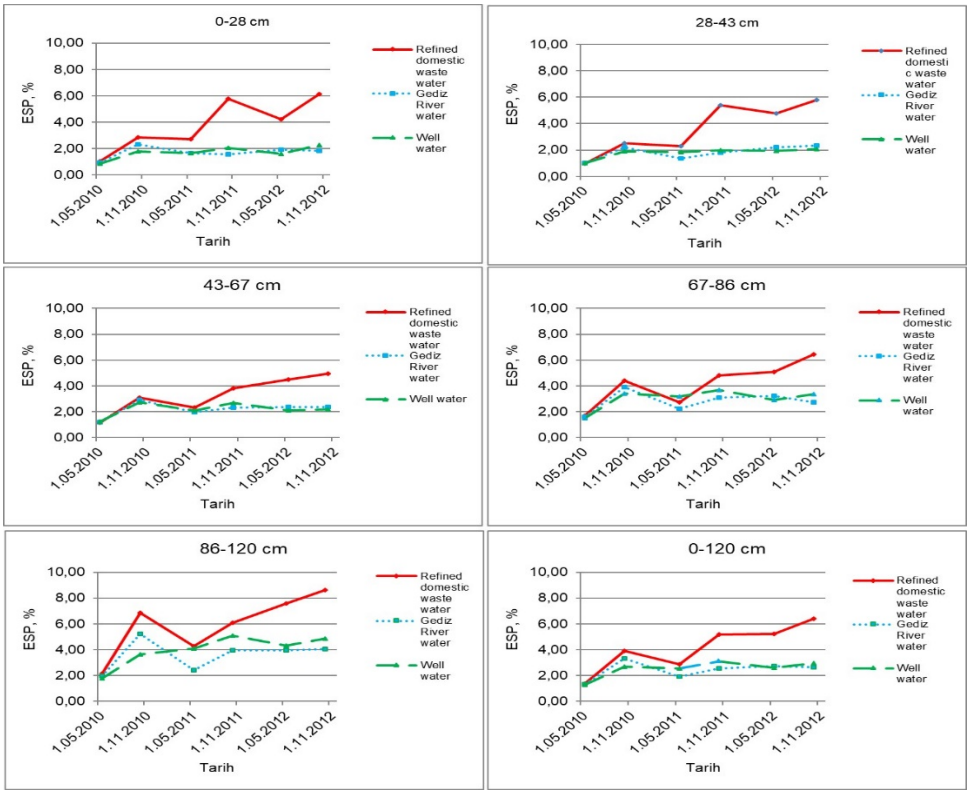

Figure 3 Temporal variation of ESP value of test soils according to the research subjects and layers

The results related to boron (B, mg / kg) of the test soil are shown in Fig.4. When the figure is examined, it is seen that B value tends to increase continuously in all soil layers of soils irrigated with treated wastewater. In soils irrigated with well water and Gediz river water, it is observed that the value of B is generally increased even though there is a decrease in the soil

Although the test soil was initially in the low-boron soil category, the amount of B increased in the well water and the Gediz river water after the 2012 cotton harvest, but still in the low-boron soil class. Soils irrigated with treated domestic waste water were in the "medium boron soil" class at the end of 2012.

$CaCO_3$ contents of the soils are shown in Fig.5. When the figure is examined, it is seen that $CaCO_3$ values in all soil layers do not change significantly with respect to different water sources.

During the study $CaCO_3$ values were observed to be between 5.5-9% and in the "medium calcareous" class.

Çay and Kanber (2013) and Altınbaş et al. (2004) found that $CaCO_3$ content did not change under different water use and different soil layers conditions.

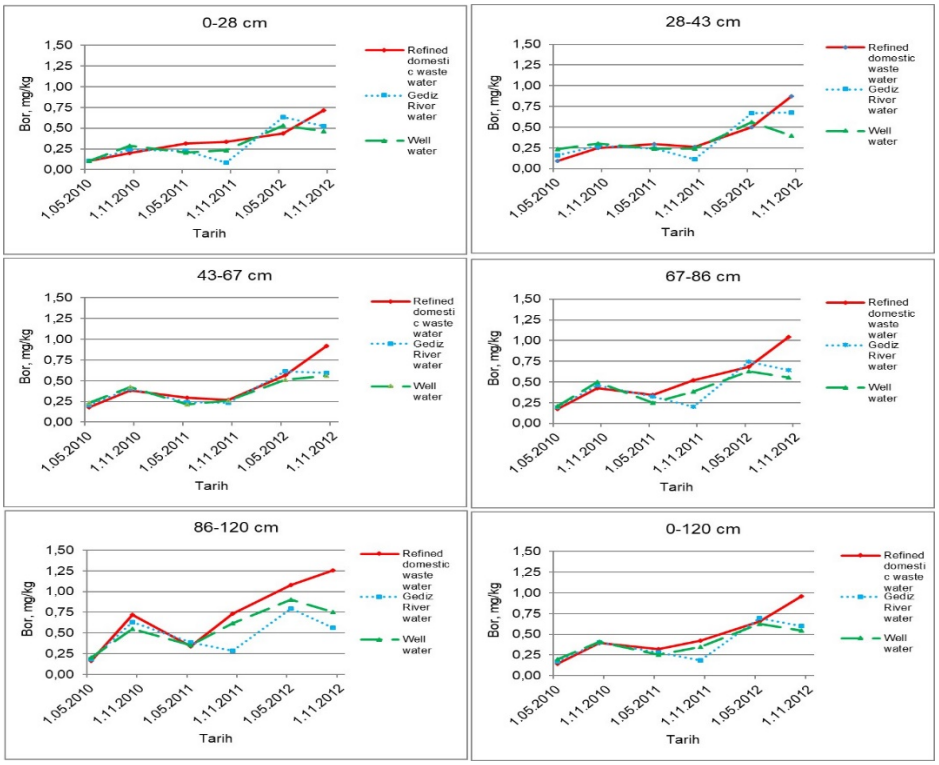

Figure 4 Temporal variation of Boron value of test soils according to the research subjects and layers

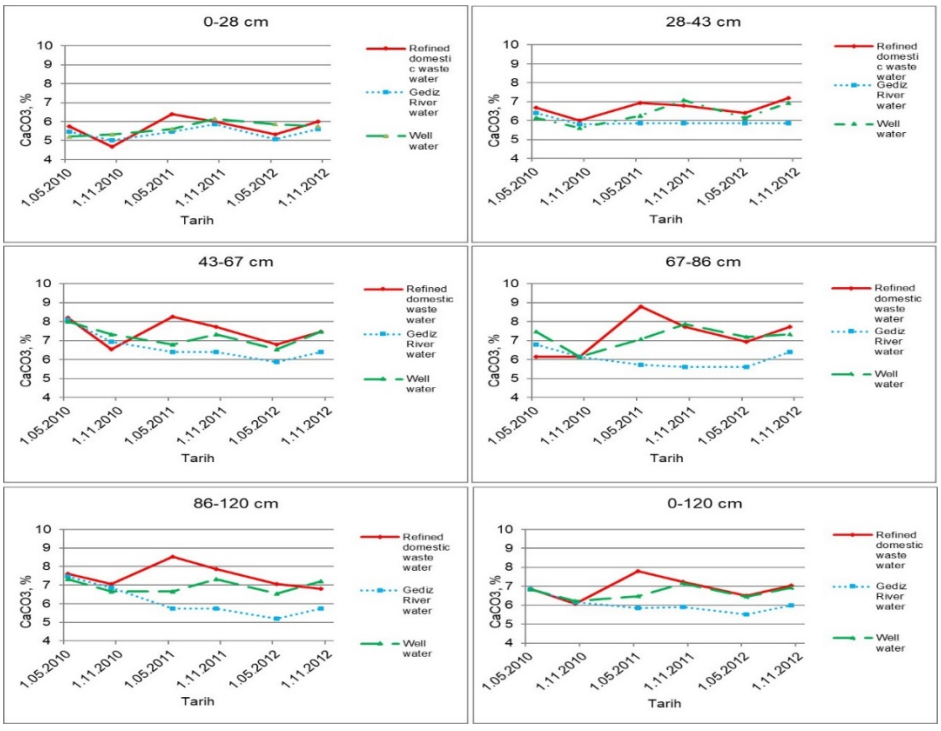

Figure 5 Temporal variation of $CaCO_3$ value of test soils according to the research subjects and layers

RESULTS

The effects of irrigation with treated domestic wastewater, Gediz river water and well water to the soil were investigated and the following results were obtained. According to soil analysis results, the pH values have slightly decreased. It has been determined that the treated wastewater implementations increased EC and boron content and ESP in soil. Treated wastewater has no effect on the CaCO3 in the soil.

It should not be forgotten that the continuous use of these waters will lead to problems of salinity and alkalinity over time because the treated wastewater increases EC and boron content and ESP value even slowly. It is necessary to continuously monitor the irrigated soils with this type of waters and to restrict or stop the use of these waters in the irrigation when necessary

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USAGE OF SEWAGE SLUDGE IN AGRICULTURE

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ABSTRACT

Preservation of the natural environment, which is becoming more and more important nowadays, is likely to be achieved by consciously disposing waste or by using it on the soil, to a large extent. Maintaining and improving soil fertility are among the most important factors for achieving sustainable agriculture and high productive plants.

Assessment of waste without causing pollution is crucial for the ecosystem. For this reason, various researchs are being carried out about disposing sewage sludge treatment and also it's usabiliyty in agriculture. Sewage sludge is a suspension of concentrated solids, usually composed of organic matter and nutrient-loaded organic compounds, which can be in slurry or dry form depending on the treatment technique. İnspite being nitrogen, phosphorus, and potassium for the plants these nutrients appear insuficient in the agricultural areas.

When considering to use the sewage sludge from sewage treatment plants for agriculture, it is necessary to investigate these treatments in terms of nutrient content, salinity, pH and heavy metal content. Sewage treatment plants function is to reduce the adverse effects of domestic and industrial sewage can cause if they are used directly to environment. Because of the different sewage types there are different filtering processes. Also, when applied,the effect on soil structure and plant growth must be considered.

In this study, the meaning of sewage sludge, it's characteristics, sources , contents, stabilization methods, disposal methods, usage areas, advantages and disadvantages have been compiled by investigating some preliminary studies in our country and in the world.

Key words: sewage sludge, use of sewage sludge, agriculture, nutrients

Meaning and content of the sewage sludge:

The sludge is from 0.25% to 12% solids depending on the treatment process and is a scented, liquid or semi-solid waste (Durak,2005). The beneficial fertilizer is a good fertilizer because it has many beneficial compounds such as sludge, macro and micronutrient elements which are emerging as a result of the treatment and the organic matter is good soil improvement. For this reason, the use of purification products is supported (Strauch, D.,1991, Düring and Gäth,2002). The types of sewage sludge vary depending on the type of treatment and purpose. The pollutants in the waste structure such as pre-settling sludge formed by precipitable solid materials, chemical sludge formed as a result of chemical treatment and clotting, biological sludges as a result of biological treatment processes and sludges resulting from treatment of drinking water can be classified into four groups:

1. Precipitation sludge formed by precipitable solid materials

2. Chemical sludge formed as a result of chemical treatment and clotting

3. The biological sludge as a result of biological treatment processes

4. Inorganic sludge as a result of treatment of drinking water

Properties of the sewage sludge:

Sewage sludge is processed according to industrial types such as organic compounds, acids, alkalines, metal salts, phenols, oxidants, dyes, sulfates, hydrocarbons, oils, Fe, Cu, Al, Hg, Cd, As, Co, Pb, Cr, organic phosphorus and nitrogen (Taşatar, 1997). When it is considered that the sewage sludges from the wastewater treatment plants are evaluated from an agricultural point of view, detailed analysis of the nutrient content, salinity, pH and heavy metal content of the plant will be required. In the wastewater treatment, in the physical and chemical treatment processes, 95% -99.5% of the water-containing fluid which is obtained by flocculating or precipitating the wastewater from the wastewater or by removing the microorganisms from the system by flooding or precipitating the wastewater by passing the dissolved substances (pollutants) the wastes are called "treatment mud" (Bergkvist ve ark, 2003).

Sources of sewage sludge:

a. domestic wastewater

b. Industrial Qualified Waste Water

a. Domestic Waste Waters: Significant groups of organisms in domestic wastewaters; microorganisms such as plants, animals, fungi, protozoa, viruses, bacteria and algae. Many of the microorganisms in domestic wastes are disease-causing for humans and animals. Coliform bacteria are a sign of contamination from human wastes. Algae also cause taste and odor problems. Organic substances are broken down by bacteria during the treatment of wastewater (Dağ, 2010).
b. Industrial Waste Water; Waste water from the food industry, waste water from the mining industry, wastewater from the glass industry, textile industry waste water, petroleum industry waste water, leather industry waste water, chemical industry waste water, metal industry waste water, wood products and furniture industry waste water, spare parts industry waste water (İleri, 2007).

Waste water treatment plants function to reduce the adverse effects that can occur in the natural environment if domestic and industrial wastewater are supplied directly to the receiving environment. Because of the different wastewater characteristics, the treatments applied for the treatment of each wastewater are also different. In general, three basic treatment systems are applied in urban wastewater treatment.

The secondary treatment is a step of advanced treatment applied to provide higher quality treatment. Nitrogen and phosphorus removal are also important as far as the removal of oxygen

consuming substances is important. At this point, physical - chemical treatment processes become important. The addition of iron and aluminum salts to the pre-settling pool results in sludges having properties similar to the biological sludges in the secondary treatment. By adding chemicals to the secondary treatment effluent, muds form in a similar manner to that of drinking water treatment plants. In both cases, it is difficult for these muds to be picked up and processed. Another source of sludge is the sludge from the drinking water treatment plant. Aluminum sulphate (alum), commonly used for flocculation and coagulation in a treatment plant, forms clay known as "waste alum sludge".

1. **Primary treatment (pretreatment):**

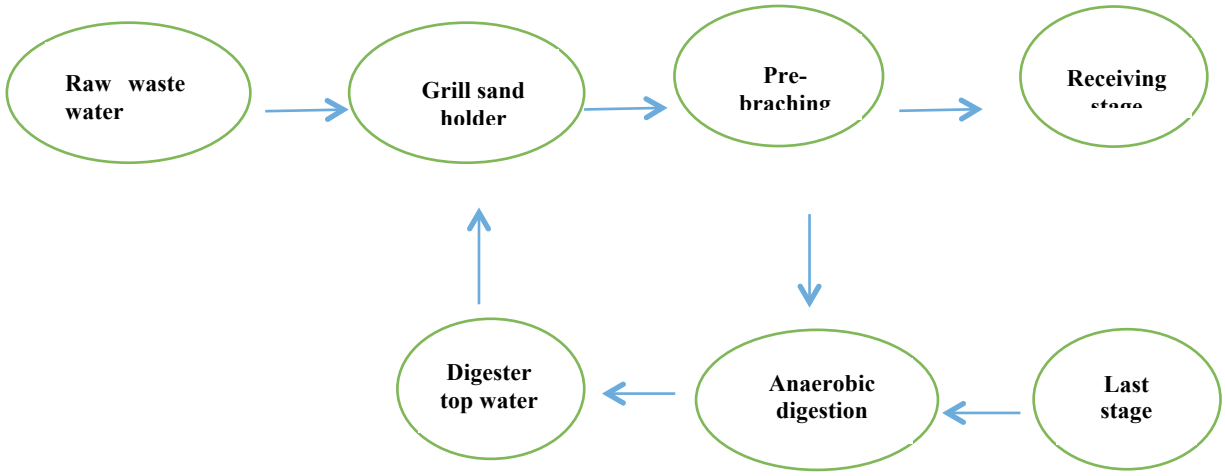
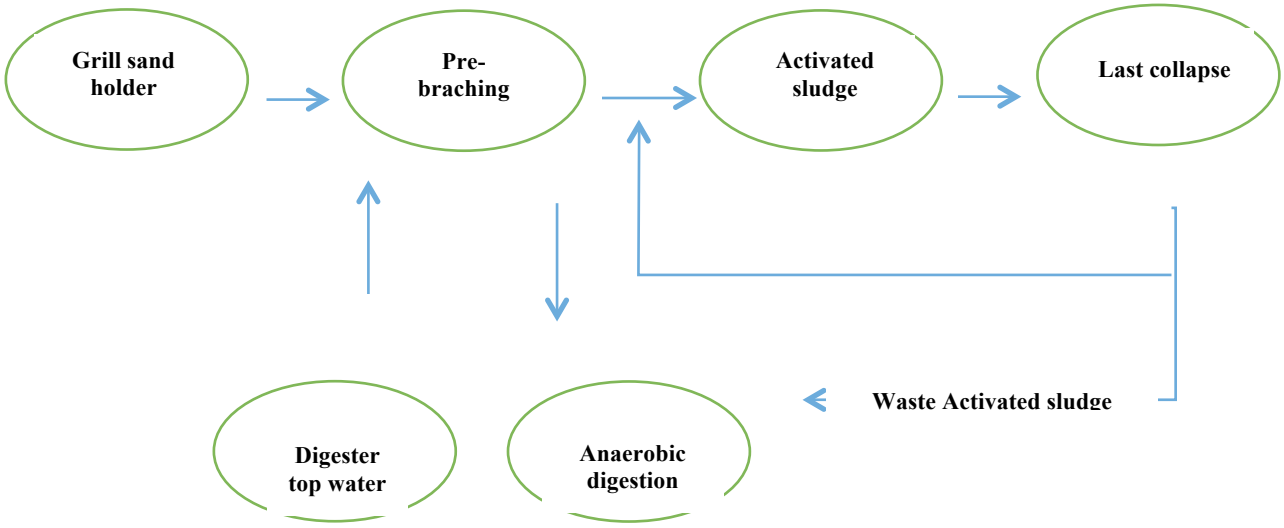


Figure 1.1: Example flow chart of pretreatment system

2. **Secondary treatment:**



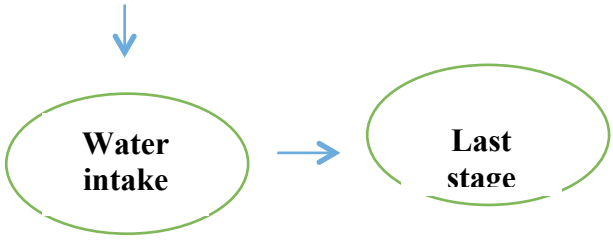


Figure 1.2: Secondary treatment plant flow diagram using activated sludge system as biological treatment

3. **Tertiary treatment (physical-chemical treatment):**

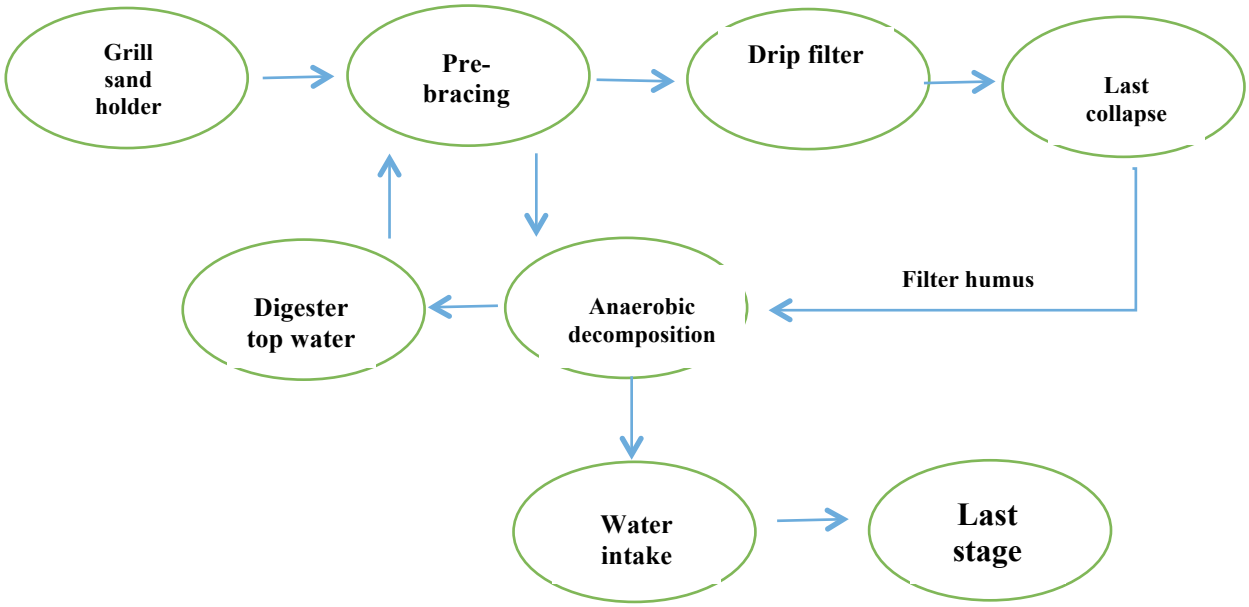


Figure 1.3: Secondary treatment plant using the drop filter system as biological treatment

I. Sludge Stabilization Methods:

Anaerobic Digestion: (decomposition) process in an oxygen-free environment. It happens in two stages. In the first stage, organic substances are converted to organic acids and in the second stage, organic acids are converted into methane and carbon dioxide, resulting in biogas. The resulting biogas is used to provide the necessary heat and electrical energy to operate the plant (Spinosa, L., Vesilin, P.A., 2001).

Aerobic Digestion: It is a method used for the biological stabilization of the resulting sludge, provided that sufficient oxygen is provided. In the operation of aerobic processes; factors such as temperature, waiting time, oxygen requirement, mixing and ambient pH should be controlled (Jewell W.J., Kobrick, M., 1987).

Composting: It's an aerobic process. In a well-run system, the temperature can be increased to 70 ° C during the decomposition of the organic matter, thereby destroying the pathogenic bacteria.

Drying: Apart from reducing the moisture content and evaporation of the water in the sewage sludge, pathogen removal is provided (Huyrad, A. et al, 2000).

Stabilization with lime: Lime is used for mud stabilization as well as improving muddy water giving properties. In this method, lime is added to the amount of mud to increase the pH value to 12. A high pH value creates an environment unsuitable for microorganisms. As a result, the sludge does not decompose, the odor disappears and health risks do not occur (Filibeli, 1996 Akyarlı ve Şahin, 2005).

II. Removal Methods of Sewage sludge

The methods used for the removal of sludge are;

Regular Storage: Landfilling is the process of storing and covering solid wastes and sewage sludges in such a way that they do not harm public health and safety. In order to increase the quality of the sludge storage area volume is reduced by taking water with natural or mechanical methods (Aksu, 2008).

Incineration: The main targets in the incineration process are to stabilize the solid wastes in such a way that they do not harm the environment and to reduce the waste volume. In addition to reducing the volume, urban wastes are disposed of in a controlled manner in order to obtain steam and electric energy. With this method, solid wastes can be reduced by 90% by volume and 75% by weight (Palabıyık, 1998). In this application, sewage sludges must be incinerated alone or in combination with other wastes.

Composting: Composting can be seen as the recycling and reassessment of the biodegradable part of the waste. The purpose of the composting process is to be able to biodegrade the waste without harming the environment. This process reduces the volume, mass and moisture of the biodegradable waste and transforms it into a valuable soil conditioner (Öztürk ve ark., 2005).

Composting is the conversion of organic wastes into a humus which is as stable as possible with air thermophilic decomposition. The resultant humus can be dead or living organisms up to 25%. Solid waste conversion and removal technologies applied for air and airless composting, volume reduction, stabilization and pathogen removal. This method is expensive compared to regular storage and is a cheap method of disposal. Composting of sewage sludges is widely practiced especially in the USA (Arıkan ve Öztürk, 2008).

Composting consists of two main stages:

1. **Active composting:** It is the thermophilic part of the process. Decomposition of readily decomposable substances results in a decrease in volume and mass. In addition, pathogen removal is provided due to high temperatures.

2. **Continuation:** At this stage, the temperature reaches the ambient temperature, but the decomposition continues and the organic matter is well stabilized.

Unloading to sea: The mud that emerged during the first years of the treatment plants was poured into the garbage storage areas and the seas in all the countries of the world. However, the casting of mud into the sea has been banned from 1 January 1999 (Arıkan ve Öztürk, 2008).

Thermal Methods: Thermal methods remove water from the mud by applying heat. Thermal drying reduces the moisture content of the mud well below that obtained by mechanical dehydration methods. Advantages of thermal drying; low transport costs, reduced pathogens and better storage and marketing opportunities for dried mud. It can be easily marketed as a thermally dried mud fertilizer or soil remover, storage and incineration are also acceptable görmektedir (Ayvaz, 2000).

III. Disposal Methods of Sewage sludge

The annual amount of municipal sewage sludge in Turkey is estimated to be 1.38 million tonnes (Aksu, 2008). Sludge disposal can be realized with the use of sewage sludges which have suitable properties as organic fertilizer and soil regulator in agriculture and economic gain can be achieved in agricultural production.

Tankerle Yayma: Since sludge is simple to apply to the surface when it is wet, it is generally possible to use less expensive sludge transfer systems instead of water intake processes. It is a widely used method for spreading mud directly to tankers with a capacity of 3.2-7.6 m3. The sludge is poured into the ground by pouring through the perforated pipes installed behind the tankers. However, the most important disadvantage of such systems is that they encounter problems during application in rainy weather and high operating costs.

Spray method: Treatment of sewage sludge can be done with fixed or portable spraying systems that do not clog the pipelines. The advantages of a spray system are that it requires less labor, less space and can be used for many plant species. At the same time, the mud can penetrate all over the product and the leaves of sensitive products can be damaged.

Injection Method Under Soil Surface: This method can be summarized as the introduction of the sewage sludge into the sewage sludge and the covering of the sewage sludge with the soil layer. The disadvantages of the system are seasonal limitations and operating methods.

Karmak Method: Applying the sewage sludge to the surface with the furrows is simply the same as the process of making the product with the furrows (Damar, 2002).

IV. European Community's Agricultural Wastewater Applications

European Community Council's Use Of Sewage Sludge In Agriculture:

1. Sludge may have valuable agricultural characteristics and should be encouraged to be applied in agriculture provided that it is used correctly
2. The use of sewage sludge should not impair the quality of the soil and agricultural products,
3. Some heavy metals can be toxic to the plant and the presence of these metals in the urine can cause damage to human beings and therefore, the limit values for the presence of these elements in the soil must be determined,
4. The use of sludge should be prohibited in case of exceeding the limit values of heavy metals in the soil,
5. In addition, these limit values should be avoided to increase the use of sludge
6. sewage sludge must be treated before use. However, if mud can be mixed into the soil in such a way that it does not harm human and animal health, member states may, under certain conditions, sometimes allow the use of sewage sludge without treatment,
7. If the sewage sludge is to be used in the pasture, or if it is to be used raw or directly in contact with soil, a certain period of time must be left between grazing or harvesting and using the sludge. Except for fruit trees, the use of vegetables and fruits grown during the season should be banned. In Turkey and in the world based on soil pollution control regulations permitted to be used in agriculture in sewage sludge treatment are certain limits for heavy metals.

Table 1. Permissible pollution concentration limits for sewage sludge to be applied to land according to the US Environmental Protection Agency (USEPA, 1995)

Polluting*	**Max Concentration (mg/kg)1**	**Cumulative Concentration (kg/ha)**	**Annual Concentration (kg/ha)**
Ar	75	41	2
Cd	85	39	1,9
Cu	4300	1500	75
Hg	840	300	15

Pb	57	17	0,85
Mo	75	-	-
Ni	420	420	21
Se	100	100	5
Zn	7500	2800	140

Table 2. Permissible pollution concentration limits for sewage sludge to be applied to land in the European Union (Anonim, 2008)

Polluting	**Max Concentration (mg/kg)1**	**Annual Concentration (kg/ha)**
Kadmiyum	20-40	150
Cu	1000-1750	12000
Pb	750-1200	15000
Hg	16-25	100
Ni	300-400	3000
Zn	2500-4000	30000

Table 3. permissible heavy metal content of Municipal Sewage Sludge According to the Regulation on the Use of Sewage Sludge in Turkey

Polluting	Max Concentration (mg/kg)1	Annual Concentration (kg/ha)
Cd	10	3
Cu	100	300
Pb	750	225
Hg	10	3
Ni	300	3000
Cr	1000	300
Zn	2500	750

V. Application areas of sewage sludge:

Processed sludge contains all the plant nutrients required for plant production. In this area, the use of commercial fertilizers is reduced in the areas where it is used, or the treated sewage sludge is completely replaced by fertilizers.

The maximum application rates depend on such factors as soil type, product type, land taping, water pollution, climate, odor formation, application method, sludge characteristics, pathogenic organisms, heavy metals, nutrients, concentrations of other toxic substances. In the case of mud disposal, the maximum permissible application rates are calculated on the basis of either nitrogen or heavy metals, and practically the lowest concentration of these is taken as the basis (Filibeli, 1996).

- Use in agricultural areas
- Use in Forests
- Use in Land Improvements

VI. Basic Principles of Agricultural Benefits from sewage sludg:

1. sludge is applied at certain rates to agricultural land. That is, the amount of N and / or P supplied on the basis of the sludge on the basis of the annual loading must be muddled so as not to exceed the annual amount of N and / or P required by the product.
2. It is desirable that the pH of the soil be treated as 6,5 or higher. Thus, the movement of heavy metals within the soil is limited.
3. Since the cation exchange capacity of the soil is an indication of the ability of the soil to bind heavy metals, the soil to be treated with the sewage sludge must also be examined from this point of view.
4. The permeability and structure of the soil is a guiding soil feature in the mud applications since it determines the drainage properties of the region.
5. Another important issue in agricultural applications of sewage sludge is the distance of land to groundwater resources.

CONCLUSION

Much research has been done on the evaluation of sludge as a source of plant nutrients and the application of agricultural sludge to agricultural and therefore economic gain (Celik and ark. 2004, Hati and ark. 2007). Referring to the general case however, the sludge is generally removed as solid waste in Turkey. Sewage sludge is recycled to be used in agriculture needs in terms of extensive research.

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THE EFFECT OF GERMINATION AND EMERGENCE-PERFORMANCE ENCHANCING TREATMENTS ON WHITE CLOVER (*Trifolium repens* L.) SEEDS

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ABSTRACT

Some applications are being made nowadays to reduce germination and emergence problems in seeds. Among these applications, improvement of harvesting, drying-processing and storage technologies as quality improvement applications, pre-sowing priming applications, seed processing and coating technologies can be said.

This study was carried out at Seed Science and Technology Center, Ege University in Bornova, İzmir in 2013. In the trial the effects of priming, film coating technique, KNO3 agent and the combinations of these applications on germination/emergence rate and speed of seeds of white clover (*Trifolium repens* L.) were investigated. The experimental material was liflex cultivar.

Statistically important differences were found among the applications. Priming+polymer+KNO3 application gave the best result for the germination/emergence rate and speed for white clover.

Key words: White clover, germination, emergence , priming, seed coating, KNO_3,

INTRODUCION

Pre-germination (priming), which is carried out in order to provide a homogenous and high quality germination and emergence in a short time, is defined as water intake which starts the metabolic activity required for germination in the seed but does not allow the root exit (Heydecker and Gibbins, 1978). Among these applications, applications of osmotic conditioning (priming) and seed coating (pellet and film coating) play an important role (Taylor et al., 1998; Duman vd., 2011).

PEG, one of the most commonly used substances in pre-germination applications, can establish a certain balance between the inside of the seed and the outside by controlling the water intake and exit into the seed through the molecular weight. This can also cause an osmotic pressure effect, so the exit of the root can be prevented. In the pre-germination applications made with organic and inorganic salts, since this pressure effect can not be created, as the priming period increases, uncontrolled water enters into the seed and root occurs (Haigh and Barlow, 1987). In a study carried out on seeds of berseem, pre-germination was carried out using PEG-6000 for 16 hours and pre-germination was observed to have a beneficial effect on the germination and emergence of the seeds (Rouhi et al., 2011).

The use of seeds coated with different colors in vegetable production firstly gives confidence to the producers in terms of seed quality. it is also stated that seed coating prevents the occurrence of errors in the sowing frequency and sowing depth during sowing (Eser vd., 2009).

The aim of this study is to investigate the effects of priming, film coating technique, KNO3 agent and the combinations of these applications on germination/emergence rate and speed of seeds of white clover (*Trifolium repens* L.).

MATERIALS AND METHODS

This study was carried out at Seed Science and Technology Center, Ege University in Bornova, İzmir. In the study, the Liflex variety of white clover was used. Priming (-0.4 Mpa) polyethylenglycol (PEG 6000), polymer coating, KNO3 application and combination of these applications were used to increase the rate and speed of germination and emergence. Pre-germination applications of seeds (osmopriming) were carried out in the ventilated application cabinet in the seed laboratories of Department of Horticulture, Faculty of Agriculture, Ege University (Bujalski and Nienow, 1991; Duman, et.al, 1998; Duman and İlbi, 2001).

In order to accelerate seed germination and ensure homogeneity, KNO3 effective substance was used recommended by ISTA to encourage germination and to eliminate seed dormancy. Pure water was used in the germination of control seeds. Film coating was made using Disco AG water-based polymers supplied by Incotec. Coating process was carried out at CC-lab seed film coating unit of CİMBRİA brand at Seed Science and Technology Center, Ege University.

Tetrazolium (TTC) assay was performed to determine the viability of the seeds. Studies were also carried out to determine the right time and temperature before the pre-germination were carried out.

OSMOPRIMING: Ventilated application technique was used for pre-germination application (Duman and İlbi, 2001). In the study, -0.4 MPa was applied for polyethylenglycol (PEG 6000), the applications were compared and evaluated statistically. 24 hours and 20 ° C temperature were selected and applied for this application as a result of preliminary studies.

FILM COATING: Care was taken to coat the seed surfaces with a homogeneous coating. Dose amount was determined according to Tuncel (2012) and seeds coated were dried on drying papers at room temperature. This process continued until the seed returned to its original weight.

KNO3 APPLICATION: For this process, KNO3 of 0,2 % was directly applied to the germination and emergence environment .

GERMINATION AND EMERGENCE PERFORMANCE TESTS: The seeds were taken to the germination test at optimum 25 ° C temperature, with 4 replications and 100 seeds in each petri dishes of 120 × 20 mm size, on double-layered drying paper (Ista, 2006). Counts were made on a daily basis to determine the average germination time and seeds with 2 mm root long were considered germinated. In order to calculate the germination speed, the average germination time was set as day using daily counts (Pederson, et al., 1993).

Emergence tests were carried out in 4 replicates and 100 seeds per replicate. Emergence tests were conducted in plastic cups (20 × 12 × 6 cm), in sterilized and humidified soil. As a result of the emergence tests, the daily counts were collected and the emergence vigour (%) values were calculated. The emergence speed was also calculated as day (Larsen ve Andersen, 2004).

Although all experiments were carried out in the laboratory and in homogeneous conditions, the study was set up as a randomized complete block design with 4 replications in order to remove possible mistakes. For the analysis of variance, the tarist statistic package program was used.

There was important differences among the treatments at 0,01 level and 0,05 significance level was chosen for the LSD test (Açıkgöz, at al., 1994).

RESULTS AND DISCUSSION

The highest germination vigour was obtained from Priming + Polymer + KNO3 treatment (95,25 %). Polymer treatment gave the lowest germination vigour (81,75%) (Table 1).

The effect of treatments on average germination time (day) was also found statistically significant. While Priming + Polymer + KNO3 was the application providing germination at the shortest day (2.75 days), polymer treatment gave longer germination time than control (4.9 days) (Table 1). The daily germination values on the seed germination rate of pre-sowing applications are given in Figure 1.

Table 1. Effect of treatments on germination values of white clover seeds

Treatments	Germination vigour (%)		Average germination time (day)	
Control	82,25	DE	3,9	C
Priming	85,75	C	2,9	AB
KNO3	83,5	D	3,75	C
Polymer	81,75	E F	4,9	D
Priming+KNO3	90,50	B	2,87	AB
Priming+Polymer	87,00	C	3,02	B
Polymer+KNO3	83,75	D	3,75	C
Priming+Polymer+KNO3	95,25	A	2,75	A
	LSD: 1.28*		LSD: 0.22*	

*: There is statistical significance difference between applications at $p \leq 0.05$ significance level.

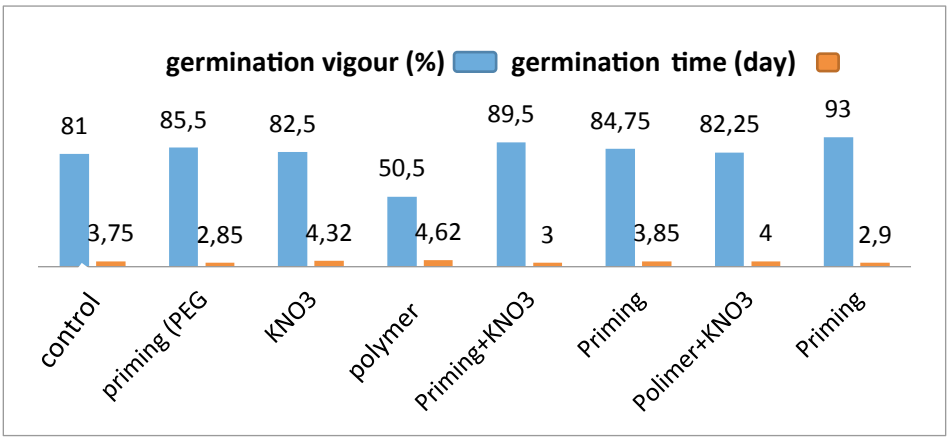

Figure 1. Daily germination values of white clover seeds after treatment

In terms of emergence values, there was also statistical significance difference between treatments (Table 2). As seen in table, the highest emergence vigour (93 %) was obtained from Priming + Polymer + KNO3 treatment. Polymer treatment gave the lowest emergence vigour (80.5 %). (Priming (2.85 days), Priming + KNO3 (3 days) and Priming + Polymer + KNO3 treatments (2.9 days) gave the shortest emergence time and were included in the same group in terms of average emergence time (Table 2). Polymer treatment gave longest emergence time (4.62 days) as seen in germination time. The effects on the daily emergence values of the applications are shown in Figure 2.

Table 2. Effect of treatments on emergence values of white clover seeds

Treatments	Emergence vigour (%)		Average emergence time (day)	
Control	81,00	DE	3,75	B
Priming	85,50	C	2,85	A
KNO3	82,5	D	4,32	BC
Polymer	80,50	E	4,62	C
Priming+KNO3	89,50	B	3,00	A
Priming+Polymer	84,75	C	3,85	B

Polymer+KNO3	82,25	DE	4,00	BC
Priming+Polymer+KNO3	93,00	A	2,90	A
	LSD: 1.90*		LSD: 0.66*	

*:There is a statistical significance difference between applications at p≤0.05 significance level.

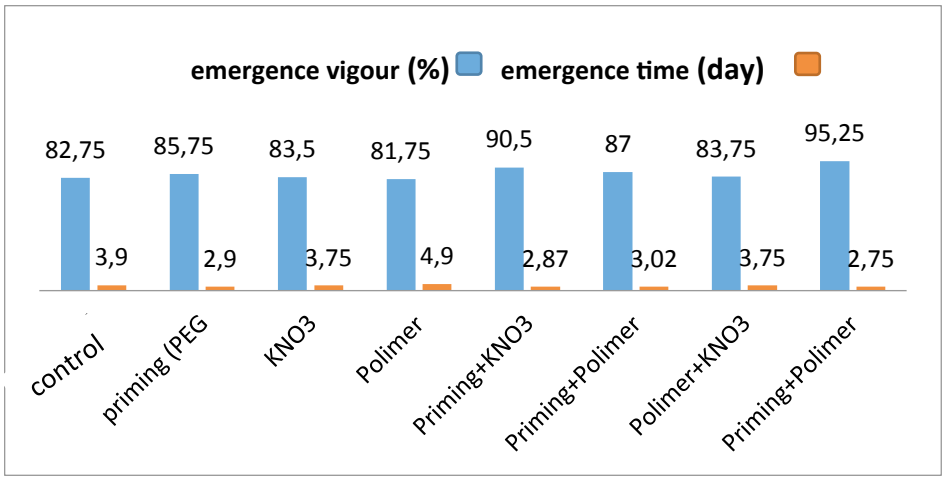

Figure 2. Daily emergence values of white clover seeds after treatment

CONCLUSION

Priming + Polymer + KNO3 treatment has been shown to be the best result in terms of improving germination and emergence power, but also shortening germination and emergence time. It is estimated that the results of the research will be a source for public and private feed crop cultivators and seed producers.

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GREEN TRANSFORMATION OF CITIES - "PARKS IN THE SKY"

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ABSTRACT

Built-up areas are increasing in cities therefore it is very difficult to create new green areas in dense cities. Urban planners, managers and design professionals have begun to respond to the problem of a lack of green areas by finding innovative solutions to add more green areas to cities. Converting abandoned railway infrastructure into elevated parks is a creative way to add green space to urban areas.

This study investigated six elevated park projects from around the world that include the High Line Park (New York), The Goods Line (Sydney), La Promenade Plantee (Paris), the Hofplein Viaduct (Rotterdam), the Bloomingdale Trail (Chicago) and the Reading Viaduct (Philadelphia) that were built on unused railways. These projects have provided ecological, social and economic benefits to the cities by improving urban ecology and biodiversity, offering recreational activities, creating new job opportunities and increasing property values. The success of these projects has triggered the creation of other elevated parks in many cities. In Turkey the railway transport system has seen a reduction in use. Therefore, some railway sections that have been abandoned in the cities have provided an opportunity to develop new parks.

Key words: disused railway sections, elevated parks, urban renovation

INTRODUCTION

Looking for ways of increasing the amount of green space in densely-packed cities is always challenging. Urban planners, managers and design professionals have begun to respond to the problem of a lack of green areas by finding innovative solutions to add more green areas to cities. Each city has a unique solution for this problem (Three Develop, 2018). One of these solutions is reuse of abandoned railroads, demolished freeways and disused canals, and other vestiges of urban transportation systems (Sinha, 2014). The conversion of disused urban rail lines to linear parks has sparked the imagination of planners, designers, and citizens in many cities (Heathcott, 2013). Establishing an urban park by converting abandoned railway infrastructure into elevated parks is a creative way to add green space to urban areas. An above-grade railroad track reclaimed as a pedestal-thin park is an interesting variation on the general category of linear parks. As the 'park in the sky', it is a new kind of public space, qualitatively different from the parkway or the boulevard by virtue of its height above street level (Sinha, 2014).

Although the first example of elevated parks is La Promenade Plantee in Paris, the concept became popular after High Line. After that, many transportation lines including segments of bridges and highways have been converted to elevated urban parks (Jaffe, 2011). Turning an abandoned railway viaduct to an urban park was a radical action but it was unexpectedly successful. As an urban park, High Line is one of the main drivers of urban development in New

York and its attention has influenced other places (Littke et al., 2016). Spurred by the success of High Line in New York, Chicago, Jersey City, and Philadelphia have initiated the process of converting their railroad embankments and viaducts into elevated parks (Sinha, 2014). These projects focus on the reuse of leftover railway infrastructure, activating landscapes and urban greening (Littke et al., 2016).

In this study six elevated park projects that were built on abandoned railway viaducts have been investigated. These include the High Line Park (New York), The Goods Line (Sydney), La Promenade Plantee (Paris), the Hofplein Viaduct (Rotterdam), the Bloomingdale Trail (Chicago) and the Reading Viaduct (Philadelphia).

METHODOLOGY

This study aimed to investigate six elevated park projects from around the world that include the High Line Park (New York), The Goods Line (Sydney), La Promenade Plantee (Paris), the Hofplein Viaduct (Rotterdam), the Bloomingdale Trail (Chicago) and the Reading Viaduct (Philadelphia) that were built on unused railways. The criteria was based on site information (location, date of design, length/height), purpose of design, services provided, ecological, recreational, economic benefits and management (Table 1).

RESULTS

High Line

The High Line was constructed in the lower west side of Manhattan in the 1930s to lift dangerous freight trains off city streets. It was abandoned in 1980 and the southern part was demolished in the 1960s and 1991 (Ling, 2013; Inhabitat, 2009). High Line went into decay and disrepair and was rediscovered in popular consciousness in 2000, after acclaimed photographer Joel Sternfeld captured the beauty of the industrial relic in photos, overgrown with wildflowers that was an abandoned human structure essentially reclaimed by nature in a matter of 20 years. The City of New York was planning to tear down the High Line and demolishing it would have cost an estimated $80 million. But a group formed, called ‘Friends of the High Line’, to protect, preserve, and renovate the High Line. This eventually lead to a design competition and the commissioning of landscape architects James Corner Field Operations and architects Diller Scodifio + Renfro to rehabilitate this abandoned space into a lush, green, elevated paradise for Manhattanites (Inhabitat, 2009).

The project was completed in three parts. The first part was opened in June 2009, the second part in 2011 and the last part in 2014. The planting design was inspired by the self-seeded landscape that grew on the out-of-use elevated rail tracks during the 25 years after the trains stopped running. There are 400 species including perennials, grasses, shrubs and trees on the High Line Plant List. They were chosen for their hardiness, sustainability, and textural and color variation, with a focus on native species. Many of the species that originally grew on the High Line's rail bed are incorporated into the park's landscape (The High Line, 2018). Arguably the best known conversion of an elevated railroad right-of-way in the United States is the High Line. The number of visitors reached more than two million in the first ten months, averaging more than 6,000 per day. (URL 1) (Table 1).

The Goods Line

The Goods Line is a shared pedestrian and cycle path, and green public space, connecting Ultimo central station to Darling Harbour in Sydney. This 500 meter long linear park is

surrounded by some of Sydney's most important cultural, educational and media institutions. It connects more than 80,000 tertiary students, locals and visitors to the Harbour. The park is built on the former railway line that served between 1855 and 1984. The section from Balmain Road to Sydney Yard was closed when Darling Harbour Yard was redeveloped into the Darling Harbour. Much of the line around Darling Harbour has been re-used for the Sydney Light Railway. The Goods Line was designed by Aspect Studios and CHROFI and the design of the project won a 2014 Australia Award for Urban Design in the Policies, Programs and Concepts in a Small Scale category (Planning Institute of Australia, 2014).

Several mixed-use spaces were created in the park to increase social and cultural interactions between people. Visitors can picnic at the dining tables or sunbathe in the sunshine in the green, grassy spaces. There are table tennis tables, study pods amongst the trees, and a children's water play area with a sand pit shaded by fig trees. It's the perfect place to take a break in the middle of the busy city and just enjoy the tranquil surrounds. It is also a new public space for pop-up events, invigorating and bringing new activity into the precinct. For example, the amphitheatre at the Mary Ann Street stairs offers an opportunity for outdoor movies and performances (Darling Neighbour, 2018) (Table 1).

Hofplein Viaduct (Luchtpark Hofbogen)

The 1.9 km length Holplein Viaduct with 189 arches and Hofplein Station was built in 1908 as an alternative electric railway from Rotterdam to Scheveningen and it was operational until 2010. The construction of the Hofplein viaduct was a technological breakthrough in the manufacture of railway viaducts because it was the Netherlands's first elevated railway to be built solely from reinforced concrete. In 2002 Hofplein Station was therefore designated as a national monument (Pena Architecture, 2018).

The abandoned viaduct was a good candidate to create a green corridor. It was decided to keep this viaduct as a recreational green corridor (belt) called de Hofbogen, between the city and the beach in Scheveningen and to restore the historic station and use it as a market place with restaurant and cafe shops. A communal area gives access to the former station's roof so that the venue can host activities and events above ground level, marking an exciting step in the Hofbogen project as it links the city center to the broader 'green connector' (Urbanghostsmedia, 2018) (Table 1).

The top of the former Hofplein Station has been converted to a city park (Luchtpark Hofbogen-means air park Hof-acres) that provided a walking corridor and picnic area. The first section was opened in 2018. In the coming years the entire Hofbogen route will be transformed into a place where local residents can play, develop urban agriculture and meet each other. Various catering venues such as restaurants and coffee shops can be found under the roof (RTI, 2018) (Table 1). As the viaduct crosses several northern suburbs of Rotterdam, it is hoped that de Hofbogen will attract entrepreneurs to the wider area and improve its surroundings culturally and creatively. The fact that the retail spaces are let and managed by Hofbogen BV means that the viaduct can continually adapt and reflect the needs of the communities it serves (Urbanghostsmedia, 2018).

La Promenade Plantee

The Promenade Plantée is a converted railroad right-of-way, partially elevated and partially below grade. It was converted to a park in 1993 after being abandoned in 1969 (URL 1). The abandoned rail bed became a haven for bird watchers, underage drinkers, drug dealers,

and urban explorers (Heathcott, 2013). Beginning in the 1980s, the area was renovated. In 1984, the Bastille station was demolished to permit construction of the Opéra Bastille. The Reuilly area was designed in 1986. It incorporated the old commercial rail depot of Reuilly into a group of park areas. The Promenade Plantée was put into place at the same time in order to reuse the rest of the abandoned line between the Bastille and the old Montempoivre gate to the city. Landscaper Jacques Vergely and architect Philippe Mathieux designed the parkway and it was inaugurated in 1993 (URL 2).

Today, High Line is the most visited, celebrated and criticized, but the Promenade Plantee is the world's first elevated park (Gastil, 2013). The Promenade Plantée stretches for 4.7 km through eastern Paris. The superstructure that elevates a portion of the Promenade has been converted into the Viaduc des Arts with dozens of high-end artisanal shops, boutiques, and cafés built into the great stone arches (Heathcott, 2013). In the middle of the walkway is the Jardin de Revily, a large garden that was built in 1998 and a popular spot for people o picnic and relax (URL 3).

This park was converted from the railway's maintenance yard. Promenaders can pass over the park across a long, narrow wooden footbridge or meander through the park along its perimeter paths (Heathcott, 2013) (Table 1).

Table 1. Evaluation table of the elevated parks

	High Line	**The Goods Line**	**Hofplein Viaduct**	**Bloomingdale Trail**	**Reading Viaduct**	**La Promenade Plantee**
Date	2009 (opened)	2012 (announced) 2015 (opened)	2006 (announced) 2018 (opened)	2015 (opened)	2018 (opened)	1993 (opened) 2000 (finished)
Location	New York, US	Sydney, Australia	Rotterdam, the Netherlands	Chicago, US	Philadelphia, US	Paris, France
Length	2.3 km	0.5 km	1.9 km	4,3 km	0.4 km	4.7 km
Purpose of design	To create green area, Preserving the experience of walking along a "railroad artifact"	To provide transportation link	To create green area, To provide transportation Link	To preserve the history, To create green area and provide more active modes of transportation	To create green area, To provide economic development	To create green area
Services provided	walking, jogging, sunbathing, sitting, no dogs	walking, jogging, sunbathing, sitting, cycling, table tennis, no dogs	walking, sitting	walking, jogging, sitting, cycling	walking, sitting, cycling, pet friendly	walking, jogging, sitting, cycling

Ecological benefits	Increase urban vegetation, biodiversity, urban wildlife	Increase urban vegetation, biodiversity	Increase urban vegetation, biodiversity	Increase urban vegetation, biodiversity	Increase urban vegetation, biodiversity	Increase urban vegetation, biodiversity
Recreational benefits	Concerts, performance, art expedition, food venders	Playgrounds, concerts, movies, performance, create social infrastructure	Playgrounds concerts, movies	Create social infrastructure	Create social infrastructure	Create social infrastructure
Economic benefits	Attract tourist Increase the property value Provide new jobs	Increase the property value Provide new jobs and business	Attract tourist Provide new jobs and business	-	-	Provide new jobs and business (shops, cafes)
Management	Public-Private partnership (city of NY and friends of High Line)	City / Municipality	Public-Private partnership (City / Municipality and friends of Hofpleinlijn)	Public-Private partnership (City / Municipality and friends of Bloomingdale Trail)	Public-Private partnership (City / Municipality and friends of Railpark)	City / Municipality

It consists of a narrow pathway bordered with small trees, shrubs and plants: roses, lavender, bamboo, ivy, vines, and wisteria. The elevated promenade sometimes widens when the viaduct crosses a street, and stairs leading to street level can be found here and there along the walk (URL 4). Bicycling is permitted in certain locations. There is stair and elevator access. It is located in one of the most densely populated cities in the world (URL 1).

Reading Viaduct

The Reading Viaduct was built in the 1890s to carry commuters to the center of Philadelphia (URL 5). Service on the Viaduct was discontinued in 1984, when the Center City commuter tunnel was opened in 2003, and local residents formed The Reading Viaduct Project for the purpose of advocating for the transformation of the Viaduct into an elevated linear park, in conjunction with the ongoing redevelopment of the surrounding neighborhoods (URL 6).

The first phase of the Reading Viaduct Rail Park opened on June 2018 giving the public access to an elevated quarter mile of trail in north Philadelphia. The eventual aim is for the park – similar to the High Line in New York – to run for 4.8 km through downtown Philadelphia (URL 7). A three-mile (4.8 km) public park will have three sections: the Viaduct, the Cut, and the Tunnel. Phase one of the park is free and open to the public. There are two entrances. The construction restored and maintained much of the existing infrastructure, and carried the industrial scale and character of the site through to platforms, benches and guardrails throughout the park. Phase 1 of the Rail Park isn't just home to plants and pathways. It's also a canvas for some beautiful site-specific public art. The piece has two complementary elements: (1) A sculpture made of a repurposed utility pole and cast aluminum birds, (2) poetry excerpts in

thirteen languages engraved in paver stones, carefully selected to celebrate communication, rail lines, and the city as a meeting place (Table 1). (URL 8).

The two-branch lineage is the majority connecting several different parts of the city. The industrial buildings of the 19th and 20th centuries surrounding this part of the city attract new investors and even commercial development itself and thus the increasing number of new residents in the post-industrial part of the town (URL 9).

As in Paris and New York, a new recreational amenity in this section of Philadelphia will result in additional economic investment and development. (URL 6).

Bloomingdale Trail

The railway line was built in 1872 to serve the small manufacturing district. It was elevated 4.8 meters above ground on an earth embankment with 37 viaducts in 1910 to prevent accidents. The freight traffic slowed down to a trickle by the 1990s and then stopped altogether (Sinha, 2013).

By the mid 1990's the few trains that used the line were re-routed and freight service ceased completely. Many of the manufacturing buildings along the corridor were converted into residences. With freight service stopped, nature quickly reclaimed the space. Trees grew up between the tracks, flowers bloomed and animals found new habitats. It was only a matter of time before the communities along the line rediscovered the space (URL 10). The Bloomingdale Line passes through four neighborhoods northwest of the loop in Chicago — Humboldt Park, Bucktown, Logan Square, West Town, and Wicker Park — crossing 36 blocks. Linear parks created from abandoned railroad and canal corridors are often the result of community effort and non-governmental organizations (NGOs) such as Rails-to-Trails and Trust for Public Land. The site has been re-imagined as a linear park connecting Humboldt Park to the Chicago River, an extension of the city's grand boulevards and furthermore connecting the lakefront to regional greenways. Its bike path and trail would link the neighborhood pocket parks, schools and other institutions, and function as a seam between communities divided by income and ethnicity (Sinha, 2013). The Bloomingdale Trail is envisioned as a multi-use recreational trail built along an elevated rail line along Bloomingdale Avenue (approximately 1800 North) from Ashland (1600 West) to Ridgeway (3732 West) (URL 11).

There are 37 viaducts to be renewed or replaced in this project. (There are only 52 bridges over the Chicago River.) At least seven sites will be developed with access ramps that are sloped gently enough for wheelchair accessibility, and most ramps will also need to be integrated into city parks. The location and magnitude of the project will call for a design that is both community-oriented and world-class (URL 11).

The new Bloomingdale Trail is a vibrant viaduct often teeming with cyclists, strollers, runners and others in Chicago's own version of an elevated park. Though comparisons to New York's High Line are inevitable, the Bloomingdale Trail is longer, wider and more democratic, welcoming dogs, baby strollers, skateboarders and Rollerbladers in a sometimes chaotic parade 5 meter above the Street (URL 12). In addition to recreation, the trail is expected to serve transportation purposes by encouraging people to walk or cycle instead of driving for some trips and will provide improved access to the Metra Clybourn (UP) Station and CTA Damen (Blue Line) Station, which has high-capacity bicycle parking (Table 1). (URL 11).

DISCUSSION AND CONCLUSIONS

Results showed that transforming abandoned railway structures into elevated parks is a way to create green areas and green corridors in the urban areas.

These parks were created in the former industrial parts of cities and changed their environments by preserving and linking history. As a design principle, the remnants of railways were preserved in the parks (Brooks et al., 2013). They also offer alternative modes of transportation (such as cycling, skateboarding, hiking), provide ecological, social and economic benefits to the cities by improving urban ecology and biodiversity, offer recreational activities, provide social integration, create new job opportunities and increase property values.

The "High Line effect" as some have termed it, has captured the imagination of citizens and policy makers alike in recent years. Elevated parks have become trendy new public spaces (URL 13). It can be concluded that the success of these projects has triggered the creation of other elevated parks in many cities all around the world. Large numbers of projects with different scales have been designed and scheduled for construction. On the other hand, these projects also have been criticized for their construction and maintenance cost per acre (Patrick 2014). Also, there is a discussion about elevated parks and whether or not they can achieve success like that of the New York case (Jaffe 2011). Rybczynski (2011) believed that the success of the both Highway and Promenade Plantée is related to their locations. Littke et al (2011) emphasized that these types of projects may not be suitable in other locations experiencing different economic and social realities.

These projects are the example of how a landscape project can be a change to a city. In the case of Turkey, the railway transport system has seen a reduction in use. Therefore, some railway sections have been abandoned in the cities which have provided an opportunity to develop new linear parks. The inspiration of this trend would be a great opportunity for our cities to reuse the space around old rail lines and create livable urban environments.

Although the idea of converting an abandoned railway viaduct to an urban park is seen as an exciting opportunity, based on the experiences of these projects it is not an easy process. It takes a lot of time, effort and money to bring all stakeholders like local authorities, residents, landowners, planners, and non-government organizations together and convince them to develop a park. Each of the projects has own its unique challenges. The most common challenges are dealing with aging infrastructure, obtaining ownership rights, finding funds for acquisition and implementation (The High Line, 2018).

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INVESTIGATION OF THE EFFECT OF DIFFERENT CONTROL METHODS ON WEED DENSITY IN ALBION STRAWBERRIES

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ABSTRACT

This research carried out in 2016-2017 in Sökün village of Silifke district of Mersin province, Albion from neutral day varieties frigo strawberry variety was used in the experiment. The effects of different control methods were investigated on the weeds density in Albion strawberry field. The research trial was planned according to the random trial design. On the control against weeds in Albion strawberry fields; Hand hoeing, Black plastic polyethylene cover (mulch), Glyphosate (480 g/l) applied as post-emergence herbicide and in the control parcel (no control methods). In the experiment carried out in the area where 25 different families and 46 weed species were identified. Average weed density calculated in the hand hoe applied parcels 15.11 number/m^2, The black polyethylene plastic cover application 9.94, Glyphosate (480 g/l) in the practice 18.87 and in the control parcels 55.77 number/m^2.

The average density of weed species determined in the plots respectively; *Cyperus rotundus* L. 13.35 number/m^2, *Sorghum halepense* L. 11.23 and *Elymus repens* (L.) Gould 10.01 very intensive; *Cynodon dactylon* (L.) Pers. 3.71 number/m^2, *Conyza canadensis* (L.) Cronq. 3.51, *Amaranthus retroflexus* L. 2.92, *Solanum nigrum* L. 2.32, *Amaranthus blitoides* L. 2.21, *Convolvulus arvensis* L. 2.16, *Amaranthus albus* L. 1.72 and *Digitaria sanguinalis* (L.) Scop. 1.01, it was determined to be intense. When compared with the density of weed species in the control parcels, it was determined that the weed density decreased by 82.18% for black plastic covering, 75.91% for hand hoeing application and 66.17% for post-emergence glyphosate application.

Keywords: Albion strawberry, weed, density, control methods

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INTRODUCTION

Strawberries are kind of grapes; they are in the team Rosales and Rosaceae family within the genus Fragaria (*Fragaria* x *ananassa* Duch.), strawberry holds an important place within fruit of grapes and cultivated in many parts of the world (Agaoglu 1986; Hancock 1999). Strawberry is one of the fruit of millions people in the world with its Perennial herbaceous, every time green, delicious, appearance, vitamins and mineral content (Kepenek, 2002; Cakaryıldırım, 2004).

Strawberries, a kind of fruit that can be consumed both industrially and freshly. The most economical production is made in the Mediterranean, Aegean and Marmara regions although production is made in different ecologies of Turkey. The biggest factor of the growing importance strawberries especially in the world and in our country at recent years, has been the

economic cultivating as of in different climatic and soil conditions. Strawberry is an important nutrient source in the world, in the most produced countries the United States ranks first with 5.658.054 tons, 4.605.038 tons Mexico 2nd place, Turkey has been involved

In the 2.801.068 tons with production 3rd place (Fao, 2016). 32.03% of strawberry production in Turkey Marmara, 46.65% Mediterranean and 21.32% happen in the Aegean region. In Mersin province and its districts Strawberry production were produced 182.97 tons at 44.214 decares. 52.474 tons of strawberries were produced in the district of Silifke at 19.200 decares (Anonymous, 2016).

There are many factors that cause loss of yield and quality in strawberry production. At the beginning of these factors are weeds, diseases and pests. When strawberries are not struggled with weeds, loss of yield and quality occurs. If strawberry fields are not struggled with weeds especially during the first two months, it can cause a yield loss of 65%. In studies conducted on this issue in Turkey Adana and Aydın are on strawberry fields; *E. repens* (L.) Gould, *A. retroflexus* L., *P. oleracea* L., *S. nigrum* L., *C. rotundus* L., *E. crus-galli* (L.) P.B., *Heliotropium* spp., *C. dactylon* (L.) Pers., *D. sanguinalis* (L.) Scop., *R. raphanistrum* L., *C. album* L., *Setaria* spp., *S. halepense* (L.) Pers., *Sonchus* spp., *T. terrestris* L., *C. canadensis* (L.) Cronq., *M. chamomilla* L. and *S. media* (L.) Vill.weed species have been observed (Serim and Öngen 1995; Pritts and Kelly, 2001; Benlioglu et al., 2002; Boz et al., 2002; Aksoy, 2005).

In other studies related to the similar subject in the world;In the solarization parcels in Yugoslavia only *P. oleracea* L. and *Panicum capillare* L. were identified.Control; *C. album* L., *Veronica* spp., *L. purpureum* L., *A. retroflexus* L. and *M. inodora* L.weed species have been observed. As a result of studies carried out by various researchers for the struggle of weeds which are a problem in some countries, it has been determined that some cultural (mulching, exacerbation and mixed sowing etc.) and mechanical (anchor, rake etc.) methods are successful (Milejow 1989; Merfield, 2000; Norremark et al., 2009).

The aim of this study is to investigate the prevalence of weed species in strawberry cultivation with regard to the purpose, family and struggle methods. In this trial; Hand hoeing, black plastic polyethylene cover, Glyphosate and Control (no application) application parcels were used.

MATERIALS AND METHODS

Material

This study has been carried out in Sökün village of Silifke district in Mersin region where the most strawberry production was made in 2016-2017. The materials of this study; Albion frigo strawberry variety, weeds seen in the field, hand hoeing, black plastic covers and post-emergence herbicide Glyphosate.

Method

Strawberry experiment area; 4 characters (Hand hoeing, Black plastic cover, post-emergence Glyphosate and Control), 3 replications and coincidence trial blocks it was carried out according to the pattern. Albion frigo strawberry variety was used in the experiment and each parcel was planned like 4x5m. Between the parcels is 1 m and between blocks is determined 2 m edge area. At the same time, no control method was applied to the control parcels.In this study,

the family and species of weeds in strawberry parcels were determined. The Turkish names of the weeds identified in researching, Davis et al. (1982) and Ulug et al. (1993) have benefited.

According to Odum (1983), the number of weeds per square meter in strawberry trial plots; the total number of each species in the 1 m^2 area is calculated by dividing the total number of species in the area surveyed. Weed density is calculated by the following formula (Güncan, 2001).

Density = B / n [1]

B: Total number of individuals in the sample

n = number of samples

Weed density scale was used by Üstüner and Güncan (2002).

Density scale,

A. High intensive (average >10)

B. Intensive (average 1 to 10)

C. Mid intensive (average 0.1 to 1)

D. Low intensive (average 0.01 to 0.1)

E. Rare (average < 0.01)

Control against weeds in strawberry trial parcels; In this study, first hand hoeing was used at December 29, 2016 for the control of narrow and broad leaf weeds (6-7 leaf stage). The second hand hoeing application was performed at 28 January 2017, 3rd hoeing at February 28, 2017, 4th hoeing 31 at March 2017 and the 5th hoeing continued at 05 May 2017. Glyphosate (herbicide) application parcels; post-emergence Glyphosate 480 g/L active ingredient herbicide 300 ml/da was carried out by calculation.

Weed control on trial field, weeds against narrow and broad leaf (5-7 leaf stage) weeds developing in the winter months; 1st application at 30 December 2016, 2nd application at 08 February 2017, 3rd application at 25 March 2017 and 4th application at 07 May 2017 protection was applied between rows. The day of herbicide application, air temperature was measured at 16 °C.

RESULTS AND DISCUSSION

According to the result of the research made in the strawberry plant area during the vegetation period of 2016-2017 in the result of the experiment established in Sökün Village, Silifke district of Mersin province; 46 weed species belonging to 25 different families have been identified. The weed density in the trial area is specified according to the parcels respectively.

Weed density in unit area in parcels applied to hand hoeing; *C. rotundus* L. 4.47 number/m^2, *S. halepense* L. 3.76, *E. repens* (L.) Gould 2.94, *C. dactylon* (L.) Pers. 2.09 and *C. arvensis* L. 1.85 calculated as of intensive.

In the parcels where black plastic cover is applied; *C. rotundus* L. 3.91 number/m^2, *S. halepense*. 2.85, *E. repens* 2.06 and *C. dactylon* 1.12 found intensive.

Glyphosate applied parcels; *C. rotundus* L. 5.17 number/m^2, *S. halepense* 4.71, *E. repens* 3.96, *C. dactylon* 3.71, *C. arvensis* L. 2.76, *M. sylvestris* 2.16, *A. retroflexus* 1.92, *P. oleracea* 1.45, *P. austrialis* 1.32, *S. nigrum* L. 1.23 and *C. canadensis* 1.02 determined as of intensive.

In the control parcels; *C. rotundus* L. 13.35 number/m^2, *S. halepense* L. 11.23 and *E. repens* 10.01 very intensive; *C. dactylon* 3.86 number/m^2,*C. canadensis* 3.51, *A. retroflexus* 2.92, *C. album* 2.81, *E. serpens* 2.78, *P. lanceolata* 2.68, *P. aviculare* 2.61, *S. nigrum* 2.32, *A. blitoides* 2.21, *C. arvensis* L. 2.16, *H. europeum* 2.04, *S. olereaceus* 2.03, *A. arvensis* 1.98, *P. convolvulus* 1.92, *P. annua* 1.90, *L. serriola* 1.79, *A. albus* 1.72, *R. crispus* 1.53, *L. multiforum* 1.37, *P. oleracea* 1.36, *G. tricornutum* 1.31, *M. sylvestris* 1.21, *B. tectorum* 1.12 and *D. sanguinalis* 1.01 observed as of intensive.

The density of weed species according to different methods applied in struggle with weeds in the experimental area is given in Table 1.

Table 1. Density of weeds found in the experiment area

Methods of control applied	Weed species	Family	Weed density (number/m^2)	Density scale
Hand hoeing (manual hoeing)	*Cyperus rotundus* L.	Cyperaceae	4.47	Intensive
	Sorghum halepense L.	Poaceae	3.76	Intensive
	Elymus repens (L.) Gould	Poaceae	2.94	Intensive
	Cynodon dactylon (L.) Pers.	Poaceae	2.09	Intensive
	Convolvulus arvensis L.	Convolvulaceae	1.85	
	Others		0	
	Total		13.02	
Black Plastic Cover	*Cyperus rotundus* L.	Cyperaceae	3.91	Intensive
	Sorghum halepense L.	Poaceae	2.85	Intensive
	Elymus repens (L.) Gould	Poaceae	2.06	Intensive
	Cynodon dactylon (L.) Pers.	Poaceae	1.12	Intensive
	Others		0	
	Total		9.94	
Glyphosate	*Cyperus rotundus* L.	Cyperaceae	5.17	Intensive
	Sorghum halepense L.	Poaceae	4.71	Intensive
	Elymus repens (L.) Gould	Poaceae	3.96	Intensive
	Cynodon dactylon (L.) Pers.	Poaceae	3.71	Intensive
	Phragmites austrialis (Cav.) Trin. Ex Steudel	Poaceae	1.32	Intensive
	Others		0	
	Total		18.87	

Control	*Cyperus rotundus* L.	Cyperaceae	13.35	High intensive
	Sorghum halepense L.	Poaceae	11.23	High intensive
	Elymus repens (L.) Gould	Poaceae	10.01	High intensive
	Conyza canadensis (L.) Cronq.	Asteraceae	3.51	Intensive
	Euphorbia serpens Kunth			Intensive
	Plantago lanceolata L.	Euphorbiaceae	2.78	Intensive
	Solanum nigrum L.	Plantaginaceae	2.68	Intensive
	Amaranthus blitoides L.	Solanaceae	2.32	Intensive
	Anagallis arvensis L.	Amaranthaceae	2.21	Intensive
	Amaranthus albus L.	Primulaceae	1.98	Intensive
	Others	Amaranthaceae	1.72	
	Total		3.98	
			55.77	

In control with weeds In the parcels where the hand hoeing method is applied, *C. rotundus*, *S. halepense*, *E. repens* and *C. dactylon* species for having tuber and stolon roots weed density is higher than others. For this reason the vegetative part of *C. rotundus* is cut with hand hoeing, but the plant development has been observed again after 9-12 days since the tuber root is in the soil. Similarly *S. halepense*, *E. repens*, *C. dactylon* and *C. arvensis* have stolon root structure, the above ground parts of weeds are cut by the hand hoeing. But the new plant emerges after 12-14 days from each piece of stolon remaining in the soil. For these reasons, the effect rate hand hoeing is low where weeds with tuber and stolon roots are present. In the practice of black plastic covering, weed species with all kinds of root systems can even soil germinations can not perform photosynthesis even when they reach the soil surface. First we have chlorosis and then necrosis, so weed density is at minimum level. However, strawberry plants or on different spots *C. rotundus,* it was observed to be out of black plastic covering even though it had a leaf cutting property. Similarly, *S. halepense*, *E. repens* and *C. dactylon* species emerged from the empty area on the body of the strawberry plant. In post-emergence glyphosate is applied to the parcel; *C. rotundus*, *S. halepense*, *E. repens*, *C. dactylon* and *P. austrialis* species 12-14 days after spraying the above-ground parts, before chlorosis and after necrosis symptom was observed but it was observed that new plants were sprouted 15-20 days after application of herbicide from tuber and stolon in the soil.

When compared the density of weed species of the control parcels and other parcels, it was determined that the weed density decreased by 82.18% for black plastic covering, 75.91% for hand hoeing application and 66.17% for post-emergence glyphosate application.

DISCUSSION

In this trial area, weeds were applied with hand hoeing, black plastic covers and post-emergence Glyphosate fighting methods. In addition, control parcels were created in which no struggle method was applied. The weed density varied according to different methods of struggle applied. Weed density was the highest in control parcels. weed species that have been identified in research conducted in strawberry fields in Turkey; *A. albus* L., *A. arvensis* L., *A. myosuroides*, *A. retroflexus*, *B. tectorum*, *C. album*, *C. arvensis*, *C. bursa- pastoris*, *C. dactylon*, *Centaura solstitialis*, *Cyperus* spp., *D. sanguinalis*, *E. colonum*, *E. indica*, *G. aparine*, *Geranium* spp.,

Juncus spp., *L. amplexicaule*, *L. scariola*, *L. serriola*, *Malva* spp., *M. officinalis*, *Oxalis* spp., *P. oleracea*, *Plantago* spp., *S. arvensis*, *S. glauca*, *S. halepense*, *S. nigrum*, *Seteria* spp., *Tanacetum coccineum*, *T. latifolia*, *Trifolium resupinatum* and *Verbascum* spp. (Tastan and Ercis, 1992; Ulug and Kadıoglu, 1992; Kumar et al., 1993, Serim and Öngen, 1995; Tekin et al., 1997; Benlioglu et al., 2001; Benlioglu et al., 2002; Boz 2004; Aksoy, 2005; Anonymous, 2008 b). The weed species and family names we obtained in our research are similar.

In studies conducted on strawberry fields in the world; *A. retroflexus*, *Amaranthus* spp., *C. album*, *C. bursa- pastoris*, *C. esculentus*, *C. rotundus*, *D. sanguinalis*, *D. stramonium*, *Erodium cicutarium*, *E. crus-galli*, *Fumaria* spp., *E. carolinianum*, *H. leporinum*, *H. suaveolens*, *L. amplexicaule*, *L. scariola*, *M. annua*, *M. lupulina*, *M. parviflora*, *M. polymorpha*, *O. corniculata*, *Oenothera laciniata*, *P. annua*, *P. aviculare*, *P. dubium*, *P. oleracea*, *P. persicaria*, *S. media*, *Spergula arvensis*, *T. terrestris*, *U. urens* and *V. persica* species were found (Milejow, 1989; Elmore, 1991; Dalmau et al., 1993; Vizantinopoulos and Katranis, 1993; Silveria et al., 1994; Tacconi and Santi, 1994; Labrada et al., 1994; Yaduraju and Ahuja, 1996; Campiglia et al., 1998; Ioannou, 1999; Ricci et al., 1999; Moya and Furukawa, 2000; Peachey et al., 2001; Johnson and Fennimore, 2005; Adcock et al., 2008; Johnson and Mullinix, 2008; Webster, 2010; Monday et al., 2015; Boyd and Reed, 2016). The similarities between the findings of other researchers and the weed species we have obtained are partly seen. That is why; weed species and density; weed control methods, climate, vegetation cover, soil physical and chemical properties of the region, and vary depending on the altitude of the region. For this reason, the type and density of weed among the countries can vary greatly.

In the method for controlling weeds in strawberry fields in Turkey; In the study conducted by Tastan and Ercis (1992) in the study area of Ankara, the weeds were applied in Glyphosate 300-400 cc / da and 700-1000 cc / da dose after emergence with 4-8 leaf stage. As a result of this herbicide application; *B. tectorum*, *C. solstitialis*, *T. latifolia* and *S. arvensis* species 100% effect is obtained against the product, *A. myosuroides*, *L. scariola*, *Plantago* spp. and *M. officinalis* 86-90% rate effective was found. Ulug and Kadıoğlu (1992) conducted herbicide treatment in Cukurova region and applied Glyphosate 1000 cc/da herbicide, as a result of this application *A. albus*, *C. arvensis*, *C. dactylon*, *Cyperus* spp., *D. sanguinalis*, *E. colonum*, *Malva* spp., *P. oleracea*, *S. glauca* and *S. halepense* rate of efficiency 86-90% was found. In another study, post-emergence Glyphosate was found to be effective on *P. oleracea* and *C. arvensis*, where as *E. repens* was not effective. (Sözeri et al., 1998). In the chemical struggle on strawberry field in the world; the direct application of the glyphosate acting herbicide made by Baurdot and Butter (1985) on weed species there was a decrease in exile numbers. It has been reported by Zandstra and Hanson (2003) that the application of Glyphosate in chemical struggle with weeds in strawberry field is effective against single and perennial weeds. Daugowish et al., (2008) used pre-emergence herbicides (Oxyfluorfen, Simazine and Pendimethalin) in combating weeds in strawberry fields in the California area. As a result of this application; *C. bursa-pastoris*, *M. officinalis*, *M. parviflora*, *M. polymorpha* and *S. physalifolium* 70-100% rate effective. Dittmar et al., (2016) used broad-spectrum fumigants in Florida as well as plastic covers for struggling with weeds in weeds. This application has been found to be effective against weeds, nematodes and soil-borne diseases. As a herbicide post-emergence in strawberry production, Glyphosate has been effective in application against narrow and wide leaf weeds. In this topic, the ratio we have obtained and the ratios obtained by the researchers are different. Reason of this the application of herbicide is different from time to time and weed spıecies.

CONCLUSION

The species, families and density of weeds in the strawberry field of Albion frigo were investigated in the village of Sökün in the Silifke district of Mersin province. According to the results of this research, 46 weed species belonging to 25 different families were detected in the experimental area. The weed density was calculated as of avarage 24.40 number/m^2. The average density of weed species in experimental parcels was; *C. rotundus*, *S. halepense*, *E. repens*, *C. dactylon*, *C. arvensis*, *A. retroflexus*, *C. canadensis*, *S. nigrum* and *C. album* determined as.

Weed density was found different according to different methods in control with weeds. The lowest weed density was observed in the application of black plastic covering, followed by hand hoeing and post-emergence Glyphosate application. The density of weed species; the climate of the region, physical and chemical properties of soil, culture plant, irrigation and fertilization methods, depending on the methods of combating weeds vary.

In this study, density of weeds differed according to different methods of struggle. In the study done by us, weed density in the trial area is different according to different methods of control; while the lowest was seen in the application of black plastic cover followed by hand hoeing and Glyphosate parcels respectively. It has been observed that the active substance used in the chemical struggle with weeds varies according to the dose, application time, climate and soil characteristics and the impact rates of weeds and other different methods of control.

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INVESTIGATION OF WEED SPECIES, FAMILY AND DENSITY WERE PROBLEM IN PEANUTS

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ABSTRACT

This research was established in Sumbas province of Osmaniye. In this study, the weed species, the family and the density, which are problems in peanut lands, have been investigated. The trial was set up with 4 repetitions according to the random parcel design. In peanut fields that were caused problems against weeds; Hand hoe, machine hoe, machine and hand hoe, pre-emergence herbicide (Dimethanamid-P720 g/L), post-emergence herbicide (Imazamox 40 g/L) application, integrated control methods were applied. No control methods were applied in the control parcels. The density of weed species according to these methods of control; 0.91 on the hand hoe applied parcels, 1.23 on the machine hoe, 0.22 on the machine and hand hoe, 4.56 on the pre-emergence herbicide, 0.63 on the post-emergence herbicide, 0 on the integrated control methods and in the 24.28 number/m² on the control parcels the density was calculated.

The weed detected 21 species from 14 families in the research area. The average weed density according to the parcels in the experimental area; 7.67 number/m² on *Cyperus rotundus*, 7.31 on the *Amaranthus retroflexus*, 6.15 on the *Portulaca oleracea*, 5.66 on the *Elymus repens*, 4.12 *Sorghum halepense*, 3.99 on the *Euphorbia nutans*, 3.37 on the *Chenepodium album*, 3.27 on the *Echinochloa colonum*, 2.41 on the *Stellaria media*, 2.39 on the *Digitaria sanguinalis*, 2.29 on the *Amaranthus albus*, 2.21 on the *Convolvulus arvensis*, 1.26 on the *Xanthium strumarium* and 1.25 on the *Solanum nigrum*.

Key words: Peanuts, weeds, family, species and density

1. INTRODUCTION

Peanut (*Arachis hypogaea* L.) is an annual and herbaceous plant belonging to the Leguminosae family, and was grown and improved in South America and Central America 3.500 years ago. Throughout the world, it is grown in tropical and subtropical climatic areas. The USA ranks the first with 406.646 tons in peanut production in the world, Iran ranks the second with 315.151 tons, and Turkey ranks the third with 170.000 tons (Anonymous, 2018).The majority of this production is performed in Adana in 247.550 da area with 99.325 tons of production, in Osmaniye in 126.665 da area with 48.573 tons respectively. A total of 93% of the planting in Turkey is made in Adana, Osmaniye and Antalya provinces; and 58% of the total production in Turkey is covered by Adana (Anonymous, 2017b).

Seeds of peanut (*A. hypogaea* L.) contain fat, protein, carbohydrates, vitamins and minerals which are very important nutrients for living organisms. Peanut seeds have fat at a rate of 44-56% varying among its cultivars. Peanut oil is superior to many vegetable oils in terms of its taste and shelf life. Meanwhile, its pulp is a valuable animal feed additive. There are crude protein, nitrogen-free substances and mineral substances in the pulp of the peanut. For this reason, peanut pulp is used in great amounts in the production of mixed feeds in many developed

countries. There are approximately 18% carbohydrate and plenty of minerals like K, Ca, Mg, P and S in peanut seeds (Arıoglu, 2013). Although all of the varieties planted in Turkey are Virginia-type appetizers, the cultivar that is most widely planted is the NC-7.The leaf color is green, fruit yield potential is 400-450 kg/da. The number of days needed for ripening is 140-160 days, 1000-grain weight is 900-950 g, percentage flesh rate of the fruit is 70-75%, grain color, shape and size are light pink, cylindrical and big. The fat percentage is 50-52%, protein rate is 22%, oleic acid is 55%, and linoleic acid is 27% (Kadiroglu, 2018).

There are many factors that influence the yield and quality in the peanut production. Among the most important of these factors, there are weeds, disease factors, pests, climatic factors and soil factors (Güncan, 2009).

Some of the important weeds observed in peanut cultivation in Turkey are *Sinapis arvensis*, *C. dactylon*, *C. rotundus*, *A. albus*, *A. retroflexus*, *P. oleracea*, *E. repens*, *S. halepense*, *E. nutans*, *Chenepodium album*, *E. colonum*, *C. arvensis*, *S. media*, *D. sanguinalis*, *X. strumarium*, *Solanum nigrum* and *Capsella bursa-pastoris* (Uluge t al., 1993; Kadıoglu et al., 1993; Orel, 1996; Uygur, 1997; Arslan and Üremis, 2003; Kadiroglu, 2018).

The most common weeds observed in peanut cultivation in the world are *C. rotundus*, *C. dactylon*, *Panicum repens* and *Dactylo cteniumaegyptium*, whichwere detected in peanut fields in the sandy soils of Tamil Nadu region of India (Manickam et al., 2000). In the same region, Suryawanshi et al. (2001) reported that the most common weeds in peanut in the region were *A. viridis*, *Parthenium hysterophorus*, *Acalypha indica*, *C. rotundus*, *C. dactylon*, *P. repens*, *Eclipta alba* and *Trianthema portulacastrum*; Thimmegowda et al. (2007), on the other hand, reported that *D. marginata*, *D. aegyptium*, *Chloris barbata*, *E. colonum*, *Eleusine indica*, *Commenlina benghalensis*, *A. viridis*, *Lagas camollis*, *E. hirta*, *E. geniculata*, *Borreria hispida*, *P. oleracea*, *Ageratum conyzoides*, *Spillanthus acmella*, *Acanthosperum hispidum*, *Cleome monophylla*, *Phyllanthus niruri* and *Achyranthusa spera* were very common in the area. Ferrel et al. (2015) reported that the most problematic weeds in peanut cultivation in Florida were *A. palmeri*, *Anodacr istata*, *Cardiospermum halicacabum*, *E. crus-galli, Desmadium incanum*, *C. dactylon*, *Cucumis anguria*, *Vigna unguiculata*, *Mollugo verticillata*, *Citrullus lanatus*, *D. californica*, *Crotalaria juncea*, *E. prostrata*, *Galium aparine*, *Raphanus raphanistrum*, *C. esculentus*, *D. aegyptium* and *X. strumarium*.

The losses in the yield in peanut cultivation ranged from 17 to 96% depending on the intensity and type of the weed flora (Rajendran and Lourduraj, 1999). Peanut seed yield is reduced by up to 62% when compared to narrow and broad-leaved weed density (Paulo et al., 2001). When compared with the parcels and control parcels where integrated control methods are applied in peanut production, it was observed that there was an increase in seed production at a rate of 30-36% (Jhala et al., 2005). Clewis et al. (2007) reported that weeds decreased the yield at a rate of 40% in peanut cultivation.

Herbicides may be defined as the chemical substances, which kill plants or prevent them from developing, or as the active substances that are used in chemical fight against weeds. According to their time of use, herbicides are categorized in three groups as pre-sowing, pre-emergence and post-emergence (Güncan, 2016). The selection of herbicides changes depending on the type of the crops, potential use of them, crop growth stage, the status of the plant cover, soil type and the weeds in the field (Davies and Gal, 2002). The pre-sowing herbicides are benefin, dinitromine 23.5%, ethalfluarin 33.3%, vernolate, pendimethalin, alachlor, metolachlor,

imazethapyr, oxyfluorfen and oxadiazon; the pre-emergence herbicides are dinoseb, naphthalene, pendimethalin, alachlor, metolachlor, imazethapyr, oxyfluorfen and oxadiazon; and post-emergence herbicides are bentazone+imazamox, cycloxydim, holoxyfob-P-methylester, imazamox, fluazifob-P-buthyl, haloxyfobethoxy ethyl ester, fomesafen and bentazone are used in the fight against weeds in peanut cultivation (Güncan and Karaca, 2018).

While it was found that Imazapic was effective against broad-leaved annual weeds in peanut cultivation, *C. rotundus* and *C. esculentus* were found to be effective against narrow-leaved weeds (Richburg et al., 1994; Warren and Coble, 1999; Wilcut et al., 1996). According to the study conducted by Burke et al. (2004), clethodim and imazapic mixture was effective against *Brachiaria platyphylla*, *P. texanum*. ,*P. dichotomiflorum*, *Carex eleusinoides*, *E. indica* and *D. sanguinalis*, which are problems in peanut cultivation; Imazapic was found to be effective against narrow-leaved weeds in a single application. Imazapic and clethodim were found to be effective at a rate of 99% against similar weeds.

This study was conducted to determine the weed species, their families, and densities, which pose a problem in the peanut cultivation. This study was conducted in Sumbas district of the city of Osmaniye.

2. MATERIAL AND METHOD

2.1.Material

This study has been carried out in Sumbas district of the city of Osmaniye region where the most peanut production was made in 2017. The materials of this study; peanut variety, weeds seen in the field, hand hoeing, machine hoeing, pre and post-emergence herbicides.

2.2. The characteristics of the study area

According to the data of 2017 in peanut cultivation in Osmaniye, the production was 50.164 tons in 32.605 da area. A vast majority of this production was in Kadirli district, which ranks the first in 58.570 da area with 24.457 tons. Central district followed it with 34.440 da area and 12.278 tons, Düzici with 30.000 da area and 9.780 tons, Sumbas with 7.680 da area and 2.957 tons, Toprakkale with 1.550 da area and 568 tons and Bahçe with 365 da area and 126 tons, respectively.

2.3.The geographical characteristics of the study area

The Sumbas district of the city of Osmaniye is located in the eastern part of Çukurova Region. It is between 30.00-37.08 northern latitude and 36.13-36.20 eastern longitudes in the Northern Hemisphere. It is surrounded by Gaziantep in the East, Hatay in the South, Adana in the West, Kahramanmaraşin the West.

2.4. The soil properties of the study area

The soil properties of the Study Area are pH 7.51 mild alkali, soil depth is 30 cm, potassium amount is 117.25, phosphorus amount is 5.15, lime rate is 31.09, organic substance amount is 2.85, soil salt rate is 0.026, salt-free, and the soil structure is clayey-loamy.

2.5. The climatic properties of the study area

Sumbas District of Osmaniye is located in the Mediterranean Region of our country, and the Mediterranean Climate is seen in the region. Summers are hot and dry, winters and mild and wet. The temperature, precipitation and relative humidity values of the year 2017 when the study was conducted are given in Chart 2.4.

2.2. Method

The study was designed in a 4-repetition randomized split parcels according to random trial design. The peanut seeds were planted as second crop at 7 cm depth, between 70 cm and 11.5 cm rows. The amount of the seeds to be planted to the decare was calculated as 13 kg. For the purpose of investigating the effects of 6 different methods used inthe fight against weeds seen in peanut cultivation on the weed density,the hand hoe, machine hoe, machine + hand hoe, pre-emergence and post-emergence herbicide application and integrated fight methods were applied in the study.

Pre-emergence (Dimethenamid-P 720g/l), post-emergence (Imazamox 22.4g/l+Bentazon 480g/l) herbicides and emissive-adhesive oil (fatty acid esters 348.75 g/l) and alkalized alcohols-phosphate esters (209.25 g/l) were used in the study. In addition to these different applications, control parcels were formed in which no fight methods were applied. In this study, the weed density was computed according to the formula given by Güncan (Güncan, 2001).

Density= B/n

B= Total individual count in the sample taken,

n= Number of the samples taken.

The weed density scale was computed according to Üstüner and Güncan (2002);

Density scale;

A.Very Intense (average >10)

B.Intense (average 1-10arası)

C.Moderately Intense (between 0.1-1 in average)

D.Less Intense (between 0.01 -0.1 in average)

E.Rare (less than 0.01 in average)

2.2.1. Pre and post-sowing applications

Wheat was grown in the Study Area as a pre-plant before peanut. Wheat harvest was made on 20.05.2017. Irrigation was performed on 26.05.2017 by using the Pan-Irrigation Method. The Study Area was ploughed with a 2-headed plough at 25 cm depth on 02.06.2017.

Disk-harrow and harrow application was carried out on 04.06.2017. After sowing the seeds with sowing-machine, harrow was applied to the soil surface again. Since crown rot disease (*A. niger*) was common in the agricultural areas throughout the district, NC-7 seed was cultivated with a treatment with active fungicide (Fludioxonil 25g/l+Metalaxyl-M 10g). The peanut seed was planted and 18-46-0 fertilizer were applied with phonematicsowing-machine on 06.06.2017 (Figure 3.2). Each parcel was planted as 4 rows. It was observed in the controls after the peanut planting that the peanut seeds germinated on 12.06.2017 (Figure 3.3). The first machine hoe application was carried out following the emergence of the peanuts on 01.07.2017; the second hoe application was carried out on 27.07.2017; and the third hoe application was carried out on 20.08.2017. The first hand-hoe application was made on 02.07.2017; the second application was made on 28.07.2017; and the 3rd application was made on 21.08.2017. The first machine and hand hoe application were made on 01.07.2017, the second application was made on 27.07.2017 and the third application was made on 22.08.2017. The first irrigation in the Study Area was made on 10.07.2017. The first blooming on the peanut was seen on 18.07.2018. The pre-

emergence Dimethenamid-P (720 gr/lt) application was made on 07.06.2017 before the emergence of weeds on the soil surface. The post-emergence Imazamox (22.4 g/l)+Bentazone (480 g/l) was applied on 07.07.2017. The second application was made on 08.08.2017 and the third application was made on 06.09.2017. The Integrated Fight Method was made with pre-emergence (Dimethanamid-P 720g/l) on the surface of the soil on 07.06.2017, the machine hoe application was made on 27.06.2017 and the hand hoe application was made on 28.06.2017. the post-emergence Imazamox (22.4g/l)+Bentazon (480g/l) application was made on 29.07.2017. After the sowing in the Study Area, the 2nd irrigation was made on 30.07.2017 and the 3rdirrigation was made on 20.08.2017. No fighting methods were applied in the control parcels.

On 09.07.2017, iron deficiency, leaf spot disease, red spider and green worm damage were detected on the leaves. Pesticides were used against these diseases at the recommended dose. Prochloraz 400 g/l+Propiconazole 90 g/l fungicide was used for leaf spot disease, Lambda Cyhalothrin 50 g/l insecticide was used for green worm, Etoxazole 110 g/l was used for red spider damage,and iron chelate was used for plant nutrient deficiency. After the chemical application, irrigation was made according to the pan-irrigation method after 1 day. A total of 25 kg urea was given per decare on 13.07.2017.

3. RESULTS AND DISCUSSION

3.1. The weeds and their intensities seen in the study area

A total of 21 weeds from 14 families were observed in the Study Area in which NC-7 peanut cultivation was made. The weed intensity in the trial parcels in the Study Area was computed as *C. rotundus* 7.67 pcs/m², *A. retroflexus* 7.31, *P. oleracea* 6.15, *E. repens* 5.66, *E. nutans* 3.99, *S. halepense* 4.12, *C. album* 3.37, *C. arvensis* 2.21, *E. colonum* 3.27, *S. media* 2.41, *D. sanguinalis* 2.39, *A. albus* 2.29, *X. strumarium* 1.26 and *S. nigrum* 1.25, respectively, which was interpreted as “Intense” (weed count 1-10) (Table 3.1.1).

Table 3.1.1. The weed intensity in the Study Area according to the fight methods against weeds

Weed species Latin name	Turkish name	Hand Hoe	Machine Hoe	Machine andHandhoe	Pre-emergence	Post-emergence	Integrated	Control	Totalaverage
*Amaranthusretroflexus*L.	Red-root fox tail	1.58	4.47	0	18.43	0	0	40.67	9.30
*Portulacaoleracea*L.	Purslane	2.75	2.69	0	13.72	0	0	39.07	8.31
*Cyperusratundus*L.	Buckthorn	6.93	3.85	2.1	13.60	5.32	0	36.12	6.93
Euphorbia nutans L.	Euphorbia	0	0.87	0	8.74	2.01	0	35.51	6.73
*Echinochloacolonum*L.	Spotty *Echinochloacolonum*L.	1.50	1.15	0	4.89	0	0	34.28	5.97
Elymusrepens(L.) Gould.	Twitch	3.92	5.84	1.3	6.54	1.89	0	33.17	7.52
Stellaria media (L.) Vill.	Woodruff	0	0	0	5.42	0	0	30.46	5.12
Chenepodium album L.	Sirken	0.14	1.15	0	5.48	0	0	39.48	6.60

*Amaranthusalbus*L.	Cockscomb	0.87	1.18	0	4.02	0	0	35.54	5.94
Sorghum halepense(L.) Pers.	Kaynaş	2.18	2.56	1.5	4.56	2.36	0	29.13	6.04
Digitariasanguinalis(L.) Scop.	Large crabgrass	0.90	0.14	0	2.45	0	0	27.01	4.35
Solanum nigrum L.	Dulcamara	0.70	0.26	0	2.48	0	0	25.41	4.12
*Physalisangulata*L.	Lantern weed	0.10	0.03	0	0.51	0	0	23.15	3.39
Fumaria officinalis L.	Fumitory	0.07	0.02	0	0.48	0	0	20.05	2.94
Convolvulus arvensis L.	Bindweed	0.83	2.26	0	4.28	2.05	0	18.14	3.93
*Triticumaestivum*L.	Wild wheat	0	0	0	0	0	0	16.02	2.28
*Xanthium strumarium*L.	Common cocklebur	0.7	2.19	0	0	0	0	14.36	2.46
Ecballium elaterium L.	Crow's melon	0	0.03	0	0.14	0.08	0	9.39	1.37
*Polgoniumaviculare*L.	Shepherd's crook	0.10	0.04	0	0	0	0	5.54	0.81
*Heliotopiumeuropeaum*L.	Gray weed	0.30	0.01	0	0	0	0	3.49	0.54
*Aegilopscylindrica*L.	Goatgrass	0	0	0	0	0	0	3.24	0.46
Total average		1.12	1.36	0.23	4.52	0.65	0	24.72	4.65

Different fighting methods (hand hoe, machine hoe, machine and hand hoe, pre-emergence, post-emergence and integrated) in the fight against weeds were applied to the weeds seen in the peanut cultivation. In this study, the methods, which affected the weed density at the highest rate were determined to be the integrated machine and hand hoe post-emergence machine hoe hand hoe pre-emergence herbicide applications, respectively.

In the peanut study area, different fighting methods were applied to fight the weeds, and the weed intensity in unit area (1 m²) was computed separately for each application. According to the results of the present study, the effect of the integrated fight method was found to be the highest, and the effect of the pre-emergence herbicide application was found to be the lowest.

As seen in 3.th recurrence, different control methods were applied with different weeds in the peanut study area, and it was computed that the weed density seen in the unit area (1 m²) was different from each other. According to the result of the present study, weed density was computed to be 4.47 pcs/m^2, 1.35 intense (number of plants 1-10) and very intense with 23.90 (number of plants 10) in the pre-emergence, machine hoe and control parcels, respectively.

It was determined that the machine hoe, machine and hand hoe, pre-emergence and post-emergence applications were more effective among different fighting methods against weeds in peanut cultivation when compared with the control parcels.

4. DISCUSSION

The 14 weed species detected in the peanut Study Area where 6 different fighting methods were applied were found to be "Intense" in numerical terms. These species were *C. rotundus*, *A. retroflexus, P. oleracea*, *E. repens*, *E. nutans*, *S. halepense, C. album*, *C. arvensis*, *E. colona*, *S. media*, *D. sanguinalis, A. albus, X. strumarium* and *S. nigrum.* When the effects of the 6 different control methods on weed intensity were examined, it was determined that the efficiency ranking was as; integrated fight machine and hand hoe post-emergence herbicide machine hoe hand hoe pre-emergence herbicide.

The number and density of the weed species observed in the peanut NC-7 study area varied according to different fighting methods, size of the cultivation area, chemical and physical properties of the soil in the area, and climatic factors. As the homogeneity increased in these factors, the cultivation area decreased; and as the homogeneity decreased in these factors, the weed species and their densities decreased. For this reason, in the peanut Study Area, while the weeds consisted of 21 species and 14 families in the peanut study area, the weeds consisted of 62 species and 22 families in the city of Osmaniye. The weed species reported in the studies conducted in Turkey (Ulug et al., 1993; Kadıoglu et al., 1993; Orel, 1996; Uygur, 1997; Arslan and Üremiş, 2003; Kadiroglu, 2018) about the intensity of weeds that are harmful for peanut cultivation and the ones detected in our study were found to be similar. It was determined that the weed species reported in the studies conducted in other countries of the world were *D. aegyptium* and *P. repens* (Manickam et al., 2000); *Parthenium hysterophorus*, *A. indica*, *E. alba* and *T. portulacastrum* (Suryawanshi et al., 2001); *C. barbata*, *C. benghalensis*, *L. mollis*, *B. hispida*, *A. conyzoides*, *S. acmella*, *A. hispidum*, *C. monophylla*, *P. niruri*, *A. aspera* (Thimmegowda et al., (2007); *A. cristata, C. halicacabum*, *D. incanum*, *M. verticillata*, *C. juncea* and *E. prostrata* (Ferrel et al., 2015); and it was also determined in the present study that these weeds did not exist in the study area and in the city of Osmaniye. In addition, it was also determined that the weeds seen in the world countries were not seen in Osmaniye and in Turkey.

In the present study, the weed species seen in the NC-7 peanut cultivation field caused yield losses at high levels. In other studies conducted in this area, Hauser et al. (1982) reported that the wet weights of the weeds were important rather than their intensities; and Thomas et al. (2004) reported that a 1 g increase in the weed biomass caused a 4.7 kg/ha decrease in the peanut yield. In addition, because of its horizontal and semi-horizontal growth way, the peanut has less competitive power against the weeds; and the loss of yields due to weeds could reach up to 70%; and for this reason, the fight against weeds in peanut crop should be commenced earlier (Drennan and Jennings, 1997). The weeds that existed in the field where the present study was conducted are generally considered to be highly competitive, and pose major problems (Holm et al., 1977). In addition, peanut is a culture plant with low competitive power, and many researchers suggest that weeds are among the most important factors that reduce crops in these fields (Hauser and Parham, 1969, Drennan and Jennings, 1997). The findings we obtained in the present study were found to be similar to those that were obtained by these researchers.

5. CONCLUSION

In the peanut study area, 21 weeds were identified belonging to 14 families. According to the fighting methods against weeds, the density of the weeds was minimum in the parcels where the integrated method was applied, it was determined that the results were as 0.23 pcs/m^2 in the parcel where machine and hand hoe was applied, 0.65 in post-emergence herbicide application parcel, 1.12 in hand hoe application parcel, 1.36 in machine hoe application and 4.52 pcs/m^2 in pre-emergence herbicide application parcel. In the control parcels it was found that this value was 24.72 pcs/m^2.

The average weed intensities in the study area according to parcels were *C. ratundus*L.□*A. retroflexus*L.□*P. oleracea* L. □*E. repens*L. □ *E. nutans*L.□*S. halepense*L. □ *C. albüm*L. □*C. arvensis* L. □ *E. colonum*L. □ *S. media* L. □ *D. sanguinalis*L. □*A. albus*L. □ *X. strumarium* L. □ *S. nigrum* L., respectively.

The most effective way to fight against weeds in peanut cultivation is the integrated method, which is followed by machine and hand hoe applications. Since the weed reserves are quite high in soil, weed germination occurs with certain intervals especially in the crops where irrigated agriculture is carried out. For this reason, mechanical fighting or herbicide application will not be adequate in the peanut cultivation, which requires at least 3-4 irrigations; because weed species have superior competitive power when compared to the peanut crop. For these reasons, it is necessary to implement the integrated fighting method, which can be used together with mechanical and chemical fighting methods.

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DETERMINATION OF RELATION BETWEEN EFFECTIVE HEAT SUMMATION VALUES FOR CV. SULTAN 7 WITH METEOROLOGICAL DATA OF MANISA PROVINCE

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ABSTRACT

Using meteorological and environmental data, combined with information about the vineyard, phenological observations can assist growers in making decisions about what varieties to plant. One of the ways to decide the right variety in a location is determination of Effective Heat Summation (EHS) values. In this study, EHS values were determined for cv. Sultan 7 (*Vitis vinifera* L.) in 2015, 2016 and 2017 in Manisa, Turkey. All calculations based on the phenological observations of cv. Sultan 7. As a phenological stages in the study, bud-break, full bloom, verasion and harvest dates were recorded for three years. EHS values were calculated as degree-day (dd) by extracting 10 ^{0}C from average monthly temperatures from bud-break to harvest periods and multiplying with the day number in each month and adding the obtained values to each other. The base temperature of 10°C refers to the minimum temperature necessary for grapevine physiological activity. The average of EHS values for Sultan 7 were found as 1803.6 dd, 2073.4 dd and 1951.6 dd in 2015, 2016 and 2017 respectively. Total vegetation days of variety was determined 165, 159 and 154 days in three years respectively. Meteorological data were also taken into consideration since there were differences in terms of temperature, precipitation and humidity between years. When the obtained meteorological values were examined, there was determined that the lowest precipitation occurred in 2016 with 615.40 mm value. At the same time, the average temperature values were compared over the years, the highest average temperature value was found in 2016 (28.5 ^{0}C).

Key words: Climate, phenological stages, grapevine, variety**.**

INTRODUCTION

Manisa is one of the most important province in terms of production of table grapes and raisin which is located at west part of the Turkey in Aegean Region. The province has very favorable climatic and soil conditions. These conditions have allowed large number of variety of grapes to be grown in different times for years. In 2017, 1.534.419 million tonnes grapes were produced in Manisa which was consist of almost 37 % of total grape production of Turkey. Moreover, 1.084.454 million tonnes (almost 68%) of the total raisin production of Turkey 1.603.000 tonnes (as fresh) were produced in Manisa (Turkish Statistical Institute, 2017). Approximately 85 % of the raisin production of Turkey is exported. Due to its ecological suitability and high profit, raisin production is an important economic source for most grape growers in Aegean Region. Region has very fertile land, plenty of sunshine and abundant water supplies (Soylemezoglu et al., 2015).

The climate in Manisa is warm in summers and mild and rainy in winters. The long term climate data (1926-2016) is obtained from the national meteorological station. The average temperature is the highest in July and August and the lowest in January and February. The monthly average total rainfall is the highest in December and January while the lowest in July and August. The annual average temperature is 16.9 °C and the annual average total rainfall is 728.8 mm (Güler *et.al.,* 2017).

Vitis vinifera L. grapevines are a phenologically distinct crop with the most important developmental stages being budburst, flowering, veraison (color change and maturation nascent), and harvest (grape maturity). The time between these phenological stages varies greatly with grapevine variety, climate, and geographic location (Jones and Davis, 2000). Not only these factors but also changeable meteorological events in following years affect the phenology of varieties in different regions.

Grapevines needs a certain sum of temperatures for the ripening of varieties of grape. The stages of phenological are considered in particular budburst-harvest or bloom-harvest periods are taken into account in the calculation of these values according to some criteria's. One of the most important criteria that helps us to decide which varieties of grape to grow in a region is Effective Heat Summation (EHS) values (Winkler *et. al.*, 1974; Çelik *et. al.*, 1998; Bekar and Cangi, 2017).

The Winkler Index (WI) is widely used as a guide to selecting grape varieties and determining the suitability of a given area to produce quality grapes (Amerine & Winkler, 1944; Winkler *et. al.*1974; Tonietto & Carbonneau, 2004, Jones, 2005). WI calculates climate as the sum of the daily average temperature above a base value of 10°C, the minimum temperature at which vine growth occurs, for each day in the period from budburst through harvest (Köse, 2014).

The aim of the study was to determine the phenological stages and to compare climatic conditions of Manisa province between 2015, 2016 and 2017. At the same time, requirements of EHS of Sultan 7 variety were determined in the same experimental area in different successive years.

MATERIAL and METHODS

Experimental Site and Plant Material

This study was carried out on *Vitis vinifera* L. cv. Sultan 7 grape variety in center district (Yunusemre) of Manisa province in 2015, 2016 and 2017. Sultan 7/ 1103 Paulsen rootstock graft combination was used in vineyards spacing of 3.0 m X 2.0 m with the 'Y' trellising system. Vine trees was cane pruned (pruning with long canes) approximately six canes. This seedless variety was registered in 2011 by Manisa Viticulture Research Institute. It is among the most widely grown grape cultivars in Manisa province for both table grape and raisin production.

Climatic Data and Ecological Classification of Study Area

Climatic data were recorded by Climate/Meteorological Station (METOS by Pessl Instruments Weiz, AUSTRIA). The station was placed in the experimental vineyard. Daily maximum, mean temperatures and precipitation values were calculated from daily climatic data. As for ecological classification of study area according to Winkler Index (WI-GDD), growing degree-days (GDDs) were calculated from the climate grids based upon the standart simple degree–day formulation using average temperatures above a 10^0C base for 01 April to 31

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October. Values were classified according to the Table 1. (Amerine and Winkler, 1944; Köse, 2014).

Phenological Stages of Sultan7

The data of main phenological stages of Sultan 7 grape variety (budburst, blooming, veraison and harvest dates) were collected for 2015, 2016 and 2017. All stages except harvest time were considered to have occurred when 50 % of the vines showed these physiological responses (Köse, 2014). For harvest time, ripening dates of variety were determined according to total soluble solids (TSS) of grape juice with using refractometer and these values were accepted between 21-23 Brix.

Table 1. Winkler climatic parameter, definition and sources

Climatic parameters	Definition	Source
Winkler Index (WI-GDD) **Region I (cold) < 1 390** **Region II (moderately cold) 1 391 to 1 670** **Region III (warm) 1 671 to 1 940** **Region IV (moderately warm) 1 941 to 2 200** **Region V (hot) > 2 200**	***Σ((Tmax + Tmin)/2 -10^{0}C))*** Tmax: maximum temperature calculated for 01 Apr to 31 Oct Tmin: minumum temperature calculated for 01 Apr to 31 Oct	(Amerine & Winkler, 1944) (Köse, 2014)

Determination of Heat Requirements

In our study, threshold temperature for the calculation of the 'Effective Heat Summation (EHS)' was accepted as 10°C for the grape variety (Winkler *et. al.,* 1974). The effective heat summations were calculated as "degree-days" according to the number of days between each and every phenological phase.

$$\mathbf{EHS = \Sigma\ (T\text{-}Te)}$$

EHS = Effective heat summation (Growing Degree-Days / GDD)

T = Daily average temperature (^{0}C)

Te = Threshold temperature (^{0}C)

RESULTS AND DISCUSSION

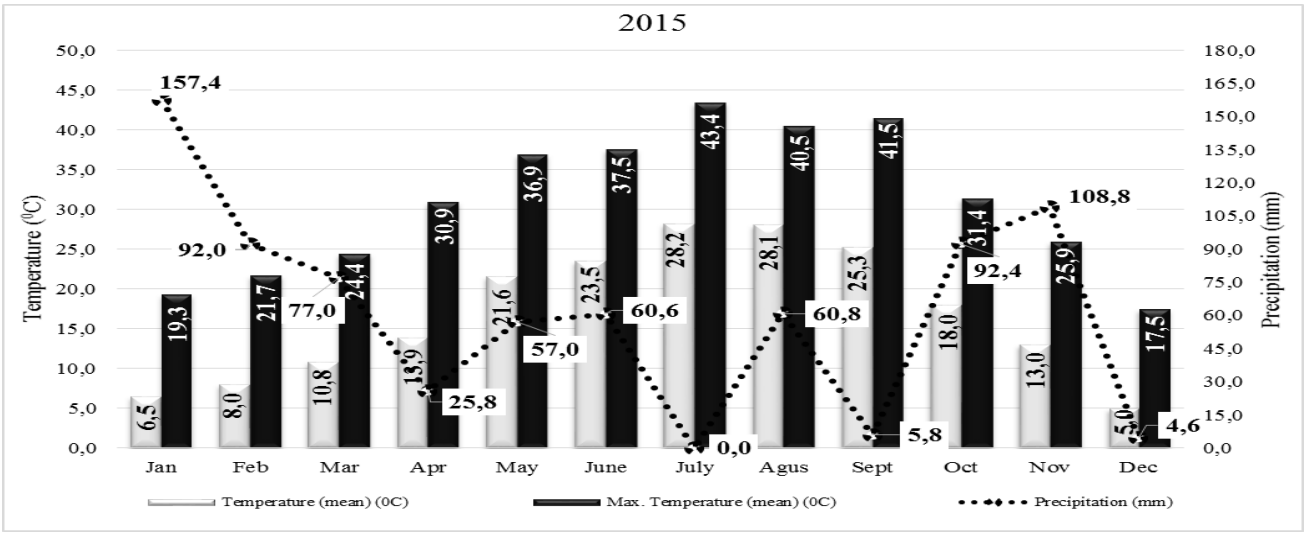
Climatic Data of Experimental Area

Figure 1, 2 and 3 show the monthly maximum, mean temperatures and precipitation values in 2015, 2016 and 2017 respectively. According to values, total annual rainfall was 742.2 mm in 2015, 615.4 mm in 2016 and 649.2 mm in 2017. At the same time total annual mean temperature values below 9 ^{0}C are not suitable for viticulture so these values are important in a region for grapevines (Çelik *et al.* 1998). In this study, total annual mean temperature values are determined as 16.8 ^{0}C in 2015, 16.5 ^{0}C in 2016 and 16.8 ^{0}C in 2017. When the values evaluated in terms of average of mean temperature in vegetation periods (March– August), the values showed that 21.0 0C in 2015, 22.6 0C in 2016 and 21.5 0C in 2017.

Classification of Ecology of Study Area: 2015 to 2017

Growing degree-days (GDDs) were calculated from the climate grids based upon the standard simple degree – day formulation using average temperatures above a 10 ^{0}C base for 01 April to 31 October (Fig.1)

The EHS values was calculated for study area 2770.0, 2286.3 and 2705.1 GDD in 2015, 2016 and 2017 respectively. These findings shows that ecology of study area can be classified as hot climate (GDD > 2200) for all years according to classification of Winkler Index by Amerine and Winkler (1944).



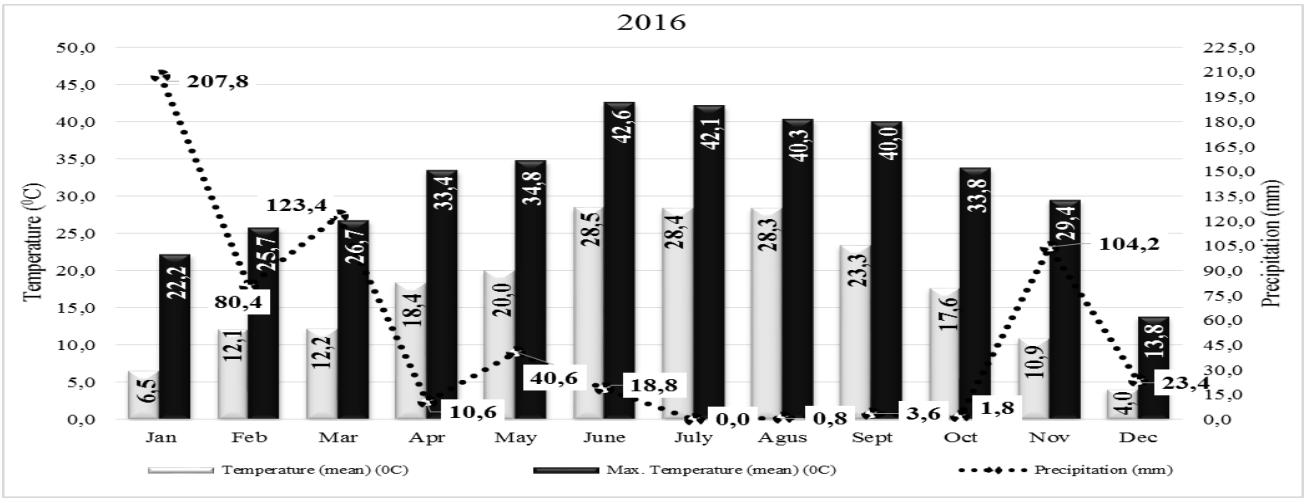


Figure 1. Data of monthly maximum, mean temperatures and precipitation values in 2015.

Figure 2. Data of monthly maximum, mean temperatures and precipitation values in 2016.

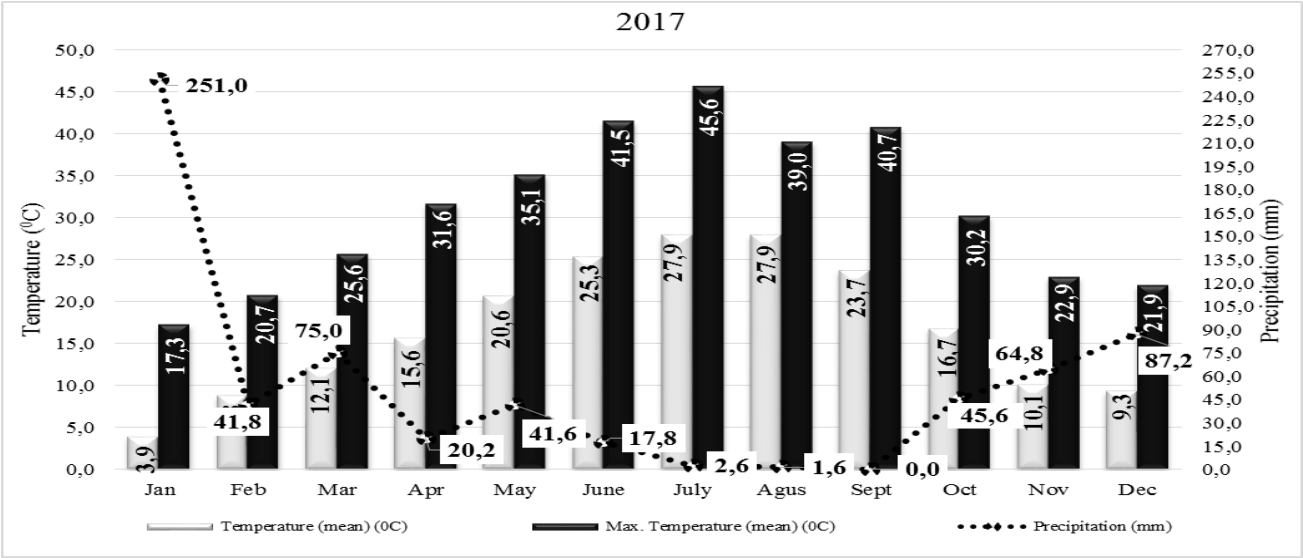


Figure 3. Data of monthly maximum, mean temperatures and precipitation values in 20

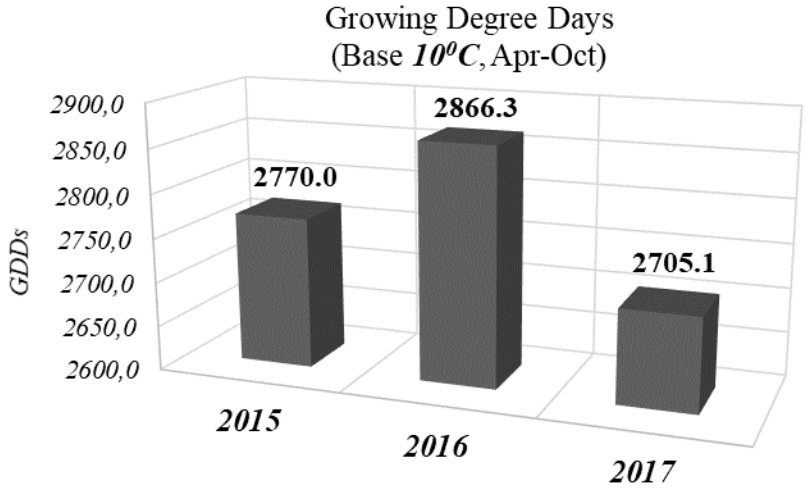


Figure 1. Ecological classification of study area according to Winkler Index, growing degree-days (GDDs) values.

Phenological Stages For The Study Area and Variety: 2015 to 2017

Phenological data for three years are presented in Table 2. The budburst time of three years ranged from 7 March to 20 March and this time occurred earlier in 2015 than in 2016 and 2017.

Table 2. Phenological dates of variety in the study area for 2015, 2016 and 2017

Years	*Budburst time*	*Blooming*	*Veraison*	*Harvest time*
2015	7-March	6-May	18-July	20-August
2016	16-March	10-May	16-July	25-August
2017	20-March	16-May	14-July	24-August

For blooming time in this study, dates were recorded on between 6 to 16 May and the number of days from budburst to blooming time ranged from 56 to 60 days according to years (Fig. 4). When we look at the temporal difference between budburst and blooming times of three years, it is seen that this time difference decreases between 2015 and 2017. At the same time, it is observed that when the flowering time was being short or long, this situation affected the total vegetation period length more than duration of between veraison and harvest time. Similarly, heat summation value varied from 189.7 to 393.8 GDD in between budburst and blooming time in three years (Fig. 5). Especially in 2015, although the number of vegetation days were found as long period, heat summation was determined the shortest value when the values compared to the other years.

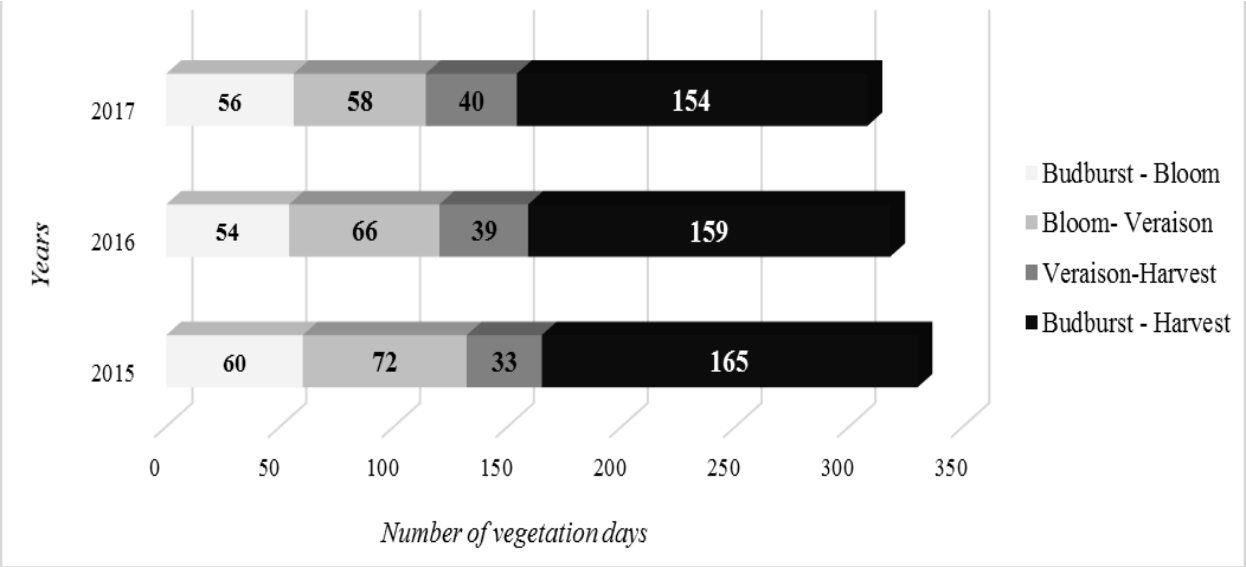


Figure 4. Number of days in phenological stage for Sultan 7 grape variety in 2015, 2016 and 2017.

Veraison for the study period occurred on 18 July, 16 July and 14 July in 2015, 2016, and 2017 respectively with the number of days between blooming and veraison ranging from 58 to 72 (Fig. 4). Among the bloom and veraison times heat summation value of between 833.0 and 1010.3 DD was required and in this term in 2017 having the lowest heat requirements but in 2016 it had the highest requirements during this period (Fig. 5). Last phenological period in years;

harvest time for the study occurred between 20 August and 25 August. The veraison to harvest time continued from 33 to 40 days and heat summation value was determined between 629.4 to 725.6 DD (Fig. 5). In 2015, the variety had the shortest duration (witlh 33 days) from veraison to harvest stage, whereas the variety had the longest duration (with 40 days) in 2017 (Fig. 4).

For Sultan 7 grape variety, total heat requirement from the budburst to harvest time was calculated during the year 2015, 2016 and 2017. We have found considerable differences between values of 2015 and values of 2016 and 2017 in terms of longness of vegetation duration and heat summation requirement of Sultan 7 grape variety. Heat summation requirements for three years varied from 1803.6 to 2073.4 GDD. In 2016, the highest total effective heat (2073.4 GDD) was noted but the longness of vegetation duration of variety was determined as 159 days. Otherwise in 2015, although but the longest longness of vegetation duration of variety was determined as 165 days, total effective heat requirement was noted the lowest one (1803.6 GDD).

Galletta and Himelrick (1990), reported that differences existed among the fruits regarding growth, development and maturity depending on the cultural practices and temperature; especially the temperature changes between the seasons and the number of days before full bloom and before the harvest.

Because of no scientific publication about phenology of new variety Sultan 7 until now. For that reason, we compared it with the Sultana grape variety which showed more similarity to phenology of Sultan 7 in terms of occurring of phenological stages.

In a study in 1996, phenological observations of Sultana variety in Konya province were indicated that the budburst time was occurred on 20 April, the blooming time was on 19 June and the harvest time was on 7 September (Akkurt and Fidan, 1998).

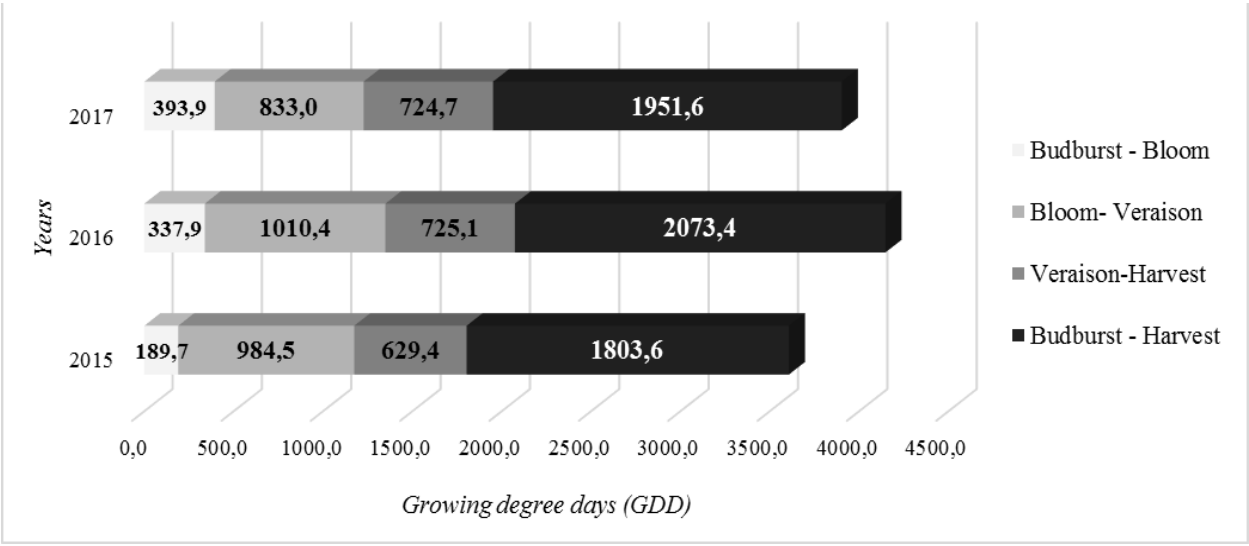


Figure 5. Heat summation requirements of Sultan 7 grape variety between budburst and harvest time in 2015, 2016 and 2017.

Çelik *et. al.* (1988) determined value of the total effective heat summation between the budburst and harvest time for Sultana grape variety was 1380 GDD in Ankara province. On the other hand, Şensoy *et, al.* (2009) stated that values of total effective heat summation for Sultana grape variety was between 1264.5 and 1363.9 GDD in Van province.

CONCLUSION

This study involved phenological and climatic data to determine the suitability of Manisa province in Turkey's Aegean Region for viticulture. The findings showed that *Vitis vinifera* L. cv. Sultan 7 can be grown in the region in terms of EHS and climatic conditions. Additionally, although it was studied for only one grape variety, as expected, we found differences in phenological stages between three years of experiment because of differences in climatic conditions.

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RECENT DEVELOPMENTS IN GOAT MEAT PRODUCTION OF TURKEY AND MARKETING ALTERNATIVES

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ABSTRACT

According to data of the Turkish Statistical Institute, there are still 10.63 million goats in Turkey. Hair goats constitute approximately 98% of goat population. 37,525 ton of red meat produced from 2.07 million slaughtering goat meat in 2017. This represents only 3.3% of the total Turkish meat production, which is at 1.13 million tons. The main purpose of this study is to analyse recent developments in goat meat production and marketing between 2008 and 2017 in Turkey. The suitability of the goat as a meat animal and current consumer trends have been discussed and alternative marketing channels and strategies for goat meat have been evaluated in this study. Statistical data have been obtained from FAOSTAT and Turkish Statistical Institute. Data obtained have been shown in the tables issued by the use of percentage and index calculations. Changing demographics and consumer demands are having a significant impact on what people eat. There is a trend towards more global products and flavours. With an increase in demand for low-fat red meat alternatives by consumers, the future of the goat farming looks promising.

Key words: Goat breeding, small ruminant, red meat, goat meat production, marketing.

1. INTRODUCTION

Meat takes an important place among animal protein sources. The main reason for this is stemming from the structure of amino acids (Onurlubaş et al., 2015). When the proposition is examined in terms of human, development, growth, endocrine system and many other metabolic events are realized. For this reason, the right amount of red meat should be consumed (Sachez-Villegas et al., 2003). In other words, consumption of red meat can be said to be a measure of socio-economic development for societies at the same time (Yağmur and Güneş, 2010). Over the past decade, consumer preferences have shown significant changes in meat consumption. To start with, a preferred orientation towards red meat to white meat has become a matter of preference. There has been a growing interest in specific meat products, especially consumers in countries such as the US and Canada. Quality factors such as cholesterol, energy level, brittleness, softness and water retention capacity play an important role as well as price. In purchasing decision of consumers, visualise and fat tissue (mosaicization) level for muscle should not be ignored. It is now a slow-growing goat meat market for goat meat consumption in the world. In other words, it has become a new alternative for people who want to eat red meat with low-fat content, especially cardiovascular diseases. Goat meat has begun to gain a bit more popularity in people with cardiovascular problems with these described quality features. The demand for goat meat is remarkable. However, there is not yet a very obvious or major demand for consumption compared to cattle, sheep and pork (Yaylak et al., 2010).

According to data of FAO, around 5.6 million tonnes of goat meat was produced worldwide in 2016 (FAOSTAT, 2018). Yet, this amount of goat meat production does not clearly

reflect the actual level of production; a high proportion is either sold to consumers directly at the farm gate and consequently does not follow proper marketing channels, or is consumed in the home and therefore not marketed at all.

Some studies on goat meat production and marketing in Turkey have been done (Koşum et al., 2003; 2005; Bağdatlı et al., 2012; Koluman, 2014; 2015; Koluman et al., 2016; Ogun et al., 2016; Hatipoğlu et al., 2016). However, the studies on the technical and economic aspects of goat meat production should be carried out continuously.

The aim of this study, goat meat production and marketing in Turkey were discussed the current situation and problems. In addition, existing marketing channels of goat meat and approaches to increase consumption were examined. Finally, some technical and economic proposals have been made regarding the topic. Statistical data have been obtained from FAOSTAT and Turkish Statistical Institute (TurkStat). Data between 2008 and 2017 obtained have been shown in the tables issued by the use of percentage and index calculations.

2. GOAT POPULATION IN TURKEY

Changes according to the year of the goat's presence in Turkey are given in Table 1. The number of goats, which were more than 5.6 million in 2007, showed significant decreases in 2011 and 2012. Especially with the incentives and supports that started in 2010, this number increased and reached 10.6 million in 2017. Based on goat presence in 2008 (assuming index 100), this value reached 149.86 in 2017. When the share of goats in total small ruminant is examined, it is 18.92% in 2007 and this value increased by 24% in 2017.

Table 1. Changes according to the year of the goat number in Turkey (1000 head)

Years	Sheep	Goat	Total small ruminant number	Index (2008=100)	The rate of goat for total small ruminant (%)
2008	23,975	5,594	29,569	100.00	18.92
2009	21,750	5,128	26,878	90.90	19.08
2010	23,090	6,293	29,383	99.37	21.43
2011	25,032	7,278	32,310	109.27	22.53
2012	27,425	8,357	35,782	121.01	23.36
2013	29,284	9,225	38,509	130.23	23.96
2014	31,140	10,345	41,485	140.30	24.94
2015	31,508	10,416	41,924	141.78	24.85

2016	30,984	10,345	41,329	139.77	25.03
2017	33,678	10,635	44,313	149.86	24.00

Source: TurkStat, 2018.

3. GOAT MEAT PRODUCTION IN TURKEY

In Turkey, the number of slaughtered sheep and goat is presented in Table 2. The consensus reached on the chart is that in the total sheep and goat meat production, the number of sheep cut over the last 15 years declined significantly in 2009, but the relative increase and decrease in the following years has been a matter of course. In other words, the index of small ruminant that was slaughtered in 2009 was 72.42 while it was 113.32 in 2017. When the share of goats in the cut small ruminant is examined, it ranges from 12 to 30%, and from 2013 onwards, there are relative increases.

Changes according to the year of the sheep and goat meat production in Turkey are given in Table 3. Goat meat production in 2017 increased to 37,525 tons in particular. This is directly related to the increase in the number of goats in the mentioned years. The lowest quantity was with 86,308 tons in 2009. The highest quantity was with 158,747 tons in 2010. When the share of goat's meat in total small-leaved meat production is examined, this value ranges from 12 to 27%. The lowest rate was observed at 12.45 % in 2008 and the highest value reached 27.32% in 2016.

Table 2. Change over the years have slaughtered the number of small ruminants in Turkey

(1000 head)

Years	Sheep	Goat	Total slaughtered small ruminant number	Index (2008=100)	Rate of slaughtered goat in total small ruminant (%)
2008	5,589	767	6,356	100.00	12.07
2009	3,997	606	4,603	72.42	13.16
2010	6,874	1,219	8,093	127.33	15.07
2011	5,479	1,254	6,733	105.93	18.62
2012	4,541	927	5,468	86.03	16.95
2013	4,958	1,341	6,299	99.10	21.29

2014	5,197	1,570	6,767	106.47	23.20
2015	5,008	1,999	7,007	110.24	28.53
2016	4,084	1,756	5,840	91.88	30.07
2017	5,134	2,069	7,203	113.32	28.72

Source: TurkStat, 2018.

Table 3. Changes according to the year of the small ruminant meat production in Turkey (tonnes)

Years	Sheep	Goat	Total small ruminant meat production	Index (2008=100)	Rate of goat meat in total small ruminant meat production (%)
2008	96,738	13,753	110,491	100.00	12.45
2009	74,633	11,675	86,308	78.11	13.52
2010	135,687	23,060	158,747	143.67	14.53
2011	107,076	23,318	130,394	118.01	17.88
2012	97,334	17,430	114,764	103.87	15.19
2013	102,943	23,554	126,497	114.49	18.62
2014	98,978	26,770	125,748	113.81	21.29
2015	100,021	33,990	134,011	121.29	25.36
2016	82,485	31,011	113,496	102.72	27.32
2017	100,058	37,525	137,583	124.52	27.27

Source: TurkStat, 2018.

4. GOAT MEAT CONSUMPTION IN TURKEY

The global goat meat market had total revenues of 25,657 million USD in 2015, representing a compound annual growth rate (CAGR) of +15.0% from 2007 to 2015. In physical terms, the market showed an increase of +2.4% over the period under review. Finally, the goat meat market reached 5.7 million tonnes in 2015. In 2015, according to market research conducted by Index Box, the leading consuming market was China (2.3 million tonnes). It was followed by India (512,800 tonnes), Pakistan (303,600 tonnes), Nigeria (299,800 tonnes) and Sudan (155,900 tonnes), Iran (139,200 tonnes), Mali (84,600 tonnes) and Turkey (84,200 tonnes). These countries were also the leading producers of goat meat (Avramenko, 2017).

In China, the largest consumer country, per capita goat meat consumption was estimated at 1.6 kg/person, twice the global average (0.8 kg/person). The highest level of goat meat consumption was registered in Sudan (3.9 kg/person). India (0.4 kg/person) had the lowest levels of goat meat consumption. In Pakistan, per capita goat meat consumption remained stable at 1.6 kg/year. In Turkey, per capita goat meat consumption was estimated at 1.1 kg/person. However, per capita goat meat consumption in Turkey was also estimated in other studies. For example, it was estimated as 0.2 kg (Akbay et al., 2008) and 6.1 kg (Saçlı and Özer, 2017). In another study, goat meat consumption rate of households in Turkey was determined as 3.3% (Uzunöz and Karakaş, 2014). In a study, income elasticity and demanding price elasticity for goat meat in Turkey were determined as 0.53 and -1.69, respectively (Akbay et al., 2008). According to results of this study, if income of household increase 10%, goat meat consumption of household will increase 5.3%. However, if goat meat price increase 10%, goat meat demand of household will decrease 16.9%. In a study, reasons for not consuming goat meat were determined as smell of meat (56.25%), no habit (16.67%), hard of meat (5.20%), health disruption (4.16%) and other reasons (17.72%), respectively (Atay et al., 2004).Goat meat consumption rate of households in different regions of Turkey were determined by survey. Results of these surveys were given in Table 4. Goat meat consumption rate vary between 1.8% and 27.6% according to regions. Table show it is higher in the East region of Turkey.

Table 4. Goat meat consumption rate of households in different regions of Turkey

Region	Goat meat consumption rate of households (%)	References
Kocaeli-Merkez	4.2	Akçay and Vatansever, 2013
İzmir-Ödemiş	8.6	Yaylak et al., 2010
Gaziantep-Merkez	2.3	Karakuş et al., 2008
Elazığ-Merkez	15.3	Şeker et al., 2011
Aydın-Çine	5.7	Atay et al., 2004
Konya-Selçuklu	2.8	Tüzemen, 2012

Van-Merkez	1.9	Aygün et al., 2004
Aydın-Merkez	1.8	Ulaş, 2011
Bingöl-Merkez	27.6	Karakaya and Kızıloğlu, 2017

Consumer price for goat meat vary according to meat characteristics in Turkey. Average meat price for goat kids in special markets (Ermenek, Alibaba etc.) as follow;

Hip meat: 7.67 $/kg Stalk: 6.85 $/kg Arm meat: 7.40 $/kg Fillet meat: 6.85 $/kg Ribs: 6.57 $/kg Chop: 8.19 $/kg

5. MARKETING CHANNELS FOR GOAT MEAT IN TURKEY

Goat meat with intensive marketing channels in Turkey, producing local markets is a common form of national markets for the company's extensive production can be assessed at two levels. Strengthening the marketing channels of breeders, particularly in rural areas, is of socio-economic importance in the goat husbandry sector (Koluman et al., 2016). Products produced at this level may also be included as local or ecological products in national markets. It is especially important that the carcasses obtained after slaughter as well as live animals be improved in cold chain conditions between the farm and the national market and sanctions for the removal of the so-called traders from this sector. The breeder sells a live goat for 3-5 $/kg, sometimes even not. Livestock purchased by intermediaries at very low prices are marketing small animal carcasses to 4-6 $/kg after culling (Anonymous, 2015).

Goat meat is evaluated only in regional markets in Turkey conditions. In some areas, traditional types of special meals such as "kid spinning or capricorn" give some important clues about the consumption of the kid's meat. Kid meat is a kind of meat with its own cooking methods and different methods have to be used to cook other red meat. Cooking techniques and recipes of goat meat have been the subject of scientific research. The initiation of scientific studies for Turkish cuisine will also provide some important data on goat meat consumption (Dalmas et al., 2011, Stanisz et al., 2009). The development in organizing has played an important role in the development of small ruminant husbandry activities. All these developments can be regarded as important breakthroughs in the development of marketing channels in the livestock sector. General Directory of Meat and Milk Board, which added sheep and goat meat in addition to the sale of beef meat in the contracts that were renewed for the year 2015 in Turkey, acted to support the small cattle breeding and to consume more meat. In 2017, prices 5.48 $/kg for the first quality bottles and 4.93 $/kg for the second quality bottles were given. In Turkey, average live animal and meat prices for breeders are given in Table 5. Live goats also traded on the market in Turkey. In 2017, average live goat prices in Edirne Commodity Exchange for goat and goat kids were 2.74 $/kg and 4.11 $/kg, respectively.

Table 5. Development of live animal and meat prices for breeders in Turkey

Years	Live small ruminant prices ($/head)						Meat prices ($/kg)		
	Sheep (Domestic)	Sheep (Merinos)	Lamb (Domestic)	Lamb (Merinos)	Hair goat	Hear goat kid	Beef meat	Sheep meat	Goat meat
2008	169.77	204.65	112.40	137.98	139.53	86.82	9.08	8.63	7.81
2009	177.42	196.13	120.64	135.48	150.32	92.26	8.65	8.56	8.11
2010	299.33	303.33	207.33	222.67	256.67	163.33	12.27	12.62	12.21
2011	323.95	343.11	222.16	237.13	281.44	182.04	11.10	12.19	11.30
2012	288.83	321.79	199.44	230.17	262.57	168.16	9.78	10.97	10.49
2013	272.07	337.99	188.83	232.97	258.66	163.13	8.84	10.13	9.50
2014	197.26	252.05	153.88	181.73	194.52	127.85	7.81	8.35	7.76
2015	170.22	219.85	136.40	154.78	165.44	112.50	7.77	7.62	6.93
2016	178.48	227.48	142.38	159.27	166.56	114.57	8.29	8.03	7.36
2017	178.90	217.81	143.29	161.10	156.44	113.70	7.52	7.62	6.87

Source: TurkStat, 2018.

On the other hand, animal livelihood (01), meat and degraded offshoots (02), crude postments, (41) chapters were evaluated as small cattle breeding foreign trade data cannot be distinguished in many chapters in foreign trade in animal products in TurkStat data system (Anonymous, 2013, 2017).

According to the 2014 data of TurkStat, 26.7 million livestock exports have been made, of which approximately 2 million $ are small ruminants. When Turkey's exports do not show a very stable structure in the trade of livestock, which constitutes about 8% of the total livestock trade, the exports differ according to the supply of red meat and the domestic market conditions (Anonymous, 2017). Looking at the last two years of exports, we are doing to Azerbaijan, Turkmenistan, Qatar and Lebanon. The whole of 898 heads of live sheep exports carried out in 2013 is the breeding cattle. In 2014, a total of 8,483 sheep and goats were exported, including

376 goats and 8,107 sheep. According to the provisional data of 2014, 95% of sheep exports were made to Qatar and Lebanon. Goat exports are carried out in Azerbaijan and Turkmenistan.

According to the 2014 data of TurkStat, about 140 million $ worth of live animal importation has been realized, When the TurkStat data for 2014 is examined approximately 3 million dollars of sheep and 750,000 $ of goat importation have been done. In 2009, 2010, and 2011, when imports of live sheep were the highest, the highest purchases were made from Bulgaria and Australia. Almost 90% of the actual imports are realized in these countries (Aras, 2015).

6. PROBLEMS RELATED TO SMALL RUMINANT MEAT PRODUCTION AND MARKETING IN TURKEY

There are many issues pending resolution of Turkey meat production. These problems should be planned to be solved in short, medium and long walks. Turkey shows the ovine number of changes over the years. The most important cause of this change in animal assets is that the animal breeders, who are oppressed under increasing production costs, have to leave the industry (Karakuş and Kızıloglu, 2008; Duyum, 2017). As it is known, the only way an enterprise can continue its economic activities is to sell a good over a little over the cost of the goods it produces. Otherwise, the animal grower must be financially supported by direct and/or indirect means. The main reason for the low productivity is that the genetic structures of the causal animals cannot be brought to the desired level. Regeneration work on the subject should be made a state policy and long-term work programs should be regulated (Koyuncu et al., 2005). In this sense, the coordination of the universities, the Ministry, the industrial organizations will be beneficial. It is seen that the costs increase with direct or indirect effects on the production. It is known that the most important cost factor is the sales price of the feed. The rise in feed prices, especially in 2007-2008, can be said to be the extreme drought in years, which is the most important factor in the rising input prices. There is also a clear quality forage in Turkey. It is considered that the need for quality roughage can be met in some measure with the improvement of meadows and pasture. Production costs can be reduced by lowering the prices of inputs used for feed production or by increasing the support for feed plants.

Another reason is the marketing channel of Turkey started to fall in recent years, with the exception of poultry meat production is higher marketing costs due to length. Especially in red meat marketing, it is seen that average 5-6 vehicles are found, depending on whether the consumer is located in the urban or rural area. Today, the situation has fallen into the state support for animal husbandry is not enough. On the other hand, it is understood that export subsidies are also extremely inadequate (Karakaya and Kızıloglu, 2017).

Have not yet passed the carcass grading system in Turkey, is the cause of the carcass to be sold at a lower price. In addition, applications for the breakdown of meat at retail points and the increase in the value added from the carcass on this side are insufficient. In this sense, it is understood that consumers are also very reluctant to behave. On the other hand, in recent years a negative attitude towards sheep and goat meat has been demonstrated by claiming that meat oil contains high levels of cholesterol. However, studies have shown that there is no significant difference in animal species research in terms of fat cholesterol. As a result, especially in the areas of sacrificial feast, the number of sheep and goats has decreased considerably in recent years. However, Turkey's only animal arm is relatively superior to sheep breeding is allowed. In order to combat the misconceptions mentioned above and give more importance to the cattle

ranching and to combat the small-scale diseases which have decreased in number by half in the last decade, vaccination programs should be organized and followed up first. In particular, the modes of transmission and spreading of zoonotic diseases should be identified and, if necessary, these animals should be quarantined or culled for a certain period. Livestock must be paid timely and in full.

7. CONCLUSION

Goat meat, particularly in tropical regions, Southeast Asia and more is consumed due to be preferred by people with low incomes in Africa. Due to insufficient marketing situation, organisational structure, prejudice and grassland possibilities, the economic value of goat meat is very low. On the other hand, besides of goat meat production cost is low and has different advantages and goat is use low productive grassland areas and it is very effective livestock production systems in terms of cost-benefit. During the last 10 years, goat production sector has changed in Turkey. The number of dairy goat farms has increased sharply and the possibilities of marketing to goat meat come into agenda, as well (Koluman et al., 2016; Koyuncu and Taşkın, 2016).

Regardless of the cost of the breeders of policies for the sector for this purpose, short-term solutions instead of taking structural measures are seen as crucial for the sustainability of the livestock sector in Turkey (Şeker et al., 2011; Saçlı and Özer, 2017). It must come to a country that is not engaged in the import and export opportunities to discuss the existing potential and industry experience. The red meat processing industry, which is the second important part of the red meat sector, should be integrated with the livestock sector together with its own economic and technical internal problems. It is necessary to reduce the number of vehicles in the market and to establish the producer-consumer balance. A healthy structure that breeders can keep on their feet is provided. In times when animal product prices are low, price stability should be provided in the market by intervening prices when necessary. Necessary precautions should be taken in order to reduce feed production cost, which is an important input in animal breeding (Akgül and Yıldız, 2016). Feed quality and control should be made effective and precautions should be taken to ensure quality feed production in raw materials use of feed factories. The organization of farmers will also play an active role in the marketing of products and in the formation of prices. It is necessary to prevent illegal animal movements, to create sub-structures of animal markets, to make animal sales outside of animal markets, to vaccinate against outbreaks and to disinfection (Taşkın et al., 2017).

Changing demographics and consumer demands are having a significant impact on what people eat. There is a trend towards more global products and flavours. With an increase in demand for low-fat red meat alternatives by consumers, the future of the goat farming looks promising.

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THE EFFECTS OF HIGH POWER ULTRASOUND ON DAIRY FERMENTATION

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ABSTRACT

Ultrasound, which is defined as sound waves propagating at the upper frequencies of the human hearing limit, has a wide range of applications in food industry such as creaming, extraction, cutting, dissolution, fermentation, hydrolysis, microfiltration, ultrafiltration, homogenization, encapsulation, reducing the allergenicity of milk proteins and decreasing viscosity. In dairy industry high power ultrasound (HPU) which has frequencies between 20 and 100 kHz at intensities between 10 and 1000 W/cm^2 have been widely used. HPU is a promising technology in fermentation due to its properties such as improving the permeability of cell membrane, speeding up the transfer of substrates, promoting cellular growth and propagation. In the production of fermented milk products, HPU reduces incubation time increasing the acidifying activity of lactobacilli and accelerates lactose hydrolysis by allowing the release of intracellular enzyme such as □-galactosidase. The catabolism of lactose by yogurt bacteria takes place inside the cell and the transport of lactose across the cell wall membrane is mediated by □-galactosidase which hydrolyses the lactose inside the cell. The released □-galactosidase by HPU shows a higher lactose hydrolysis activity than that in the cell, and hence more lactic acid is produced. While HPU ruptures some bacteria cells, it also provides some components which can stimulate the growth of bacterial cultures thereby accelerating the milk fermentation process and enhance the growth of the remaining bacterial cells in inoculated milk during fermentation.

As the modern fermentation industry is highly competitive and innovative, the new technologies, which improve fermentation processes and increase product quality are needed. In this context, HPU can be suggested to meet both consumer and industry demands providing higher quality in dairy products and energy-saving processes, resp.

Key words: High Power Ultrasound, Fermentation, Dairy

1. INTRODUCTION

Ultrasound which is generally considered safe, non-toxic, environment friendly and energy saving is an emerging and innovative technology (Arzeni et al., 2012: 463; Huang et al., 2017: 145). It is composed of sound waves with frequency beyond the human hearing capacity. Based on frequency range, in food industry it can be classified into two groups such as low and high power ultrasound (Awad, Moharram, Shaltout, Asker, and Youssef, 2012: 410). Low power ultrasound uses intensities below 1 W/cm^2 with frequencies higher than 100 kHz where the physical effects are comparatively gentle. Therefore it is utilised for processes such as non-invasive analysis and monitoring food materials, and non-destructive separations of multi-component mixtures (Chandrapala and Leong, 2015: 143). HPU uses intensities higher than 1 W/cm^2 with frequencies below 100 kHz which induce strong cavitation effects that influence the physical, mechanical or chemical/biochemical properties of foods (Ashokkumar, 2015: 17; Mohammadi, Ghasemi-Varnamkhasti, Ebrahimi, and Abbasvali, 2014: 97). In dairy processes

HPU generally at 20 or 40 kHz is used (Mohammadi, Ghasemi-Varnamkhasti, Ebrahimi, and Abbasvali, 2014: 97).

Fermented milk is a popular milk product because of its refreshing flavor and rich nutrient content (Wang and Sakakibara, 1997: 255). However, the dairy fermentation industry requires novel techniques, which will assist food processors to meet both consumer demands for higher quality and safer products, and the industry demand for energy efficient processes. HPU (20–50 kHz) can be used in fermentation process by improving mass transfer and cell permeability leading to improved process efficiency and production rates. It can also be used to eliminate microorganisms, which might otherwise hinder the process (Ojha, Mason, O'Donnell, Kerry, and Tiwari, 2017: 410).

2. HIGH POWER ULTRASOUND

2.1. Principle of High Power Ultrasound

Ultrasound technology is based on sound waves at a frequency above the human hearing threshold. Its effects on liquid systems such as milk are due to the acoustic cavitation. Sound waves are propagated through a series of compression and rarefaction waves. When the power is high enough, cavitation bubbles form from gas nuclei existing in the fluid. As shown in Figure 1, these bubbles grow until they reach a critical size and then violently collapse (Soria and Villamiel, 2010: 324). During implosion of growing bubbles, very high temperatures (approximately 5500 K) and pressures (approximately 50 MPa) are reached inside these bubbles and several physical effects are generated, namely, shock waves, microjets, turbulence and shear forces (Ashokkumar, 2011: 864; Jambrak et al., 2011: 80).

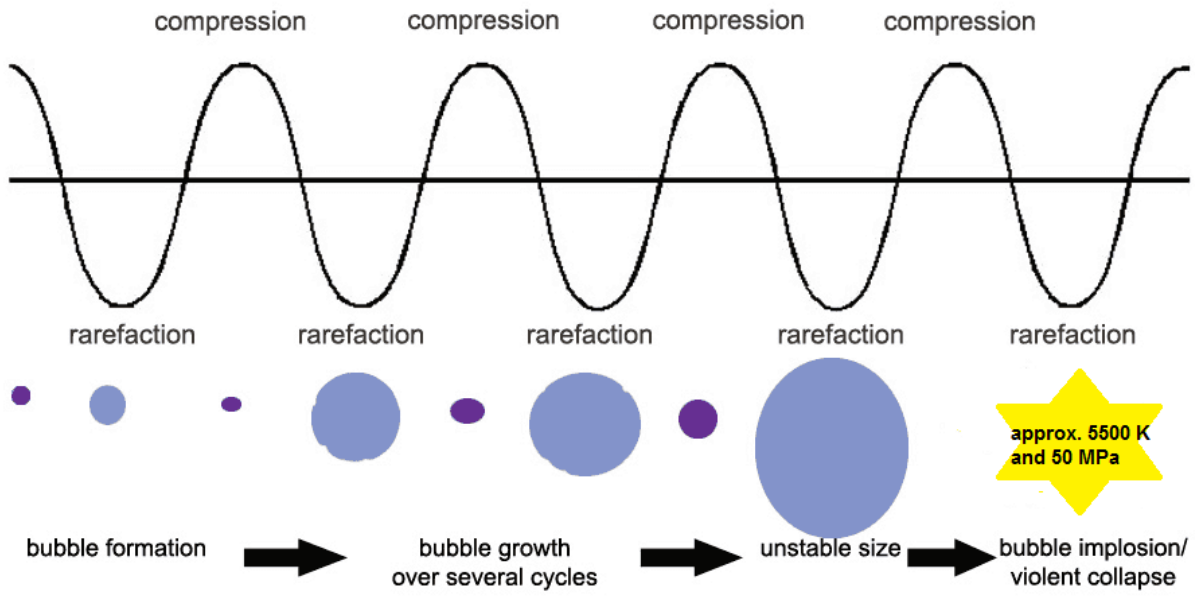

Fig. 1 Ultrasonic Cavitation

2.2. The Effects of High Power Ultrasound on Dairy Fermentation

During the early stage of fermentation, milk lactose is transported through the cell membrane of yogurt bacteria with the help of the enzyme □-galactosidase located in the membrane. The lactose is then hydrolyzed inside the cell by □-galactosidase (Sfakianakis and Tzia, 2014: 182). But lactose hydrolysis activity of □-galactosidase is higher outside the cell than inside the cell (Nguyen, Lee, and Zhou, 2012: 871).

HPU is a promising technology in dairy fermentation. In the production of fermented milk products, HPU reduces incubation time by increasing the acidifying activity of yogurt bacteria and accelerates lactose hydrolysis (Nguyen, Lee, and Zhou, 2012: 867; Ojha, Mason, O'Donnell, Kerry, and Tiwari, 2017: 410). It could improve fermentation processing by increasing membrane permeability of dairy cultures, thus intracellular enzymes such as □-galactosidase are released which provide better hydrolyzing effect outside the cell (Barukcic, Jakopovic, Herceg, Karlovic, and Bozanic, 2015: 94-101). Thus, the released □-galactosidase shows a higher lactose hydrolysis activity, and hence more lactic acid is produced (Wu, Hulbert, and Mount, 2001: 216). As a result of rupture of the probiotic bacteria cells by HPU, some components which can stimulate the growth of bacterial cultures are obtained and this accelerates the milk fermentation process and enhances the growth of the remaining bacterial cells in inoculated milk during fermentation (Nguyen, Lee, and Zhou, 2009: 410).

Table 1. Application of high power ultrasound in food fermentation

Product	**High Power Ultrasound Treatment**	**Application**	**Effects of High Power Ultrasound**	**Reference**
Reconstituted sweet whey	20 kHz, 480 W and 600 W for 6.5, 8 and 10 min combined with moderate heat (45°C, 55°C)	To improve the fermentation process and quality of reconstituted sweet whey	-Reduced fermentation time -Increased the number of viable cell count at the end of fermentation	Barukcic, Jakopovic, Herceg, Karlovic, and Bozanic, 2015: 94-101
Pasteurised whey which was inoculated with activated culture by HPU	20 kHz, 84W for 150 sec	To improve the fermentation process	-Reduced fermentation time up to 0,5 h	Barukcic, Jakopovic, Herceg, Karlovic, and Bozanic, 2015: 94-101

Probiotic fermented milk	20 kHz, 100 W for 7, 15 and 30 min	Milk fermentation	-Improved fermentative activities of bifidobacteria -Accelerated lactose hydrolysis	Nguyen, Lee, and Zhou, 2009: 410-416
Probiotic fermented milk	20 kHz, 100 W for 7, 15 and 30 min	Milk fermentation	-Accelerated lactose hydrolysis -Balanced the ratio of acetate to lactate and the ratio of total of acetate and propionate to lactate in HPU	Nguyen, Lee, and Zhou, 2012: 866-874
Yogurt	20 kHz, 90 W, 225 W, and 450 W for 1, 6, and 10 min before and after culture inoculation	Yogurt fermentation	-Reduced fermentation time up to 30 minutes -Improved water holding capacity and viscosity	Wu, Hulbert, and Mount, 2001: 211-218

As seen in Table 1, Barukcic, Jakopovic, Herceg, Karlovic, and Bozanic (2015: 94-101) indicated that pasteurised whey sample which was inoculated with ultrasonic activated culture (at 84W for 150 sec) had 0,5 h shorter fermentation time. Also authors found that thermosonication (20 kHz, 480 W at 55°C for 8 min) treatment of reconstituted whey powder had been increased the viable count of dairy starter culture at the end of fermentation time with improved organoleptic properties compared to thermally processed samples. Nguyen, Lee, and Zhou (2009: 410-416) reported that HPU at 20 kHz and 100W for 7, 15 and 30 min could stimulate probiotics such as *Bifidobacterium* spp. accelerating lactose hydrolysis and transgalactosylation of bifidobacteria in milk while reducing the fermentation time up to 30 min depending on probiotic strain. Nguyen, Lee, and Zhou (2012: 866-874) indicated that it is possible to produce the fermented milk products with low lactose, high oligosaccharides and less undesirable flavour of acetic and propionic acids by HPU besides accelerated lactose hydrolysis. Wu, Hulbert, and Mount (2001: 211-218) found similar results that HPU at 450W up to 10 min after inoculation reduced the total fermentation time by 0,5 h with faster acid development.

3. CONCLUSION

HPU can influence the fermentation process by improving cell permeability leading to improved process efficiency and production rates. It accelerates lactose hydrolysis and offers a good potential for producing fermented milk products with large amount of oligosaccharides and low lactose concentration with reduced fermentation time besides stimulating probiotic bacteria. The researchers together with the encouraging results on the fermentation process make HPU a potential alternative to the conventional fermentation processing to obtain higher quality in dairy products with lower cost.

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CLA (CONJUGATED LINOLEIC ACID) IN MILK FAT: PHYSIOLOGICAL EFFECTS

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ABSTRACT

Milk is a unique food that contains valuable macro and micronutrients and dairy products are an important source of fat in the human diet. However, fat content of foods has been associated to cardiovascular diseases depending on the especially high level of saturated fatty acid composition. On the other hand, milk fat in dairy products possess beneficial components for health such as conjugated linoleic acids (CLA). CLA, which **is** produced during ruminal biohydrogenation, refers to a group of positional and geometric isomers of linoleic acid with conjugated double bonds. The most common and health-associated active isomers are cis-9, trans-11 CLA and trans-10, cis-12 CLA. It is well established that CLA is generally found in the milk fat and tissues of ruminant animals and cows' milk fat is the richest natural common source of CLA. The cis-9, trans-11 CLA that have a high health promoting potential comprises 80–90% of total milk fat CLA.

CLA has attracted increased interest in recent decades as an important constituent of functional foods due to its biological and physiological benefits. It exerts many potential health benefits. According to the latest information, CLA is a generally safe nutritional substance for humans. Besides being a functional food component, it is promising to prevent many important diseases that are difficult and costly to treat. It has been reported that CLA has beneficial effects on human health such as preventing lifestyle-induced diseases or metabolic syndromes by exerting anti-carcinogenic, anti-obesity, anti-cardiovascular, anti-inflammation, anti-atherosclerotic, anti-hypertensive, anti-mutagenic, anti-diabetic, immune-enhancing, growth promoting and bone formation-promoting properties. Since CLA is not synthesized in significant amounts in the human body, a diet rich in CLA such as milk and dairy products will exhibit beneficial effects in humans.

Keywords: Conjugated linoleic acid, physiological effects, health

1. INTRODUCTION

Conjugated linoleic acid (CLA) refers to a group of positional and geometric isomers of linoleic acid (C18:2, c9, c12) and involves a double bond at positions 8 and 10, 9 and 11, and 10 and 12 or 11 and 13. Each of these positional conjugated diene isomers can occur in cis-trans, trans-cis, cis-cis or trans-trans geometrical configurations (Aydın, 2005: 189; Yang et al., 2017: 26). The cis-9, trans-11 CLA and trans-10, cis-12 CLA are the most important bioactive isomers, which exert physiological properties because they can be incorporated into the phospholipid fraction of tissues (Wang, Lv, Chu, Cui, and Ren, 2007: 313).

Food products originating from ruminants, especially beef and dairy products are the major sources of CLA in the human diet (Wang, Lv, Chu, Cui, and Ren, 2007: 313). The concentration of CLA in cows milk is variable and ranges from 2.4 to 21.8 mg of CLA/g of fat and cis-9, trans-11 CLA comprises 80–90% of total milk fat CLA (Aydın, 2005: 189; Kurban and Mehmetoglu, 2006: 90). This high variability of CLA content in milk also dairy products is mostly attributable to environmental factors such as geographical origin, season and the diet of

the cows. In addition, the processing conditions of milk, such as different fermentation cultures, heat treatments and ripening periods might affect the CLA composition of the final dairy product; yoghurt and cheese. Therefore, the CLA composition of commercial dairy products may present differences between regions and between types and brands of dairy products (Nunes and Torres, 2010: 782).

It has been well established that CLA has a number of biological functions and beneficial effects in chronic diseases (Yang et al., 2017: 26) including anticarcinogenesis (Aydın, 2005: Koba and Yanagita, 2014: 525-532), antiobesity (Inanc, 2006: 137-141; Kennedy et al., 2010: 171-179), anti-inflammation (Yang et al., 2015: 317), antiatherosclerosis (Bhattacharya, Banu, Rahman, Causey, and Fernandes, 2006: 793; Yang et al., 2015: 318), antidiabetic (Wahle, Heys, and Rotondo, 2004: 561-563) and bone formation-promoting properties (Yang et al., 2017: 26).

2. STRUCTURE AND ORIGINS OF CLA

There is a growing consensus pointing to milk fat as a source of natural bioactive components including conjugated linoleic acid (CLA) with beneficial effects on human health (Gomez-Cortes, Juarez, and Fuente, 2018: in press). CLA is accumulated in the fat of milk and tissues of ruminant animals. Milk fat is considered as the richest dietary source of CLA. The CLA isomers present in milk fat have a high health amelioration potential and there is an increased interest in CLA in human diet due to its significant physiological benefits (Sieber, Collomb, Aeschlimann, Jelen, and Eyer, 2004: 1)

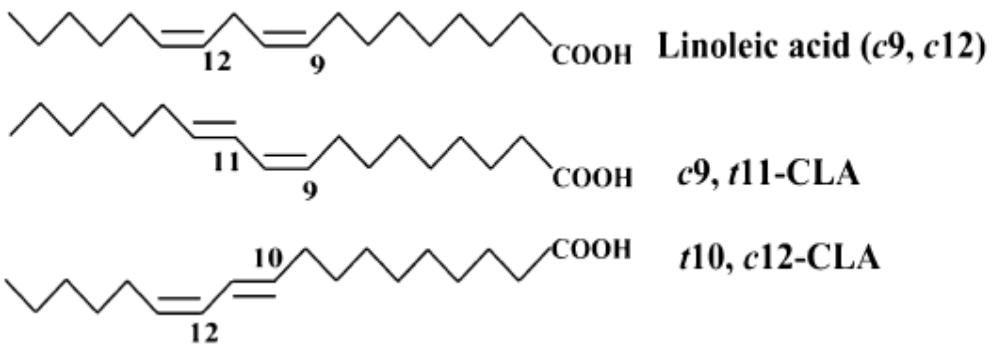

Figure 1 – Structure of linoleic acid, cis-9, trans-11 CLA and trans-10, cis12 CLA (Yang et al., 2015: 315).

Health benefits of CLA are mainly due to two of its isomers (Bhattacharya, Banu, Rahman, Causey, and Fernandes, 2006: 789): cis-9, trans-11 and trans-10, cis-12 (Fig.1). CLA isomers present in the milk are formed as an intermediate compound in the biohydrogenation of the linoleic acid to stearic acid by the metabolism of bacteria in the rumen and also through conversion of vaccenic acid in the mammary gland. In additional, more than 250 bacterial strains from 14 genera such as *Enterococcus, Pediococcus, Propionibacterium, Lactobacillus* and *Bifidobacterium* are able to form CLA from linoleic acid and thus could be used to increase the CLA level in fermented dairy products such as yoghurt and cheese (Santo et al., 2012: 136; Serafeimidou, Zlatanos, Laskaridis, and Sagredos, 2012: 1839).

3. PHYSIOLOGICAL EFFECTS OF CLA

3.1. Anticarcinogenic Effect of CLA

The role of CLA in cancer prevention has been well established and it is an efficient inhibitor of all stages of carcinogenesis; initiation, promotion and metastasis, as well as neovascularization or angiogenesis (Yang et al., 2015: 315).

In the 1990s, anticarcinogenic activity of CLA has been examined in animal models for stomach neoplasia, mammary tumors, and skin papilloma. It was found that CLA inhibits the initiation and incidence of mammary tumors in rodents (Aydın, 2005: 189-195; Koba and Yanagita, 2014: 527). Numerous studies, both *in vitro* and *in vivo*, have indicated anticancer activity of CLA (Yang et al., 2015:). It has also been found that CLA inhibits the growth of various human cancer cell lines and reduces the size and metastasis of transplanted human breast cancer cells, prostate cancer cells, and colon cancer cells (Aydın, 2005: 191; Koba and Yanagita, 2014: 527).

The mechanism which CLA exerts anticarcinogenesis could be due to an activation of peroxisome proliferator-activated receptors (PPARs). It was known that CLA was as an activator of PPAR□ and PPAR □. It was also found that ligand activation of PPAR□ induced apoptosis and inhibited proliferation of prostate, breast, colon, and gastric cancer cells in *in vitro* and *in vivo* studies. In addition, it was indicated that CLA decreased cellular proliferation and inhibited nuclear factor kappa-light-chain-enhancer of activated B cells (NF-□B) and adipocyte lipid binding protein activation in cancerous prostate epithelial cells (Koba and Yanagita, 2014: 527-528).

3.2. Antiobesity Effect of CLA

There is an increased interest in CLA as a weight loss treatment due to the substantial rise in the prevalence of obesity over the last decades (Kennedy et al., 2010: 171). Antiobesity mechanisms of CLA are concerned with the regulation of energy metabolism, adipogenesis and lipid metabolism. It decreases energy intake and increases energy expenditure. Energy expenditure is a function of basal metabolic rate, adaptive thermogenesis, and physical activity. It has been proposed that CLA reduces adiposity by elevating energy expenditure via increased basal metabolic rate, thermogenesis or lipid oxidation (Kennedy et al., 2010: 172).

Trans-10, cis-12 CLA is more efficiently oxidized than cis-9, trans-11 CLA because its double bonds are more exposed and thus, it is related to catabolic processes such as fat oxidation or lipolyis (Gomez-Cortes, Juarez, and Fuente, 2018: in press). The researches show that trans-10, cis-12 CLA supplementation reduces body fat in both animals and humans. It inhibits the enzymes such as fatty acid synthetase and stearoyl-CoA desaturase, which play a role in fatty acid synthesis and metabolism (Yang et al., 2015: 316). It enhances fatty acid oxidation, lipolysis in order to impair adipocyte triglyceride storage and down-regulate PPAR, and some PPAR target genes, such as Acyl-CoA-binding protein, adipocyte lipid binding protein, and heparin-releasable (Pariza, 2004: 1133; Yang et al., 2015: 317).

3.3. Anti-inflammation Effects of CLA

It is well known that alterations in the levels of fatty acids have an impact on immune function and both physiological and patho-physiological states (Wahle, Heys, and Rotondo, 2004: 563). CLA has been reported to exhibit anti-inflammatory properties both *in vivo* and in cell cultures through inhibition of cyclooxygenase-2, leading to a decrease in the release of prostaglandin E2 and downstream pro-inflammatory cytokine production (Yang et al., 2015: 317).

3.4. Antiatherosclerosis Effects of CLA on

The researches indicate that CLA reduce atherosclerotic lesions, plasma lipoproteins and local inflammatory status in rabbits, mice and hamsters (Aydın, 2005: 192; Yang et al., 2015: 318). It also improves plasma lipid profiles in obese, diabetic and normolipidemic subjects, with reductions obtained in *triglycerides* and low density lipoprotein cholesterol, total cholesterol, and very low density lipoprotein cholesterol in human (Bhattacharya, Banu, Rahman, Causey, and Fernandes, 2006: 793).

The mechanism involved in the antiatherosclerotic effects of CLA is related to its role on PPARs, sterol regulatory element-binding proteins and stearoyl-CoA desaturase that enhance the transcription of genes required for fatty acid synthesis. PPAR activators inhibit foam cell formation in vivo, and inhibit the development of atherosclerosis in the LDL receptor deficient mouse as well as platelet aggregation and thrombus formation in rabbits (Bhattacharya, Banu, Rahman, Causey, and Fernandes, 2006: 793; Yang et al., 2015: 318).

3.5. Antidiabetic Effects of CLA

The incidence of diabetes and impaired glucose tolerance are increasing worldwide and the potential cost to the health services of treating this disease and its accompanying diseases such as coronary heart disease, retinopathies and gangrene is enormous (Wahle, Heys, and Rotondo, 2004: 562). The researches show that CLA restores insulin sensitivity, decreases serum glucose and insulin levels in diabetic fatty rats, normalizes glucose tolerance, increases plasma adiponectin levels in Zucker diabetic fatty rats and improves insulin sensitivity in young sedentary humans (Koba and Yanagita, 2014: 530; Yang et al., 2015: 318).

Recent studies indicate that adipose tissue produces hormones like leptin, which regulates food intake in diabetic Zucker rats, non-diabetic mice and in humans with type-2 diabetes through hypothalamic signaling pathways. It is observed that CLA reduces adipocyte-secreted leptin levels in plasma, thus it could regulate one of the most important hormonal mechanisms in diabetes prevention/control (Wahle, Heys, and Rotondo, 2004: 562-563). In addition, the antidiabetic effect of CLA could be due to the PPAR□ activation. Activation of PPAR□ could increase plasma adiponectin concentration, and ameliorate hyperinsulinemia (Koba and Yanagita, 2014: 530).

4. CONCLUSION

Cancer, obesity, atherosclerosis and diabetes are serious health problems, which may be associated with dietary and lifestyle choices worldwide. Over the last few decades, CLA has attracted great interest because of its health-associated activities. Based on the information described above, CLA can be useful to improve human metabolic syndromes by exerting anticarcinogenic, antiobesity, anti-inflammation, antiatherosclerosis and antidiabetic effects.

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RECENT DEVELOPMENTS IN CORN PRODUCTION AND MARKETING OF TURKEY AND THE WORLD

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ABSTRACT

Corn is an important product in worldwide after wheat, rice and barley. The main three corn-producing countries are United States, China, and Brazil being in the world, their producing approximately 563 of the 717 million tons/year. In Turkey, 5.9 million tons corn produced in 2017/2018 season. Nowadays, corn with low production costs, along with the high consumption can be processed into a variety of food and industrial products, including starch, oil, beverages, sweeteners, glue, industrial alcohol, and biofuels as ethanol. The aim of study is determination of recent developments in corn production and marketing in Turkey and the world between 2008/2009 and 2017/2018 seasons. Study have been focused on the major factors that affect supply and demand, development of corn production, market prices and economic efficiency of corn. Statistical data have been obtained from International Grain Council, FAOSTAT, USDA, Turkish Grain Board, Turkish Ministry of Agriculture and Forestry and Turkish Statistical Institute. Data obtained have been shown in the tables issued by the use of percentage and index calculations.

Key words: corn, corn farming, corn price, corn trade, economic analysis.

1. INTRODUCTION

Corn (Zea Mays) originates in the Andean region of Central America. It is one of the most important cereals both for human and animal consumption and is grown for grain and forage. In terms of global production, corn is the third most important food crop after rice and wheat. Demand for corn is growing as both a fresh and processed food. Corn is now moving into the biodiesel market with many ethanol plants now extracting the oil from corn for use in diesel fuel.

Corn that has a fairly important role in the market for agricultural products both with its production and trade is an important food source because of the valuable nutrients it includes. It is stated that, in the world, 11% of the daily calories consumed in human diet is provided from corn and this rate even increases up to 27% in the developed countries (Anonymous, 2018). In Turkey, corn is the grain that is grown the most after wheat and barley among other grains. Corn that has an important role both in human nutrition and animal nutrition is produced in almost every region of Turkey.

Many studies on the economic aspects of corn farming in different countries of the world have been performed (Kim and Chavas, 2003; Lu et al., 2005; Monlruzzaman et al., 2009; Paudel and Matsuaka, 2009; Rey et al., 2011; Sani et al., 2013; Poramacom, 2013; Afidchau et al. 2014; Zalkuwi, 2014; Sanusi, 2014; Devadoss et al., 2016). Further, some studies on economic aspects of corn farming in Turkey have been done (Boz and Akbay, 2005; Budak et al., 2005; Dönmez, 2010; Dbeys Durğan et al., 2012; Haspolat Kaya, 2012; Orhun and Orhun, 2013, Çıkman et al.,

2014; Alemdar et al., 2014; Karasu et al., 2015; Çarkacı et al., 2016; Gül Yavuz et al., 2016, Taşdan, 2017; Bayramoğlu and Bozdemir, 2018). However, the studies on the technical and economic aspects of the corn farming should be carried out continuously.

The purpose of this study is determination of recent developments in corn production and marketing in Turkey and the world between 2008/2009 and 2017/2018 seasons. Study have been focused on the major factors that affect supply and demand, development of corn production, market prices and economic efficiency of corn. Statistical data have been obtained from International Grain Council (IGC), FAOSTAT, USDA, Turkish Grain Board, Turkish Ministry of Agriculture and Forestry (TMAF) and Turkish Statistical Institute (TurkStat). Data obtained have been shown in the tables issued by the use of percentage and index calculations.

2. CORN PRODUCTION IN THE WORLD

According to data of IGC, the world corn production, which was 1026.9 million tons in 2014/2015 season, reached to the level of 983.3 million tons in the season 2015/16 with decrease of 43.6 million tons. Estimating that the production increased to 1,087.2 million tons with increase of 103.9 million tons in 2016/17 season; IGC points an increase at a record level in its 2017/18 estimate. IGC projects that world corn production will reach 1,052.4 million tons in 2018/19 season (IGC, 2018).

FAO data is different than the data of IGC. According to data of FAO, the world corn production was 1,060.1 million tons in 2016/2017 season. Corn production area and corn production of the world increased 15.2% and 27.8% between 2008/2009 and 2016/2017 seasons, respectively (Table 1).

Table 1. Corn Production in the World

Years	Production Area (1000 ha)	Indeks (2008=100)	Production Quantity (1000 tons)	Indeks (2008=100)	Yield (kg/ha)	Indeks (2008=100)
2008/2009	163,145	100.0	829,238	100.0	5,082	100.0
2009/2010	158,821	97.3	820,070	98.9	5,163	101.6
2010/2011	164,028	100.5	851,349	102.7	5,190	102.1
2011/2012	171,207	104.9	886,007	106.8	5,175	101.8
2012/2013	178,808	109.6	874,240	105.4	4,889	96.2
2013/2014	185,934	113.9	1,015,400	122.4	5,461	107.4
2014/2015	184,662	113.2	1,038,331	125.2	5,623	110.6

2015/2016	182,490	111.9	1,010,609	121.9	5,538	109.0
2016/2017	187,959	115.2	1,060,107	127.8	5,640	111.0

Source: FAOSTAT, 2018.

A great part of world corn need is met by the American continent. As world's largest corn producer, USA by itself realized 36.3% (384.8 million tons) of world corn production as 1,061.1 million tons in 2016/2017 seson. This makes USA as the most powerful country in world corn markets. Again in the American continent; Brazil with 64.1 million tons, Argentina with 39.8 million tons and Mexico with 28.2 million tons of corn production are among the largest countries that direct the world corn markets. Countries like Brazil and Argentina in the southern hemisphere are in advantageous position due to the season differences. These countries can provide supply to the northern hemisphere that realizes the most of the consumption in the period when the production stops but the need continues. Among the other countries that produce highest amount of corn, China comes first with a production of 231.8 million tons in 2016/2017 season. China is followed by European Union with 62.7 million tons, Ukraine with 28.1 million tons and India with 26.3 million tons. On country basis; USA and China, realizes 58.2% of the world corn production (IGC, 2018).

3. CORN CONSUMPTION IN THE WORLD

According to data of IGC, world corn consumption, which was 975.1 million tons in the season 2015/2016, reached 1044.6 million tons with a record increase of 69.5 million tons in the season 2016/2017. Estimating that world corn consumption increased to 1077.2 million tons in the season 2017/18, IGC makes a consumption estimation of 1,096.4 million tons for the season 2018/19 (IGC, 2018).

Even though the area of use is really wide, approximately 60% of the world corn production is consumed by the feed industry. The increase in the demand for animal products especially in Asia and underdeveloped countries is predicted to affect the increase in corn demand for feed production. Corn consumption for industrial reasons including bioethanol that shines out among petroleum alternative products is gradually increasing. Especially among the developed countries, the countries, which want to increase the share of renewable energy in meeting energy needs, to support alternative fuels such as ethanol with practices as tax advantages is an indication that this increase will also continue in the future (Anonymous, 2018).

USA, which has the largest share in the world corn production, is also the largest consumer. The corn consumption of USA, which was 298.8 million tons in 2015/16 season. As in production, China follows USA also in consumption as the second largest consumer. According to the data of IGC; China that consumed 209.7 million tons of corn in 2015/16 season. China is followed by EU countries with 70.9 million tons, Brazil with 57 million tons, Mexico with 37.8 million tons and India with 23.3 million tons (IGC, 2018).

4. CORN TRADE IN THE WORLD

World corn trade volume reached its highest value in the season 2015/16 with 136.3 million tons (IGC, 2018). In this marketing year, it is seen that the fluctuations of the countries' production levels due to drought and the increases in the alternative areas of use such as biofuels

encouraged import. Moreover, the feed corn demand that increased in line with the increase in the animal product consumption supported this increase (Anonymous, 2018).

USA is on the top in world corn trade just like in the production. Country's corn export amount represents almost one third of the world corn trade although it seems very low compared to the total production amounts. Exporting 35-40 million tons corn every year, ranking third after USA (48.3 million tons) and Argentina (21.6 million tons), Ukraine was on top in the world corn export in 2015/2016 season with 16.7 million ton export. At the same period; Brazil (14 million tons) followed Ukraine (IGC, 2018).

The greatest share in the global corn import belongs to Japan with 14.3%. Japan that imported 15.9 million tons of the total global corn import which was 136.3 million tons in the season 2015/2016. Mexico (14.1 million tons) followed Japan in same season. In import, EU countries that are also some of the most important producers follow Japan and Mexico. While EU countries imported 13.7 million tons of corn. South Korea with 10.4 million tons and Egypt with 8.8 million tons follow EU countries in the world corn import (IGC, 2018).

5. CORN PRODUCTION IN TURKEY

75% of the corn production in Turkey is realized as the primary product and 25% is realized as the secondary product. Practices encouraging corn production, the development of high-yielding varieties, efficient use of water and fertilizers, mechanization and being easily marketed are the factors in the increase of corn cultivation fields and production. Corn farming is realized mainly in Mediterranean, the Southeastern Anatolia, Inner Anatolia and Aegean regions. 33% of the corn production of Turkey is realized in Mediterranean region, 24% of it in the Southeastern Anatolia region, 18% of it in Inner Anatolia region and 11% of it is realized in Aegean region in 2017/2018 (TurkStat, 2018). First crop corn planting is common in the Cukurova, Aegean, and Marmara regions. Second crop corn is a common product in Southeast Anatolia, especially in Sanliurfa and Mardin regions. Cukurova farmers also grow corn as a second crop. 68% of the corn cultivation consists of grain corn fields and 32% of silage corn fields.

According to the agricultural data of TurkStat; Turkey, which produced 4.3 million tons of corn in 2008/2009 season, reached 5.9 million tons production amount in 2017/2018 season. The most important reason behind this increase can be shown as the increase in the productivity. While Turkey produced 4.3 million tons on a land of 595,000 hectares in 2008/2009 season, it produced 5.9 million tons on a land of 639,084 hectares in 2017/2018 season. The yield per hectare that was 7,183 kg reached to 9,232 kg in 2017/2018 season (Table 2).

Table 2. Corn Production in Turkey

Years	Production Area (ha)	Indeks (2008=100)	Production Quantity (1000 tons)	Indeks (2008=100)	Yield (kg/ha)	Indeks (2008=100)
2008/2009	595,000	100.0	4,274	100.0	7,183	100.0
2009/2010	592,000	99.5	4,250	99.4	7,179	99.9

2010/2011	594,000	99.8	4,310	100.8	7,256	101.0
2011/2012	589,000	99.0	4,200	98.3	7,131	99.3
2012/2013	622,609	104.6	4,600	107.6	7,388	102.8
2013/2014	659,998	110.9	5,900	138.0	8,939	124.4
2014/2015	658,645	110.7	5,950	139.2	9,034	125.8
2015/2016	688,170	115.7	6,400	149.7	9,300	129.5
2016/2017	680,019	114.3	6,400	149.7	9,411	131.0
2017/2018	639,084	107.4	5,900	138.0	9,232	128.5

Source: TurkStat, 2018.

With these yield rates, Turkey is above the world average. The primary reasons of increase in corn production are widespread use of hybrid seeds and development of production technics. Development of corn yield according to countries was presented in Table 3. USA is on the top in corn yield. Canada and Turkey follow USA in corn yield.

There are four component that affected directly on corn production within the policies in Turkey. These are; purchases of Turkish Grain Board, the deficiency payments, input subsidies and foreign trade applications (Bayramoglu et al., 2016). Turkey have started to implement a new subsidy program for agricultural products in 2017, called the National Agriculture Project. The Project aims to diversify Turkey's agricultural production, increase productivity and reduce the planted area of water-intensive crops such as rice and corn in drought-prone areas. Within the new scheme, Turkey is divided into 941 agricultural basins based on climate and soil categories to subsidize specific crops for each zone. In total, 19 strategic crops, including wheat, barley, corn, rye, oats, triticale, paddy rice and forage crops are subsidized (USDA, 2018).

In Turkey, deficiency payment, diesel support, chemical fertilizer support and forage crop support were 14.71 $/ton, 17.83 $/ha, 24.26 $/ha and 275.73 $/ha in 2015/2016, respectively. In 2017/2018, deficiency payment, diesel support and chemical fertilizer support were 8.22 $/ton, 46.57 $/ha, 10.96 $/ha (TMAF, 2018).

Table 3. Corn Yield in Some Countries (ton/ha)

Years	USA	Canada	Turkey	EU	Argentina	China	Romania	Ukraine	Brazil	World

2008/2009	9.6	9.1	7.2	7.2	6.6	5.6	3.2	5.0	3.6	5.1
2009/2010	10.3	8.4	7.2	6.9	7.8	5.3	3.4	5.0	4.3	5.2
2010/2011	9.6	9.8	7.3	7.0	6.4	5.5	4.1	4.5	4.2	5.1
2011/2012	9.2	8.9	7.1	7.3	5.7	5.8	4.0	6.5	4.8	5.1
2012/2013	7.7	9.2	7.4	6.0	6.6	5.9	2.2	4.8	5.2	4.9
2013/2014	9.9	9.6	8.9	6.5	6.8	6.0	3.9	6.4	5.1	5.4
2014/2015	10.7	9.4	9.0	7.9	7.3	5.8	4.5	6.2	5,4	5.6
2015/2016	10.6	10.3	9.3	6.4	7.4	5.9	3.4	5.7	4.2	5.4
2016/2017	11.0	10.0	9.4	7.4	7.5	6.0	4.1	6.6	5.6	5.8
2017/2018*	11.1	10.0	9.1	7.8	6.4	6.1	5.9	5.4	5.3	5.7

*Forecast

Source: IGC, 2018.

The one of the policies that directly affected to the corn production is the foreign trade. One of the reasons that are high domestic price of corn in Turkey than the world market is custom duties applied for protecting domestic production. Custom duties are one of the biggest factors affecting external trade policies (Bayramoglu et al., 2016).

6. CORN CONSUMPTION IN TURKEY

There are two main users of corn in Turkey: the feed industry and the corn starch industry. Corn consumption moves in line with developments in the domestic feed sector. Despite the recent problems, the Turkish poultry sector has tripled in the past ten years. Corn

consumption was 7.07 million tons in 2016/2017, due to increasing demand from feed sector (TurkStat, 2018). The demand was possibly affected by the availability of cheap feed wheat after a record harvest, availability of other corn products, and slowdown of poultry products export.

The usage area of corn in Turkey is very large. 75% of corn seed produced in Turkey is used as animal feed. 22% of corn is used in public consumption. Annually corn consumption per capita is 20 kilograms in Turkey (TurkStat, 2018).

7. CORN MARKETING IN TURKEY

Mission of Turkish Grain Board are taking protective measures for producers and consumers by regulating agricultural product markets, especially grain market, within its field of business. Corn purchase quantity and prices of Turkish Grain Board were presented in Table 4. Turkish Grain Board purchased 27.4% of total corn production in 2015/2016 and 2016/2017 seasons. Purchasing price of Turkish Grain Board was 245 $/ton and 252 $/ton for domestic market in 2015/2016 and 2016/2017 seasons, respectively. Purchasing prices of Turkish Grain Board is above the world corn prices.

According to data of FAO, farmer corn prices according to countries were presented in Table 5. Highest corn prices are in China. Turkey is above other producer countries.

In Turkey, the corn production couldn't meet the consumption for years and the need was met through import. Corn is the most exported and imported grain products after wheat. Corn imports show ups and downs over the years. According to TurkStat's data, Turkey imported 2.05 million tons of corn in 2017/2018 (Table 6). Record domestic corn harvest, governmental restrictions on imports, TMO's sales, abundant feed wheat and a decrease in poultry product exports were the main reasons for import shrinkage. Russia, Romania and Bosnia are the largest corn suppliers for Turkey.

Table 4. Corn Purchase Quantity and Prices of Turkish Grain Board

Years	Corn production (1000 tons)	Purchase quantity (1000 tons)	Purchase quantity/ production rate (%)	Purchase price ($/ton)	ABD 3YC (FOB/$/ton)
2008/2009	4274	832	19.5	361	228
2009/2010	4250	183	4.3	302	173
2010/2011	4310	83	1.9	327	197
2011/2012	4200	48	1.1	300	295
2012/2013	4600	126	2.7	330	303

2013/2014	5900	1373	23.3	331	221
2014/2015	5950	173	2.9	333	196
2015/2016	6400	1753	27.4	245	166
2016/2017	6400	1757	27.4	252	162
2017/2018	5900	205	3.5	217	156

Source: Turkish Grain Board, 2018.

Table 5. Average Farmer Corn Prices in Some Countries ($/ton)

Countries	2008/ 2009	2009/ 2010	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017
USA	160.0	140.0	204.0	245.0	271.0	176.0	146.0	142.0	134.0
China	218.3	243.0	-	321.8	383.5	489.1	441.9	432.4	264.3
Brazil	215.8	158.4	170.0	256.1	226.6	202.1	185.9	138.1	183.7
Argentina	140,6	113,5	135.1	176.3	203.1	180.3	143.2	-	-
Mexico	253.1	207.4	222.9	328.2	304.5	263.5	234.4	216.0	189.2
Ukraine	137.3	109.0	157.0	171.4	189.6	151.4	146.8	136.9	138.2
Turkey	333.5	285.2	310.7	375.3	322.3	321.4	284.5	241.7	219.7

Source: FAOSTAT, 2018.

Table 6. Corn Import and Export of Turkey

Years	Import			Export		
	Quantity	Value	Average	Quantity	Value	Average

	(ton)	(1000 $)	Price ($/ton)	(ton)	(1000 $)	price ($/ton)
2008/2009	1,151,407	381,938	332	15,056	24,948	1,657
2009/2010	485,131	135,136	279	325,434	81,323	250
2010/2011	452,362	124,157	274	10,649	26,006	2,442
2011/2012	381,293	136,119	357	13,945	27,923	2,002
2012/2013	807,480	245,919	305	20,359	33,820	1,661
2013/2014	1,548,133	473,138	306	210,927	88,124	418
2014/2015	1,423,595	350,247	246	64,618	63,290	979
2015/2016	1,487,005	343,046	231	75,185	51,033	679
2016/2017	534,791	128,639	241	44,136	49,044	1,111
2017/2018	2,055,543	428,738	209	117,976	53,226	451

Source: TurkStat, 2018.

Export activities are significantly limited in comparison to import activities. The corn exports of Turkey that was 15,056 tons in 2008/2009. Export activities that show a floating level by years remained at 117.976 tons in 2017/2018 (Table 6). Turkey export corn seed to USA, Iraq and EU countries.

8. CONCLUSION

Corn production of Turkey has increased significantly in recent years. There are two basic reasons in this production increase in Turkey. Firstly, hybrid seed started to use in the 1980s has provided yield increase. The second is new production techniques and policy changes applied depend on production and demand increases. Turkey has become self-sufficient in corn production since 2012 because of supporting activities, production techniques and becoming widespread of corn production in Turkey by years.

There are two reasons of the high price in the domestic market. First of all is customs policy applied for providing revenue to national treasury and it is determined according to demand elasticity. Secondly, it is intended to protect the domestic production from foreign competition. Further, this situation has arisen from high input costs. The policies for input costs,

cheap input with domestic-sourced, the price policies and credit opportunities for farmers will enhance the attractivess of production and decrease their costs (Bayramoğlu et al., 2016).

As a conclusion, corn has a great important in terms of consumption directly and creating raw materials for industry in Turkey. A production planning carried out in suitable climatic conditions with most productive varieties should be made by analyzing corn varieties and application areas. Water use efficiency in corn production could be increased by better water management using with new irrigation and agronomic techniques. Prices should be determined suitability with the level of international corn market price and accordingly it should be supported to farmers for production via necessary channel. The analysis of domestic market demand and features of enterprises are necessary, despite the fact that is seen to apply the support policies for enterprises. The balance of supply and demand, natural climatic conditions and martket conditions should be taken in consideration, when custom duties have been determined.

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MEMBER PARTICIPATION IN COOPERATIVE MANAGEMENT OF AGRICULTURAL CREDIT COOPERATIVES; A CASE OF IZMIR PROVINCE

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ABSTRACT

This study investigates the members' contribution to the cooperative especially on the base of management issues. The purpose of this study is to evaluate member behavior in cooperative management and determine their participation level in related matters. Particularly, members' efficient level to the general assembly and board meetings and in the decision mechanism of the cooperative was examined. In this respect, survey was conducted in Izmir province with 84 members of agricultural credit cooperatives. A five-point Likert-scale and binary logistic regression analysis were used to analyze member behavior regarding participating in cooperative management. Results show that involvement ratio to cooperative management and knowing correct of the gathering frequency of general assembly is quite low. Besides, member participation in cooperative management is affected positively as the member having more total land assets.

Key words: Member, cooperative management, participation, agricultural credit cooperative

INTRODUCTION

Agricultural credit cooperatives aim mainly to meet the agricultural input needs of the members and contribute to the agricultural production of the farmers by providing some credit resources that they can use optimally. Generally, the small scale farmers do not have the opportunity to save and invest to prepare for the next production period. In this context agricultural credit cooperatives are in the field of to solve this problem.

Participating is important in validating or developing farmer understanding and appreciation of cooperative organization (Gray and Kraenze, 1998). Members may participate in cooperatives in a variety of ways. Member participation in the governance aspects of the organization gives cooperatives their distinctive character (Didier et al, 2012). The attitude and opinions of the members can influence their conduct and willingness to participate. These can also affect the enthusiasm and commitment of members (Xiang and Sumelius, 2010). If members are permitted to participate in the cooperatives' governance system, they may be more committed to the cooperatives and have more trust in the board of directors. This relationship can even be expected to be relatively strong (Osterberg and Nilson, 2009). Management of farmer-owned cooperatives cannot be successful without the participation of the members. If the managers of a cooperative are ignorant of the members' opinion, the whole organization could collapse (Xiang and Sumelius, 2010).

This study analyzes some aspects of member participation to the cooperative management. This research describes some characteristics of members, including their

participation behavior and identifies member characteristics related to differences in observed participation behaviors.

MATERIALS AND METHOD

In this study, survey with 84 members from five agricultural credit cooperatives was conducted in Izmir province. A five-point Likert-scale was used to measure member behavior regarding participation to management of the cooperative. Logistic regression is used in order to determine several independent variables significantly predict the dependent variable. In this study binary logistic regression is used to find out the factors effecting members' participation to cooperative management. Regarding the regression analysis, the Nagelkerke R Square and -2 Log likelihood ratios are provided to measure if the data fits the regression test. As long as the value is closer to 1 for the Nagelkerke R Square, it makes the test more valid. The -2 log likelihood is a measure of how well the model explains variations (Botonaki et al., 2006).

This study is a part of research project on "Structuring and Shareholder/Member Relationship of Agricultural Producers Organizations' in Izmir Province" conducted in 2015 for General Directorate of Agricultural Research and Politics of Ministry of Agriculture and Forestry.

RESULTS

Characteristics of the members' profiles

According to obtained results, some characteristics as averages are bellowed; age of the members is 52, farming experience is 34 years, membership duration is 17 years and distance between the cooperative and the member's house is 4,93 km. Members' annual income is 59700 TL, total land asset is 7 ha and the household size is 4,3 persons (Table 1).

Table 1. Demographic characteristics of the members

	Average	Min	Max
Age	52	28	75
Farming experience (year)	34	8	60
Membership duration (year)	17	1	40
Distance between the cooperative and farmer (km)	4,93	0,1	22
Total annual income (TRY/year)*	59700	5000	400000
Total land assets (ha)	7	0,5	44
Household size (person)	4,3	2	9

*The average exchange rates between Turkish Lira (TRY) and the USD ($) for September 2015 is 1 USD = 3.04682 TRY.

Table 2 shows the education level of the members, in this respect, 72,6% of the members are primary school educated.

Table 2. Education level of the members

	Frequency	Percent (%)
Primary school	61	72,6
Middle School	12	14,3
High school	10	11,9
University	1	1,2
Total	84	100

Member participation in management process

Members were asked whether they participate in managerial bodies of the cooperative and to management of the village. According to their responds, 29,8% of the members participate in village management, on the other hand only 8,3% of the members participate in the managing bodies of agricultural credit cooperatives (Table 3).

Table 3. Participating in management of village and cooperative bodies

	No		Yes	
	f	%	f	%
Have you been participated in village management?	59	70,2	25	29,8
Have you been participated in the managing bodies of the cooperative?	77	91,7	7	8,3

Members were also asked whether they know the gathering frequency of general assembly of the cooperative. Regarding the members' responds, 47,6% of the members declared that they do not know, 32,1% of them replied as "once a year" and 9,5% of them replied as "once every 4 years". In Turkey, normally agricultural credit cooperatives must gather their general assembly once every 4 years based on the legislation. Thus, only 9,5% of the cooperative members know right the gathering frequency of general assembly of their cooperative (Table 4).

Table 4. How often does the cooperative general assembly gather?

	Frequency	Percent (%)
Don't know	40	47,6
Once every 4 years	**8**	**9,5**
Once every 3 years	4	4,8
Once a year	27	32,1
Twice a year	5	6
Total	84	100

Member behavior regarding participation in cooperative management was measured using a five-point Likert-scale for five statements as shown in Table 5. According to the responses, 20,2% of the members absolutely agree about the notions of "I participate in cooperative meetings" and "As a member I believe that I influence board of directors when making decisions", while 38,1% of them absolutely disagree. The notion of "I develop ideas for cooperative and make recommendations" is responded as absolutely disagree by 42,9% of the

members. On the other hand, notion of "I am interested in decisions at the general assembly and board of directors meetings" is responded as absolutely disagree by 58,3% of the members. Expression with the lowest ratio evaluated by the member is about financial structure and with the highest ratio is about participation in cooperative meetings. Besides, the general average of these statements is measured as 2,36.

Table 5. Member behavior regarding participation in cooperative management

x	1		2		3		4		5		Average
	f	%	f	%	f	%	f	%	f	%	
I participate in cooperative meetings	32	38,1	12	14,3	7	8,3	16	19,0	17	20,2	2,69
As a member I believe that I influence board of directors when making decisions	32	38,1	15	17,9	10	11,9	10	11,9	17	20,2	2,58
I develop ideas for cooperative and make recommendations	36	42,9	14	16,7	4	4,8	18	21,4	12	14,3	2,48
I am interested in decisions at the general assembly and board of directors meetings	49	58,3	6	7,1	2	2,4	13	15,5	14	16,7	2,25
I am interested in the financial structure of the cooperative	63	75,0	4	4,8	0	0	6	7,1	11	13,1	1,79
										Average	2,36

x refers to the score of 5-point Likert scale (1 = "Absolutely disagree" and 5 = "Absolutely agree"), f refers to frequency.

Estimation model for member participation in cooperative management process

Independent variables were run in binary logistic regression in equations for participating in managerial bodies of the cooperative to find out if any relation existed between the variables. In this analysis, the 5-point Likert-scale question of "Knowing the gathering frequency of the general assembly" is converted to dichotomous variable in order to make it useful as an independent variable to be questioned. Additionally, the average values of the notions regarding "Member behavior regarding participation in cooperative management" were taken into account to be questioned as well. In the equation, "member participation in cooperative management" was used as a dependent variable. As presented in Table 3, if a member participates in cooperative management dependent variable is 1; if a member does not participate in cooperative management dependent variable is 0.

As presented in Table 6, total land assets influence member participation in cooperative management positively. This means that members having more total land assets more likely to participate in cooperative management. On the other hand, the member who know the gathering frequency of the general assembly more likely to participate in cooperative management. Moreover, behavioral tendency of participation in the cooperative management regarding the notions mentioned in Table 5 influence member participation in cooperative management positively.

Table 6. Model estimation for member participation in cooperative management

Independent Variables	Coefficient	Wald	Significance
Age	,302	1,797	,180
Education	-1,906	,723	,395
Membership duration	-,056	,334	,563
Farmer experience	-,119	,708	,400
Distance between the cooperative and farmer	-,440	1,894	,169
Involving in the village management	2,044	,924	,336
Total annual income	,000	,248	,619
Total land assets	,042	3,420	**,064***
Household size	-,175	,094	,759
Knowing the gathering frequency of the general assembly	7,859	3,785	**,052***
Member behavior regarding participation in cooperative management (Average)	3,675	3,711	**,054***
Constant	-25,821	3,310	,069

(*indicates that the coefficient is significant at the 10% level).

Table 7 presents values of the reliability for the test. An R square value of 0.719 indicates that the estimated model is statistically valid and fits the data reasonably well. This explains that model estimates %72 of the data.

Table 7. Model Summary of estimation for member participation in cooperative management

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	16,546[a]	,314	,719

a. Estimation terminated at iteration number 10 because parameter estimates changed by less than ,001.

CONCLUSION

In Turkey, the involvement ratio to cooperative management by the members is quite low. This study also shows that only 8,3% of the members participate in the managing bodies of agricultural cooperatives in Izmir Province. In Turkey, there is an administrative structure in agricultural credit cooperatives which involves director and other staff rather than members. This structure may cause the members to stay in the background to participate in cooperative management. On the other hand, only 9,5% of the cooperative members know right the gathering frequency of general assembly of their cooperative which show that the members knowledge about technical structure about general assembly is not enough well.

According to binary logistic regression results, members having more total land assets and members knowing the gathering frequency of the general assembly more likely to participate in cooperative management. Results show that if a member behavior tends in order to "participate cooperative meetings, believe in influencing board of directors when making decisions, develop ideas for cooperative and make recommendations, to be interested in decisions at the general assembly and board of directors meetings, and to be interested in the financial structure of the cooperative", the member is more likely to participate in cooperative management.

Taking into account all of these results, the initiatives must be taken to eliminate the gap between cooperative management and members. Especially in agricultural credit cooperatives, administrative structure and management bodies of the cooperative should collaborate. It is important for developing countries to learn the management experiences of cooperatives in

developed countries. On the other hand, successful leaders to be is required to encourage members' participation in cooperative management. In this sense, cooperative leaders should not ignore the opinions of its members and they should also make good communication with members.

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THE EVALUATION OF MARKETING AND SALES SERVICES OF CATTLE BREEDERS' ASSOCIATION; A CASE OF IZMIR PROVINCE

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ABSTRACT

The objectives of the cattle breeders' association are mainly to provide qualify cattle requirements and achieve high efficient cattle with long-life and adapted to environmental conditions of Turkey. In this regards, members mainly expect from cattle breeders' association to provide appropriate marketing conditions, animal breeding and sales activities. In this research, meet level of member expectations from cattle breeders' association was searched. The purpose of this study is to analyze activities of cattle breeders' association regarding marketing and sales issues in accordance with members' requests. In this respect, survey with members of cattle breeders' association was conducted in Izmir province. Members' satisfaction level and cattle breeders' association approach to the members was taken into account. According to the results, fulfillment of marketing and sales services of cattle breeders' association do not enough corresponds the member expectation. General average of the responses in terms of marketing and sales activities is measured quite low that shows the inadequacy of cattle breeders association on this regard.

Key words: Cattle breeders' association, marketing, member

INTRODUCTION

In agricultural production, the livestock sector has a more dispersed and irregular operating structures than the other sectors, therefore it needs a more serious organizational structure (Karakaya and Kızıloğlu, 2014). One of the significant organization problems in Turkey is that organizations tasks are not be focused on purposes of producers or breeders considering to solve their problems, and also are given attention only establishment of the organization (Albayram Doğan, et al.). In Turkey, there are producer organizations in terms of livestock sector such as cooperatives, producer unions and cattle breeders associations. Cattle breeders' association is an organization model which operates its activities under Ministry of Agriculture and Forestry within the scope of Law No. 5996. In this regard, cattle breeders association is defined as democratic organizations of the breeders in order to increase the productivity of cattle. Their goal is determined as to increase the contribution of breeding activities to the national economy and increase the profits of the breeders by a more cost effective and scientific way of production.

The provision of market participation plays an essential role in assuring better income and welfare levels for dairy producers. At the same time, it contributes to poverty alleviation (Çamoğlu et al, 2012). Cattle breeders' associations perform mainly on improving the genetic potentials of high yielding animals, increasing their productivity, keeping the genealogy and productivity records of the animals, carrying out animal health and insurance operations according to their by-law. In this context, expected duties of this organization by the members are

mainly to provide appropriate marketing conditions, animal breeding and sales activities, modern technology, to be effective in the formation of market prices, process product and classify products according to market demands. This study examines the satisfaction level of members considering mentioned expectations regarding marketing and sales issues.

MATERIALS AND METHOD

In this study, primary data was obtained from the survey conducted with 67 members from two cattle breeders' associations in Izmir province. Secondary data was obtained from by-law of cattle breeders association, some legislative documents and previous studies. In this research, a five-point Likert-scale was used to measure members' satisfaction level regarding marketing and sales services of cattle breeders' association.

This study is a part of research project on "Structuring and Shareholder/Member Relationship of Agricultural Producers Organizations' in Izmir Province" conducted in 2015 for General Directorate of Agricultural Research and Politics of Ministry of Agriculture and Forestry.

RESULTS

Characteristics of the members' profiles

Table 1 presents data regarding demographic characteristics of the members. According to results some characteristics as averages are bellowed; age of the members is 48, farming experience is 29 years, membership duration is 10 years and distance between the cooperative and the member's house is 7 km. Members' annual income is 49200 TL, total land asset is 3,9 ha and household size is 3,8 persons.

Table 1. Demographic characteristics of the members' profile

	Average	Min	Max
Age	48	25	74
Farming experience (year)	29	1	55
Shareholder duration (year)	10	1	20
Distance between the cooperative and farmer (km)	7	1	27
Total annual income (TL/year)*	49200	5000	400000
Total land assets (ha)	3,9	2	180
Household size (person)	3,8	0,2	0,9

*The average exchange rates between Turkish Lira (TRY) and the USD ($) for September 2015 is 1 USD = 3.04682 TRY.

Table 2 shows the education level of the members, in this respect, 72,6% of the members are primary school, 3% of the members are middle school, 14,9 % of the members are high school and 4,5 % of the members are university educated.

Table 2. Education level of the members

	Frequency	Percent (%)
Primary school	52	77,6
Middle School	2	3,0
High school	10	14,9
University	3	4,5
Total	67	100

Satisfaction level of members regarding marketing and sales services of cattle breeders' association

Members' satisfaction level regarding marketing and sales services of cattle breeders' association was measured using a five-point Likert-scale for six statements as shown in Table 3. According to the responses, 14,9% of the members absolutely agree about the notion of "I am pleased with cattle breeders' association's animal breeding and sales activities", while 46,3% of them absolutely disagree. The notion of "Cattle breeders' association pays the price of the product I sell on time" is responded as absolutely disagree by 53,7% of the members, notions of "I am pleased with the modern technology of cattle breeders' association" and "Cattle breeders' association is effective in the formation of market prices" are responded as absolutely disagree by 50,7% of the members. The notion of "I am pleased with processing of my products by cattle breeders' association" is responded as absolutely disagree by 85,1% of the members, while 86,6% of the members responded as absolutely disagree for the notion of "I am pleased with cattle breeders' association that packages my products by classifying them according to their type, health conditions and market demands".

Expression with the lowest ratio evaluated by the member is about classifying products according to market demands and with the highest ratio is about animal breeding and sales activities. Besides, the general average of these statements is measured as 2,07, which is quite low and corresponds as disagree at five-point Likert-scale.

Table 3. Marketing and sales services of cattle breeders' association, and satisfaction level of members

x	1		2		3		4		5		Average
	f	%	f	%	f	%	f	%	f	%	
I am pleased with cattle breeders' association's animal breeding and sales activities	31	46,3	6	9,0	3	4,5	17	25,4	10	14,9	2,54
Cattle breeders' association pays the price of the product I sell on time	36	53,7	0	0	4	6,0	15	22,4	12	17,9	2,51
I am pleased with the modern technology of cattle breeders' association	34	50,7	7	10,4	3	4,5	16	23,9	7	10,4	2,33
Cattle breeders' association is effective in the formation of market prices	34	50,7	10	14,9	2	3,0	10	14,9	11	16,4	2,31
I am pleased with processing of my products by cattle breeders' association	57	85,1	3	4,5	1	1,5	1	1,5	5	7,5	1,42
I am pleased with cattle breeders' association that packages my products by classifying them according	58	86,6	4	6,0	0	0	2	3,0	3	4,5	1,33

to their type, health conditions and market demands											
										Average	2,07

x refers to the score of 5-point Likert scale (1 = "Absolutely disagree" and 5 = "Absolutely agree"), f refers to frequency.

CONCLUSION

According to the results, fulfillment of marketing and sales services of cattle breeders' association do not enough correspond the member expectation. General average of the responses in terms of marketing and sales activities is measured as 2,07 which is quite low and this shows the inadequacy of cattle breeders association on this regard. In terms of activities of cattle breeders association on providing appropriate marketing conditions, animal breeding and sales activities, modern technology, being effective in the formation of market prices, processing product and classifying products according to market demands are not performed well. Also, Karakaya and Kızıloğlu (2014) indicated in their study about organizational structure of cattle breeders farming that 36% of farmers expect solutions from agricultural organizations on the most basic problems such as marketing of products and veterinarians' services.

In this regard, current organizations should have a mentality to act as if they were a single producer on the basis of province, district and village. Organizations in dairy cattle should be organized among themselves and formed to intensive organization model instead of spread model. They should make cooperation with other organizations and their upper units to have high marketing power therefore taking more active role in defined politics should be provided (Albayram Doğan et al., 2014). Especially in the regions where the education level is low and not conscious enough, there are important duties to the institutions and organizations that can provide services to the producers in the region in order to increase the income level of the producers and better benefit from the livestock policies being implemented (Aksoy and Denizli, 2012). Consequently, cattle breeders' associations and cooperative based organizations should be the leading organizations in terms of marketing operations in terms of cattle breeders' requests. Another issue to be taken into account is that cattle breeders association should consider members expectations on marketing issues as well.

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