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User Awareness for the Benefits of Urban Parks: Ankara City Case*

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ABSTRACT

In today's world, people living in the city face difficulties in coping with stress, anxiety and fatigue. The individuals are in the need of being in touch with the nature and relieving stress and pressure in order to get away from these emotions. The parks which are one of the remedial opportunities for the individuals in their living places in terms of spiritual and physical aspects have a positive impact on the life quality of these individuals. In the contemporary societies, the existing open spaces and new designing spaces are regulated in accordance with the requirements of the age and the society given. In this regard, while urban parks, which are one of the important factors of urban landscape, are presented to the user service, it is significant to ensure balance the relationship between environment and human in order to increase the benefits obtained from these parks. The experts and institutions involved in the planning, design and management of such parks possess certain knowledge of these benefits. However, the level of knowledge and awareness of urban population or park users are not clear. In this study, in the case of Ankara city, it was researched how much the park users have knowledge of the economic, ecological, social and physical benefits of urban parks. One-on-one interviews with make a survey were conducted with 384 urban park users. According to the findings, 47.2% of the participants stated that they do not have general information about the benefits of urban parks, 31.8% of them that they had knowledge, and 20.8% said that they are not interested. The participants stated that urban parks were effective in cleaning the polluted air (37.5%), lowering the urban temperature (33.3%) and increasing the relative air humidity (31.3%). Based on these findings, suggestions were made to the researches, professional disciplines and public institutions.

1. Introduction

Urban is a set of relations that reflects all of the established relationships in a society (Harvey, 2013). In today's world, the world is rapidly urbanizing, and by 2030 more than 60% of the world population is expected to live in cities (Bolund and Hunhammar, 1999). The phenomenon of migration from rural to urban has begun to take place in Turkey especially since 1950s, and the concepts of city and urbanization have emerged. The continuation of migration from rural to city, placing great demands on urban capacities, and the fatigue and pressure of the individuals' struggle to maintain their lives are the common problems of people who live in the cities.

In today's world, people living in the city face difficulties in coping with stress, anxiety and fatigue. The individuals are in the need of being in touch with the nature and relieving stress and pressure in order to get away from these emotions. The parks which are one of the remedial opportunities for the individuals in their living places in terms of spiritual and physical aspects have a positive impact on the life quality of these individuals.

Urban parks are the places which are designed suitable for active and passive recreation areas and for people of all ages with the natural and cultural aspects of the city. In the contemporary societies, the existing open spaces and new designing spaces are regulated in accordance with the requirements of the age and the society given. In this regard, while urban parks, which are one of the important factors of urban landscape, are presented to the user service, it is significant to ensure balance the relationship between environment and human in order to increase the benefits obtained from these parks. The experts and institutions involved in the planning, design and management of such parks possess certain knowledge of these benefits. However, the

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*This study was produced from Master's thesis of Sema Melike KILIÇ

level of knowledge and awareness of urban population or park users is not clear.

It is important for urban people to know the impact of urban parks on strengthening the environment and human relations.

In this study, in the case of Ankara city, it was researched how much the park users have knowledge of the economic, ecological, social and physical benefits of urban parks. One-on-one interviews with make a survey were conducted with 384 urban park users. Based on these findings, suggestions were made to the researches, professional disciplines and public institutions.

It is considered that determining the urban population's awareness about the benefits of urban parks will contribute to the protection of these parks, the increase in value given to the green areas, and the development of the urban identity and the sense of belonging. It will also strengthen the contribution of users to the planning, implementation and management processes of urban parks based on their preferences.

2. Benefits of Urban Parks

2.1. Economic Benefits of Urban Park

Trees can contribute to energy conservation since they help to reduce the cost of heating and cooling the buildings. As the research made on this shows, 100 million mature trees (3 trees per house) in the cities of the United States have saved 2 million dollars in energy expenditure (Dwyer et al., 1992). Trees serve as wind curtain, decreasing wind speed and reducing air infiltration of buildings by up to 50%, which results in annual heating savings up to 25% (Millwarda and Sabirb, 2011). Temperatures measured in parks also have a strong relationship with plant density. Measurements were made around Bukit Batok Nature Park (36 hectares) and Clementi Woods Park (12 hectares) in Singapore, which have natural reserve. It was observed that 10% energy was saved and felt up to 400 meters in Bukit Batok Nature Park (Yu et al., 2006).

Property value and people's consumption habit can be influenced by the presence of parks and green areas. According to this, it has been found that the houses close and adjacent to parks and open areas have approximately 8%-20% higher prices than those in other places. Another study has been found that the rental rates of commercial office properties are about 7% higher in the areas with a high-quality landscape, including trees (Wolf, 2004). It has been verified that the net benefit in increasing the average urban park size in a medium-sized city can be as high as 160 dollars per house (Jenningsa et al., 2016). In the old town centre of Guangzhou, the price of housing decreases by 6.6% when the distance to the nearest urban park doubles (Jim and Chen, 2009). A small park of 200.000 dollars is able to cover its own cost in 15 years by providing an additional property tax income of 13.000 dollars (Sherer, 2003).

Apart from cultural infrastructure, historical sites, monuments, various activities and entertainment infrastructure, good quality parks also attract tourists (Olbińska, 2018). Riverwalk Park costed 425.000 dollars is one of the most popular attraction centers for the city's 3.5 billion tourism industry (Sherer, 2003).

2.2. Ecological Benefits of Urban Park

Urban parks with vegetation contribute significantly to balancing the urban climate, form the lungs of the cities, eliminate environmental pollution by cleaning the air from the particles, adding oxygen to it and removing carbon dioxide from the atmosphere, and host many birds, animals and flowers by providing the wild life corridors for the city. Parks are instrumental in land reclamation by creating vegetation on many vacant and waste lands in the urban areas; they improve the appearances of the lands and increase the ecological values. In this sense, they are considered as a cheap option for recreational costs (Rabare et al., 2009).

In 1994, the trees in New York eliminated 1.821 mt (metric tons) of air pollution, which was estimated as 9.5 million dollars (Nowak, 2002). In an area where tree cover is dense (e.g. adjacent forest areas within parks), 15% of ozone, 14% of sulfur dioxide, 13% of particulate matter, 8% of nitrogen dioxide and 0.05% of carbon monoxide can be cleaned from the air by trees (Sherer, 2003). Trees take the carbon in the CO_2 gas and store it as cellulose in the wood tissues and release the oxygen back to the atmosphere. A healthy tree can store approximately 6 kg or 2.6 tons of carbon in an area of 4047 m^2 per year (Barış, 2005).

The air flow rubbing on the building surfaces gets hot and loses it speed, resulting in a constant air flow at a certain level of the urban. For this reason, urban parks are the units that regulate this air flow and make it natural. It has been found that the temperature of the green belts in Frankfurt, which do not exceed 50-100m in the cities, makes a difference of 3.5 ^{0}C compared to the city center. While making these experiments, it was found that a cool air blow from the green areas and that there was a 5% increase in relative air humidity compared to the city center (Akdoğan, 1970). In the study of Gerey and Deneke (1986), they have proved that tree reduce air temperature by evaporation in summer. In growing environments suitable for sufficient water intake, a single tree can deliver 400 liters of water to the air by transpiration per day. It has been estimated that this corresponds to 5 room air conditioners operating for an average of 20 hours a day (Atay, 1990). It has been found that a green mass of the green areas in urban areas with warm and humid climatic conditions, depending on location, size, density and tree species, decreases summer temperatures by 4-11°C, increases winter temperatures by 2-4°C and creates a balance in receiving solar radiation (Altunkasa, 2004).

2.3. Social Benefits of Urban Park

Urban parks play a unique role in establishing the relationship that constitutes social capital. quality parks

can provide opportunities for volunteering and community events. Parks create community harmony by enabling people to interact with each other in partnerships (Rabare et al., 2009). Urban parks provide a good environment for the interaction of the citizens with each other, an educational area for children and a laboratory environment for studies such as protection of animal species (Sezgin, 1996). By providing spaces and opportunities for physical activity, they play an important role in the increase of satisfaction with their effects on the living environment and health (Konijnendijk et al., 2013). The availability of urban parks that are easily accessible and designed to attract people of all ages can reduce the risk of chronic illness by facilitating physical activity and relieving stress (Sugiyamaa et al., 2018). A study conducted in China examined the role of urban parks in improving physical activity and mental health. Park visits caused a variety of positive mental reactions. According to the results; people expressed to develop themselves in self-confidence (69.9%), energy levels (61.4%), feeling healthy (60%), mental healing (52%) and relaxation (37.8%). A positive relationship was found between the physical activities and mental health of park users and their residents (Liu et al., 2017). According to the results of the study conducted by Kuo and Sullivan (2001); being contact with nature reduces mental fatigue, aggression and violence. Access to public parks and recreational facilities is strongly linked to the reduction of offenses, particularly juvenile offenses (Rabare et al., 2009). The "midnight basketball" programs conducted for a year in Kansas City resulted in a 25% drop in youth arrests in the region. Similarly, in Fort Worth (Texas), crime fell by 28% in the one-kilometer community centers where midnight basketball was recommended (Sherer, 2003).

2.4. Physical Benefits of Urban Park

In these contemporary times, in which urbanization is in the vertical direction, people find themselves lost in tall buildings. Designing open areas and parks by creating a balance in terms of the scale of this structure has a positive effect on people (Öztürk, 2004). The harmony and contrasts created by using the size, form, texture and color characteristics of urban open and green areas create an attractive impact on the urban population. They serve the city as an aesthetic entity that brings vitality and liveliness to the urban landscape with its different colors from season to season. (Özkır, 2007). They provide links between green spaces, cities and the organic system. They eliminate monotony by occupying the space between the geometric structure patterns of the cities. Thus, while eliminating the dryness of the physical structure of the city, on the other hand, they give the building masses of the city a soft appearance and bring all elements together in an organic order. They help to set mass-space. Green spaces in the city provide the necessary security for people by separating vehicle traffic from pedestrian recreation and settlement areas (Boyacı, 2010).

3. Materials and Methodology

3.1. Materials

In the study, urban parks and park users in Ankara province were taken as materials (Figure 1). While forming the theoretical foundations of the research, graduate theses, scientific researches, books etc. were used. The A4 size questionnaire forms were used to determine the awareness of the users. SPSS 22 software was used in the statistical analyzes to be applied to the findings obtained from Microsoft Office software during the writing phase.

Figure 1
Location of the Research Area (Googleearth, 2019)

3.2. Methodology

Research methodology was conducted through the determination of the aim, the literature review, the findings obtained and the formation of the theoretical frameworks in the first stage; through the designing and applying the questionnaire in the second stage; through the organization of the data obtained in the third stage; and the statistical analyses in the last stage.

The economic, ecological, social and physical benefits of urban parks have been demonstrated through the literature review. Based on the theoretical framework, a questionnaire was designed to question the awareness of urban park users about the demographic characteristics and economic, ecological, social and physical benefits of urban parks. Attention was paid to the fact that the questionnaire would be understandable, easy to apply and include purposeful questions. A pre-test was conducted with the designed questionnaire to check for deficiencies and errors. The population of Ankara province was taken as universe size and according to sample size in Table 1, the questionnaire was conducted with 384 participants (Yazıcıoğlu and Erdoğan, 2004).

Table 1
Samle Sizes for α= 0.05 (Yazıcıoğlu and Erdoğan, 2004)

Universe size	±0.05 Sample Error (d)		
	p=0.5 q=0.5	p=0.8 q= 0.2	p=0.3 q=0.7
100	80	71	77
500	217	165	196
750	254	185	226
1000	278	198	244
2500	333	224	286
5000	357	234	303
10000	370	240	313
25000	378	244	319
50000	381	245	321
100000	383	245	322
1000000	384	246	323
100 milyon	**384**	245	323

The questionnaires were conducted in randomly selected and mutual interviews in Ankara urban parks between 10.00 and 15.00 every day of the week in order to vary in terms of demographic aspects of the subjects.

The data obtained after the survey was transferred to computer and edited with Microsoft Office Excel software. Missing and incorrect questionnaires were excluded from the scope of the research. The frequencies for the findings were determined by using SPSS 22 software.

4. Results and Discussion

4.1. Demographic Characteristics of Participants

Gender distribution was given in Figure 2 in terms of demographic characteristics of the participants in the survey conducted in the scope of the study. Of the total 384 respondents, 232 (60%) were female and 152 (40%) were male (Figure 2).

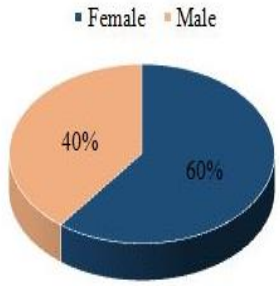

Figure 2
Gender Distributions of Participants

Age distribution was given in Figure 3 in terms of demographic characteristics of the participants in the survey conducted in the scope of the study. According to this, 30% of the participants were between 18-24 years old, 35% were between 25-34 years old, 22% were between 35-44 years old, 11% were between 45-64 years old, 2% were 65 years and older (Figure 3).

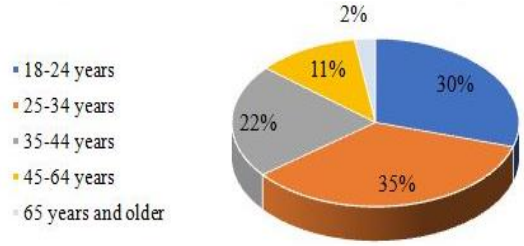

Figure 3
Age Range of Participants

Education status was given in Figure 4 in terms of demographic characteristics of the participants in the survey conducted in the scope of the study. According to this, 1 person is illiterate. 8% of the survey participants are primary school graduates, 17% are high school graduates, 9% are associate degree graduates, 50% are bachelor degree graduates and 16% have master's degree graduates (Figure 4).

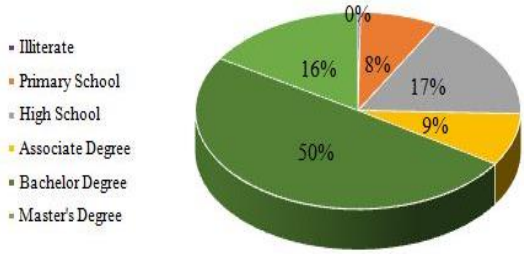

Figure 4
Educational Status of Participants

Occupational groups were given in Figure 5 in terms of demographic characteristics of the participants in the survey conducted in the scope of the study. According to this, 10% of the survey participants are unemployed, 26% are workers, 21% are public employees, 21% are students, 5% are housewives, 12% are self-employed and 5% are retired (Figure 5).

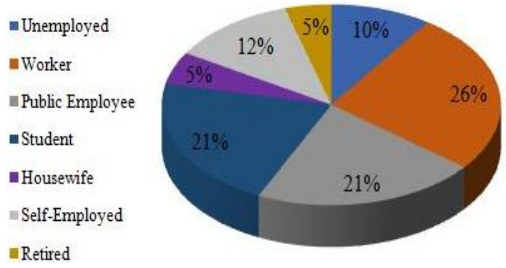

Figure 5
Occupational Groups of Participants

Income groups were given in Figure 6 in terms of demographic characteristics of the participants in the survey conducted in the scope of the study. According to this; 27% of the survey participants have monthly income of 0-1000 TL, 23% of 1000-2000 TL, 20% of 2000-3000 TL, 19% of 3000-5000 TL, 11% of 5000 TL or more (Figure 6).

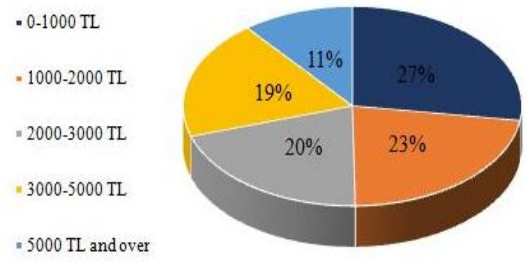

Figure 6
Income Groups of Participants

The condition of living in Ankara was given in Figure 7 in terms of demographic characteristics of the participants in the survey conducted in the scope of the study. According to this, 91% of the participants live in Ankara and the rest 9% don't live in Ankara (Figure 7).

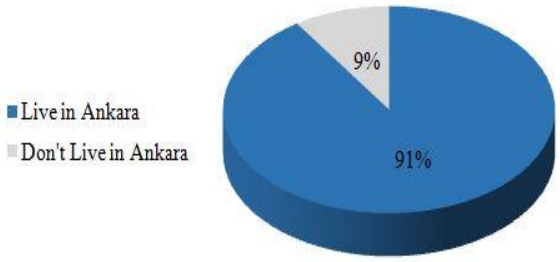

Figure 7
Resident Statuses of Participants

4.2. Awareness of Participants about Benefits of Urban Parks

4.2.1. Overall Awareness of Participants about Benefits of Urban Parks

The knowledge and awareness levels of the park users participating in the survey about the benefits of urban parks were given in Figure 8 in a graphical form. According to this, 12.2% of the respondents has given the answers do not know, 35.2% know little, 20.8% are not interested, 28.4% have knowledge and 3.4% have expertise knowledge. According to these rates, 47.2% of the participants do not have information about the benefits of urban parks, 31.8% have knowledge of urban parks (Figure 8). It can be said that approximately one-third of urban park users in Ankara are aware of the benefits of green spaces.

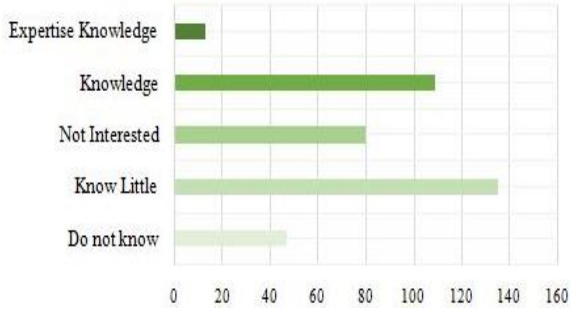

Figure 8
General Awareness of Participants on the Benefits of Urban Parks

4.2.2. Awareness of Participants about Economic Benefits of Urban Parks

The knowledge and awareness of the urban park users participating in the survey about the economic benefits of urban parks (energy saving-urban tourism potential, housing price effect-job opportunity) were given in Figure 9. Regarding the question "Can urban parks provide energy saving for the houses in a certain impact area by cooling the environment in summer and shielding the wind in winter with the plant materials they contain?" 24.2% the respondents do not have any information about it, 4.7% stated that urban parks do not definitely provide such benefits, 14.1% stated that they do not provide such benefits, 47.7% stated that they provide such benefits, 9.4% stated that they definitely provide such benefits. 47.7% of the survey participants are aware that green spaces save energy. According to the findings, one out of four participants do not know about the contribution of plants to energy saving. Regarding the question "Can urban parks provide benefits for the tourism potential of the cities in which they are located?" 6.3% the respondents do not have any information about it, 7.8% stated that urban parks do not definitely provide such benefits, 14.6% stated that they do not provide such benefits, 57.8% stated that they provide such benefits, 13.5% stated that they definitely provide such benefits (Figure 9). Ankara is open to foreign tourists since it is the capital city of Turkey. The existence of the post-republic parks in the city and their use in the parks has become the focus of tourists. In additionally, the enterprises and organizations in these parks constitute employment.

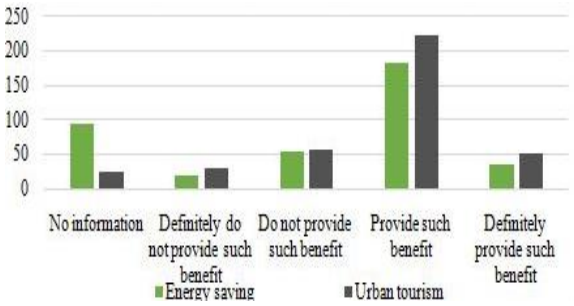

Figure 9
Awareness of Participants about Energy-Saving and Urban Tourism

"Regarding the question "To what extent can a well-designed urban park create impact in the housing prices in its impact zone? Would the price be higher?" 10.7% do not information about it, 2.9% stated that there would be no definitely rise at all, 4.9% stated that there would be no rise, 47.4% stated that there would be rise, 34.1% stated that there would be definitely rise. Urban parks increase the welfare level of the environment in which they are located and make them a point of attraction with its structure that brings people together with nature. In parallel with these results, the direct proportional increase in housing prices in Dikmen Valley and its surrounding areas in Ankara in the 2000s can be given as an example. Regarding the question "Can the organizations held in urban parks (e.g. concerts, festivals, competitions, shows and so on) increase job opportunities for the urban population?"

12% do not have information about it, 4.9% stated that there would be no definitely rise at all, 14.3% stated that there would be no rise, 57% stated that there would be rise, 11.7% stated that there would be definitely rise (Figure 10). Through the youth organizations and the openings of various festivals held in the urban parks in Ankara, it ensured to appeal to wide masses and to offer job opportunities for the local people. Through the paid-free concerts held in Ulus Genclik Park in Ankara, the rates of socialization are on the rise among the public as there is an increase in job opportunities. Ankapark which is one of the new parks in Ankara hosts various artists and creates job opportunities for people as well.

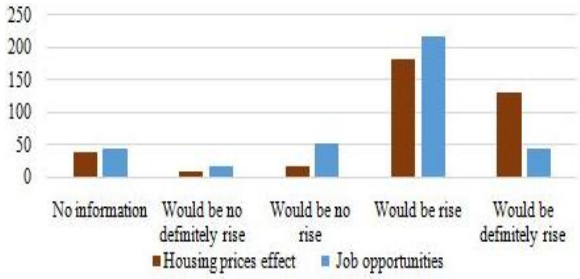

Figure 10
Awareness of Participants about on Housing Prices Effect and Job Opportunities

4.2.3. Awareness of Participants about Ecological Benefits of Urban Parks

The knowledge and awareness of the urban park users about the ecological benefits of the urban parks (oxygen production-plant species diversity protection and increase, polluted air cleaning-city temperature reduction-relative air humidity increase, greenhouse effect-noise) were given in Figure 11.

Regarding the question "How useful can urban parks are in the production of oxygen?" 6.5% of the participants do not have information about it, 8.1% stated that they are useless, 19.8% states that they are little useful, 48.4% stated that they are useful, and 17.2% stated that they can be very useful. The users of urban parks in Ankara are also aware of the contribution of green spaces to the oxygen cycle for our world and our city. Regarding the question "How useful can urban parks are in the protection and increase of plant species diversity?" 11.7% of the participants do not have information about it, 12.8% stated that they are useless, 23.7% stated that they are little useful, 39.8% stated they are useful, and 12% stated that they are very useful (Figure 11). The presence of different plant species in our environment reflects the ecosystem wealth. It enables the design of a healthy green area with the choices of the plants used in the urban parks and the texture and soil of the urban. However, it is required to ensure the landscape design in these parks with the regional plants in order to maintain this diversity in the city. The fact that trees such as oriental plane, birch, cercis and lime trees, which adapt to the climatic conditions in Ankara and reflect Ankara, confirms the findings.

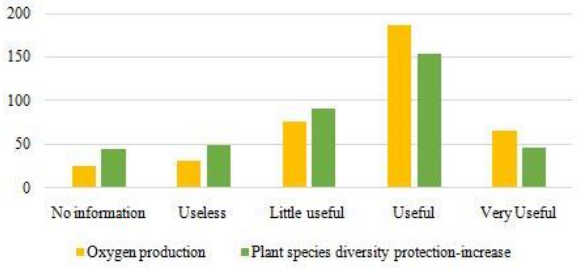

Figure 11
Awareness of Participants about Oxygen-production and Plant Species Diversity Protection and Increase

Regarding the question "How effective can urban parks are in cleaning the polluted air in the city?" 9.1% of the participants do not have information about it. 10.4% stated that they are no effect, 26.8% stated that they are little effective, 37.5% states that they are effective, 16.1% stated that they are very effective answered. Through the increasing use of vehicles and different heating methods in Ankara, the weather of the city is negatively affected. However, the presence of green areas in the city and the increase in these green areas produce a reducing effect on its gray appearance. Regarding the question "How effective can urban parks are in reducing the city's temperature in summer?" 14.6% of the participants do not have information about it. 12.2% stated that they are no effect, 28.6% stated that they are little effective, 33.3% stated that they are effective, 11.2% stated that they are very effective answered. The presence of green spaces in the city can reduce the temperature of the city. Regarding the question "How effective are city parks in increasing the relative air humidity in summer?" 23.2% of the participants do not have information about it. 10.7% stated that they are no effect, 27.6% stated that they are little effective, 31.3% stated that they are effective, 7.3% stated that they are very effective answered (Figure 12).

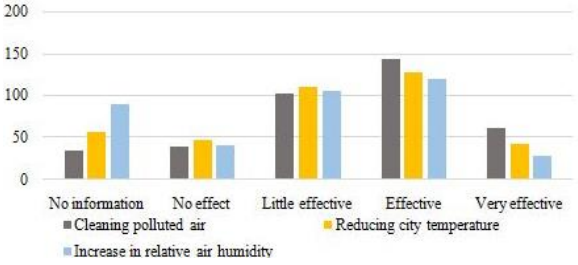

Figure 12
Awareness of the Participants about Cleaning Polluted Air, Reducing City Temperature and Increase Relative Air Humidity

Regarding the question "How much can urban parks reduce the greenhouse effect by holding carbon in the atmosphere?" 25.3% of the participants do not have information about it. 12% stated that they cannot reduce it, 32% stated that they can a little reduce it, 25% stated that they can reduce it, 5.7% stated that they can a lot reduce answered. While using the carbon dioxide in the atmosphere for photosynthesis, plants produce oxygen. However, by reducing the amount of

carbon dioxide in the atmosphere, our world becomes less warm. Regarding the question "To what extent can urban parks reduce environmental noise?" 10.4% of the participants do not have information about it. 27.9% stated they cannot reduce it, 21.6% stated that they can a little reduce it, 29.4% stated that they can reduce it, %10.7 of stated that they can a lot reduce answered (Figure 13). Environmental noise can be reduced by the texture and location of the plants. Noise can be prevented by coarse-textured trees or rough-and-densely-textured small trees or shrubs used around the park.

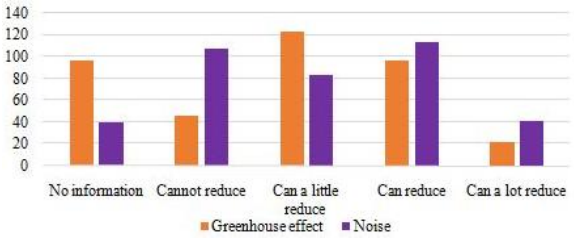

Figure 13
Awareness of Participants about Greenhouse Effect and Noise

4.2.4. Awareness of Participants about Social Benefits of Urban Parks

The knowledge and awareness of the urban park users about the social benefits of urban parks (social development-reducing crime rates, public health protection and recreation) were given in Figure 14 in a graphical form. Regarding the question "To what extent can urban parks contribute to social development?" 9.6% participants do not have information about it. 6% stated that they do not definitely contribute to it at all, 12.8% stated they do not contribute to it, 55.2% stated that they do contribute to it, 16.4% stated that they do definitely contribute to it. Due to its function as a gathering place, parks bring people from many different cultures together. They bring tourists and the local people together. The socialization rate among people increases with the organizations and daily use of the parks in Ankara. Regarding the question "To what extent can urban parks contribute to reducing crime rates in the city?" 16.1% of the participants do not have information about it. 2.9% stated that they do not definitely contribute to it at all, 31% stated that they do not contribute to it, 24% stated that they do contribute to it, 6% stated that they do definitely contribute to it. The users of urban parks in Ankara do not possess awareness about the aspect of urban parks in reducing crime rates. Nevertheless, the well-designed green areas of the urban parks have a healing effect by guiding the urban population. With the revision of the Gençlik Park in 2005 and re-opening in 2009, it constitutes the most populous area of the region and Ankara today. Regarding the question "To what extent can urban parks contribute to protection of public health in the city?" 16.4% of the participants do not have information about it. 7.6% stated that they do not definitely contribute to it at all, 19.8% stated that they do not contribute to it, 44.5% stated that they do contribute to it, 11.7% stated that they do definitely contribute to it (Figure 14). 44,5% of the urban park users in Ankara are aware of the fact that green areas are useful for the protection of public health. Those who feel good in terms of mental and physical health can become useful individuals for society.

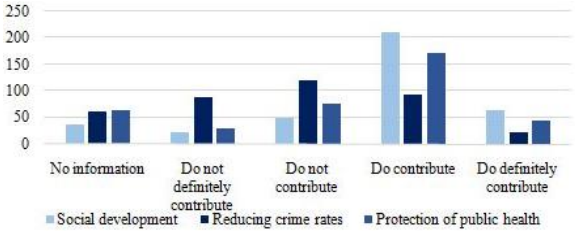

Figure 14
Awareness of Participants about Social Development, Reducing Crime Rates and Protection of Public Health

Regarding the question "How effective are city parks in terms of recreation?" 4.9% of the participants do not have information about it. 3.6% stated that they wouldn't be definitely effective at all, 8.3% stated that they wouldn't effective, 56.5% stated that they would be effective, 26.6% stated that they would be definitely effective (Figure 15). The urban park users in Ankara go to the parks in order to gain energy and spend their weekends. The choices of the individuals about spending their leisure time can be varied according to their needs and interests. The urban parks offer different recreational alternatives for people such as horseback riding in Altınpark and fishing in Göksu Park.

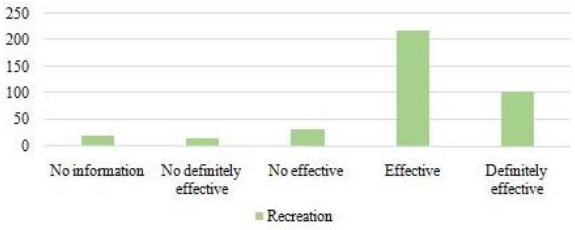

Figure 15
Awareness of Participants about Recreation

4.2.5. Awareness of Participants about Physical Benefits of Urban Parks

The knowledge and awareness of the participants about the physical benefits of urban parks (visual impact-buffer zone, impact of tall buildings on people, protection of historical building and places) were given in Figure 16. Regarding the question "To what extent can urban parks contribute to the visual attraction of the city?" 2.9% of the participants do not have information about it. 4.9% stated that they do not definitely contribute to it at all, 5.7% stated that they do not contribute to it, 50.5% stated that they do contribute to it, 5.9% stated that they do definitely contribute to it a lot. "Regarding the question "Can urban parks contribute to the city by providing a buffer zone among the different areas such as accommodation, trade, business and education?" 22.4% of the participants do not have information about it. 5.5% stated that they do not definitely

contribute to it at all, 11.2% stated that they do not contribute to it, 47.1% stated that they do contribute to it, 13.8% stated that they do definitely contribute to it a lot (Figure 16). A well-designed urban park contributes to the aesthetics of the urban positively. Additionally, the location of green areas in the urban is as important as their beauty. If green areas are used as a boundary, or a limitation to certain places in the city, the aesthetic and location integrity will be achieved. In this way, the planning development of the urban will be possible to be guided.

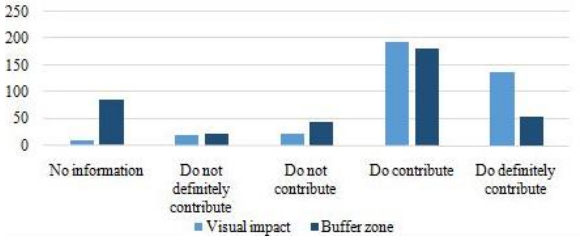

Figure 16
Awareness of Participants about Visual Attraction and Buffer Zone

Regarding the question "To what extent can urban parks useful for reducing the effect of tall buildings on people?" 7.8% of the participants do not have information about it. 4.7% stated that they cannot definitely useful for it at all, 8.3% stated that they cannot useful for it, 45.4% stated that they can useful for it, 34.1% stated that they can definitely useful for it (Figure 17). Through the vertical development in recent years, people feel themselves as small dots. In the urban parks where the horizontal development has been ensured, the comfort rates can be boosted. There are physical and mental differences between the individual among tall buildings and the one in an urban park in Ankara. Additionally, 45.4% of the urban park users in Ankara are aware of the fact that urban parks create a positive effect on reducing the pressure of tall buildings on people.

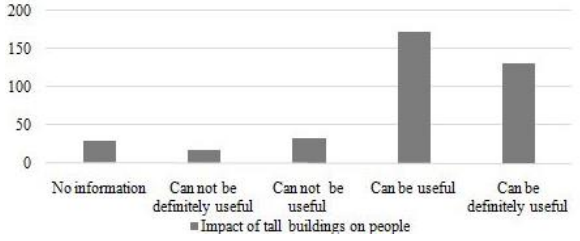

Figure 17
Awareness of Participants about Reducing oppression of Tall Buildings on People

Regarding the question "How effective are city parks protection of historical buildings and places?" 22.1% of the participants do not have information about it. 9.1% stated that they wouldn't be definitely effective at all, 25.5% stated that they wouldn't effective, 34.4% stated that they would be effective, 8.9% stated that they would be definitely effective (Figure 18). Societies should pay special attention to historical places. Ensuring the protection and availability of these places can raise public awareness accordingly.

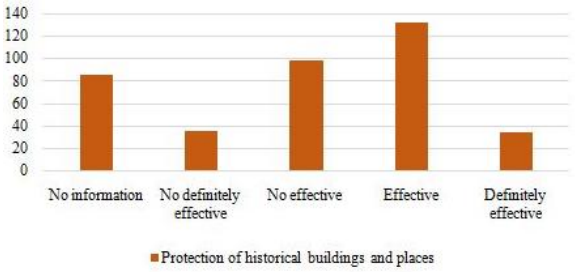

Figure 18
Awareness of Participants about Protection of Historical Buildings and Places

5. Results and Recommendations

While urban parks provide space for the city and the inhabitants to breathe, they can guide the socio-economic situation and development of the city. Urban parks are more than a park. The green areas are comfort zones for the urbanite with its size, variety and accessibility. Parks have economic, ecological, social and physical benefits. Ankara is an important city politically and physically since it is the capital city of Turkey. For its planned infrastructure and the innovative and environment-friendly approaches Ankara can be created a different capital atmosphere in accordance with the urbanite.

In Ankara, urban parks are designed and implemented by local governments and offered to the service of the city people. As a result of the usage of these parks by the people of the urban, some user-based evaluations and interpretations emerge. In recent years, satisfaction surveys have been conducted for the use of parks. When viewed from this angle, the question "To what extent does the level of knowledge of urban park users reflect their satisfaction with this service?" is raised. The location of the green areas and urban parks in the city should be planned according to the needs. The 35.2% of the urban park users in Ankara answered that they know a little when the question about their knowledge and awareness levels is asked. The urban park users in Ankara stated that they do not possess enough awareness about the overall benefits of urban parks.

According to the results of the research, the knowledge and awareness of the users about the benefits of the parks are generally low. Interestingly enough, their levels of knowledge and awareness about the economic, ecological, social and physical benefits have emerged at higher levels. Besides, regarding the question "How much can urban parks reduce the greenhouse effect by holding carbon in the atmosphere?" 32% of the participants stated that they can reduce it a little and regarding the question "To what extent can urban parks contribute to reducing crime rates in the city?" 31% of the participants stated that they do not contribute to it.

Today we need social green spaces such as urban parks in order to strengthen our changing social ties

with developing technology. With the increasing population in Ankara, the amount of green areas per capita should be increased in line with the needs of the citizens and due to the benefits of urban parks.

Urban parks should be located in city center for easy access of people in the city. Through a simple design, urban parks should be places in which the public can feel and live. Through the coordination between landscape architecture and other disciplines, the local authorities should produce solution alternatives regarding the designing, planning, implementation and sustainability stages of urban parks. It is inevitable to form new green areas for the increasing population in Ankara. People in Ankara should be asked about their preferences for the existing urban parks, the deficiencies of these parks and their expectations from new parks. In this way, the qualities of urban parks can be enhanced.

The urban park users who possess knowledge and awareness can take active roles in changing the services of the local authorities. In this sense, the awareness-raising and information activities about the benefits of urban parks should be conducted for people in Ankara in order to ensure sensitivity about the city planning, the use and sustainability of natural sources and the environmental problems. Additionally, the local authorities should be informed about these issues, and it should be ensured that the local authorities include the conscious park users as stakeholders in the activities about the planning and implementation of parks.

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The Approaches of the Contracting Companies to the Housing Landscape in Konya Province*

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ABSTRACT

Today's residences show highly functional and qualified formations and offer many functions to their users. One of the most important factors that increase the housing function and aesthetics is the housing landscape. In this study; the opinions and experiences of the contractor companies that have implemented housing projects in line with the supply and demands of the users have been determined. A survey was conducted through face-to-face interviews with 97 house producer company officials affiliated to Konya Contractors Association. In the first part of the questionnaire, the approaches to projecting the housing landscape and the factors that affect the project process are questioned. In the second part, landscape application approaches, various professional groups in the application stages, quality and characteristics of the application are presented. In the third section, the economic and financial evaluations of the residential landscape are made and the values that the landscape adds to the housing through projects and applications are determined. In the last part of the questionnaire, the satisfaction levels of the contractors and their customers were measured based on the experience of the contractors. According to the findings; 89 out of 97 company officials show a positive approach to constructing landscape projects. In addition, 49 company officials stated that the effectiveness of the landscape in housing prices is high and very high.

1. Introduction

Cities are formed and shaped as a result of people's needs and desires in historical time periods and then they change and develop. The modern and social community of the present century has also endeavored to realize its desire to live in a comfortable, peaceful place and environment at the highest level (Kırgızoğlu, 1995).

The conceptual integration of the city and the landscape is formed by considering the structures together with the surroundings (Keleş, 2008). The streets, squares and parks in the city shape the displacement of people. These dynamic areas are important complements of work and home life in providing mobility, creating communication nodes, creating common spaces for recreation (Carr&friends, 1992).

It can be said that people's interest and love for concepts such as nature, garden and tree stems from their own creation and self. Because of this reason, human beings have a positive attitude when they interact with plants and plant areas, whether they are aware or not (Polat&Önder, 2012). Nature increases social cohesion and interaction among neighbors by encouraging the use of outdoor spaces (Chiesura, 2004). In a study conducted by the universities of Chicago and Illinois, it was found that the degree of development of social ties within the neighborhood was proportional to the level of vegetation (Sherer, 2003).

The housing sector constitutes a very important part of the construction sector. Housing has had a very important place in people's lives since ancient times (Gül, 2012). Today, when the housing need is examined, its infrastructure and transportation have been completed; social facilities such as education, health, culture and trade are sufficient; parks, gardens, landscaping, sports, recreation and entertainment facilities that offer contemporary living opportunities to people living in residential areas is understood (Bayraktar, 2007).

Residential gardens are becoming an important element for housing manufacturers as the contractor firms aim to act in line with the supply and demands of their customers. It is important for the contractors to increase their needs and responsibilities on the landscape and to consciously continue their projects and applications.

*This study was produced from Master's thesis of Bahadır EKİCİ

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2. Residential Landscape Projects and Applications

Architecture and various design activities are seen as a link between people and the environment that is constantly changing. These design elements are the most important remnants of human activities from the past to the present. (Per&friends, 2013). Nowadays, the dwellings built away from the known dwelling type are transformed into structures which give importance to the exterior appearance, offer many opportunities to the user and become an expression of social status (Edwards&friends,2005). Residential units are architectural structures in which the freedom of creation within the design itself can be ensured (Broto, 2000). In the residential area, the garden serves as the social center of the family and it is also seen as the place where various guests can be accommodated (Song&friends,2011). Residential landscape areas constitute the smallest unit of green areas. Gardens of single or multi-storey houses, terraces and roof gardens, balcony arrangements are evaluated within this unit. At this level, the building and the garden are integrated. It is generally defined as front, side and back garden. Its size, functions and aesthetic activities play an important role in relation to the cultural and economic status of the landlords as well as the physical and social characteristics of the city (Gül and Küçük, 2001).

In the landscaping works, the implementation of the landscape design process in the stages from the design to the implementation of the project is necessary in order to reach the needs, ecological priority, qualified, functional and aesthetic standards in urban areas and provide the expected benefits from these areas (Şişman&friends2008; Polat and Önder, 2012). The finalization of the design process with a viable product can be achieved by monitoring and synthesizing the steps in the design process (Çınar, 2008).

These stages begin with the acceptance of the proect construction by the user or the employer and the creation of the site layout plans. Then, a survey about the area where the landscape project will be carried out inventories are collected within the scope of the study. These inventories are covered by topography, soil structure, climate data, vegetation, land use, landscape damages and infrastructure. After the field inventories are collected, project analysis is performed within the scope of this information and data. In the vicinity of these studies, the preliminary project should be created together with the stain studies in line with the thoughts and wishes of its users. The function studies carried out at all these stages need to be transformed into form in the final project formation. In the last stage of the application project, structural and plant elements are completely solved and the landscape project is terminated according to the finest details and features in terms of technical aspects.

Landscape architecture is in a basic relationship with the environment. The places where the landscape will be applied have their own features. Landscape areas are generally damaged or empty areas from pre ious activities. Landscape applications in these areas contribute to the environment, but can also bring nega ive results in wrong applicaions (Smith&friends, 2008).

Landscape applications are carried out in various stages of herbal and structural. These are shaped like application of the project, construction of structural elements, irrigation installation, lighting installation, soil reclamation, plant material planting, planting grass and garden equipment, etc.

3. Materials and Methods

3.1. Materials

The main material of this research is constituted by the Konya Chamber of Commerce and the contractor firms which work in the field of housing construction affiliated to Komüt (Konya Contractors Association) (Figure 1). Graduate theses, scientific researches, books and related literature were used to form the theoretical foundations of the research. Survey forms were designed to determine the approach of the contractor firms towards the housing landscape. SPSS 22 software was used in the statistical analyzes to be applied to the findings obtained from Microsoft Office software during the writing phase. Chamber of Commerce and Konya Contractors Association data's, satellite pictures for information, zoning plans, aerial photographs and so on materials provided. In addition, cameras, voice recorders were used in the study.

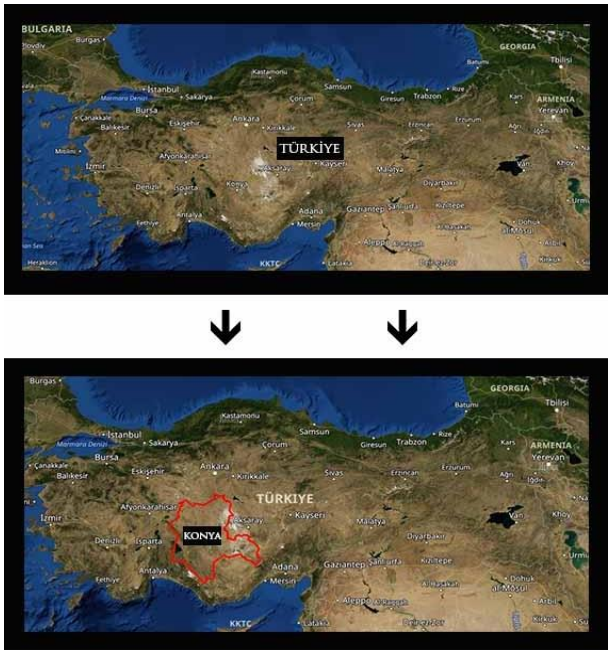

Figure 1
Location of the Research Area

3.2. Methods

The method of the study was carried out in three stages. In the first stage, after determining the purpose and scope of the study, theoretical foundations were formed in line with the literature reviews and the data gained. In the second stage, construction firms were identified and surveys were designed. In the last stage, the information and data obtained were arranged and analyzed, and the results and recommendations were presented.

With in the scope of the survey, 31 questions were asked to the contractor company authorities under the headings of landscape projects, landscape applications, economic dimension of landscape and experiences. Four of the questions were open-ended and the others were five-choice (likert scale) multiple choice. All contractor companies affiliated to Konya Contractors Association were accepted as universe size and the sampling size was calculated as 97 with 95% confidence interval and 0.05 error margin (Newbold,1995). The survey was conducted through face-to-face interviews with 97 contractor company officials.

The data obtained from the survey forms were first edited in Microsoft Office Excel software and then transferred to SPSS 22 statistical software and analyzed. Frequencies of multiple-choice questions were removed and open-ended questions were analyzed and their common points were reflected in the findings and recommendations. The research findings were discussed and suggestions were made for housing contractors, landscape architects, architects and occupational groups and organizations in the sector.

4. Results and Discussion

4.1. Results for Landscape Projects

In the case of Konya, 97 contractor company officials were asked about their approach to constructing a landscape project: 8 people neutral, 41 people positive and 48 people stated that they strongly positive (Figure 2). The housing projects of the contractor firms continue to respond to many demands in today's conditions. One of these works within the scope of housing projects is landscape. Landscaping is not only an application but also an element that needs to be designed. The contractor companies are aware of this and they give an opinion about the construction of landscape projects with a very high rate.

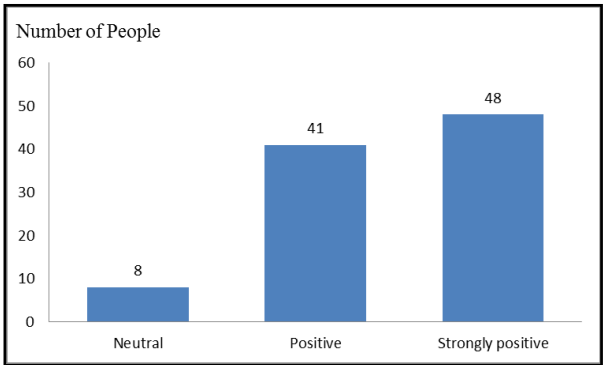

Figure 2
Contractor firms approaches to landscape design

In the questionnaire posed to the contractor firm authorities regarding the perception of the contractor firms from different occupational groups that a landscape project was carried out; 46 people positive, 10 people strongly positive, marking their options reveals that landscape projects are done by different professional groups (Figure 3). In order to change this table in the coming period, these sensations of the contractor companies should not be ignored and the necessary arrangements and precautions should be taken by professional organizations, chambers and municipalities by evaluating the results.

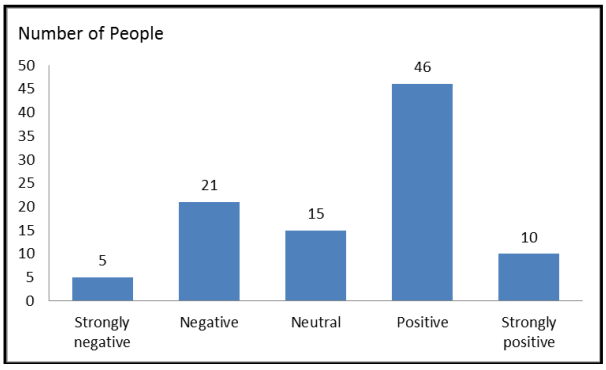

Figure 3
Contractor firms from different professional groups have heard about the landscape project

It is seen that the normal option is given by 40 people in the answers of the question about the possibilities of the contractor company authorities to reach the

landscape architect in their landscape project requests (Figure 4). In recent years, the increasing popularity of landscape architecture has become a sought-after profession in demanding contractors. However, market conditions cause the number of landscape offices to be limited. For this reason, employment problems arise for landscape architects and there is not much demand and opportunity to reach landscape architects without commercial identity.

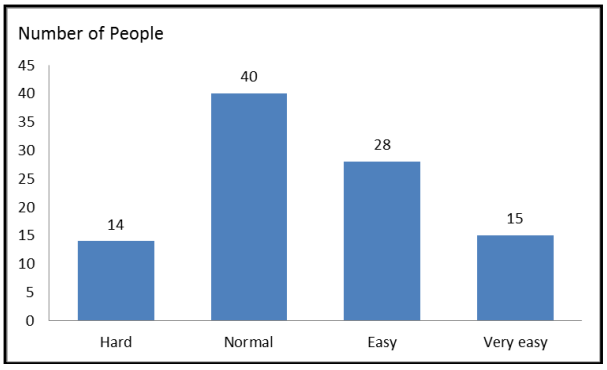

Figure 4
Opportunities for contractor firms to reach landscape architects for landscape project requests

Within the scope of the survey, when the results of the landscape projects undertaken by the contractor company officials within the scope of housing projects are examined; 19 people never, 52 people between 1-5, 13 people between 5-10, 5 people between 10-20, 8 people stated that they have built more than 20 landscape projects (Figure 5). It is foreseen as a result of the bilateral communications established during the survey that the contractor firms will have more landscape projects done in the future. The major contributors to this are the municipalities that license the constructions, the ministry of environment and urbanism, conscious housing customers and qualified contractor firms.

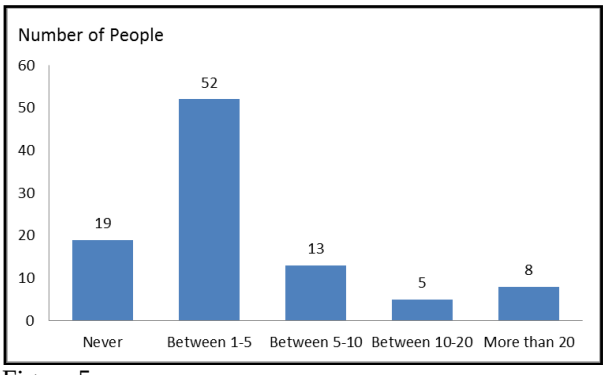

Figure 5
Number of landscape projects undertaken by contractor companies within the scope of housing projects

When asked the opinions of the contractor company authorities about the quality of the landscape projects carried out in the market, 2 people are very unqualified, 20 people are unqualified, 57 people are normal, 14 people are qualified, and 4 people expressed their opinions as highly qualified (Figure 6). Landscape projects in the market are carried out as much as possible with the wishes and the customers. However, when designing landscape projects, they are also designed by various occupational groups without conforming to certain standards. This standard is foreseen by the contractor companies during the survey process, which will not occur if the municipalities do not want landscape projects in the construction license. Looking at this result, landscape projects in the market can not be said to be highly qualified. The most important responsibilities here are the landscape architects.

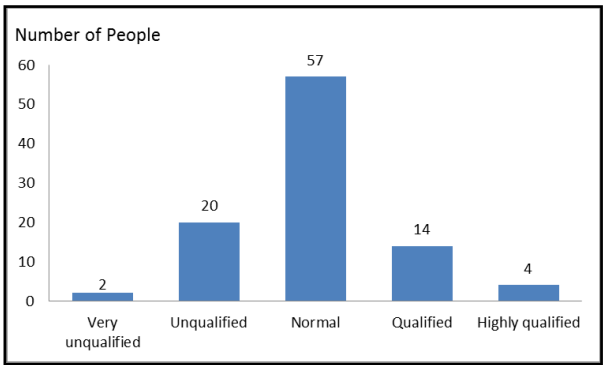

Figure 6
The opinions of the contractor firms about the quality of landscape projects in the market

Looking at the responses to the contribution of landscape projects to the promotional materials of housing projects, 6 officials think that landscape projects do not have any impact, but a large majority do (Figure 7). The main purpose of the contractor firms is to sell the houses they produce in the most profitable economic conditions. So much so that publicity and advertising play a very active role in the sales of today's houses. Houses are sometimes sold from models, sometimes from models, catalogs and even architectural projects. The contractor companies are aware of this and try to use landscape elements as efficiently as possible in their projects.

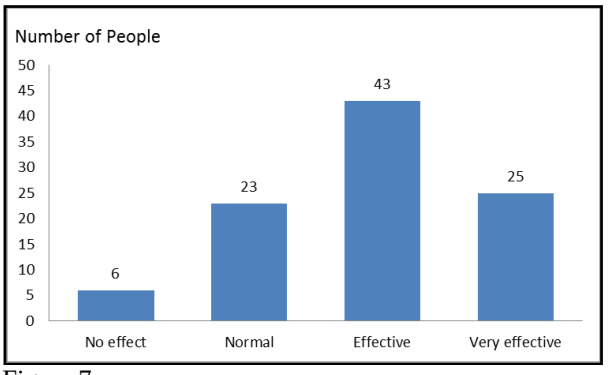

Figure 7
Contribution of landscape projects to the promotional materials of housing projects

According to the responses of the contractor company officials about the request of the construction projects of the landscape projects, 12 people strongly negative, 23 people negative, 16 people neutral, 34 people positive and 12 people have expressed their opinion are strongly positive (Figure 8). Municipalities in the process of buying residential buildings construc-

tion permits; They require the architectural project of the architect, the static project of the civil engineer, the mechanical project of the mechanical engineer, the electrical project of the electrical engineer, the ground survey report prepared by the geological engineer and the application projects of the map engineer. In addition to all these, after the necessary documents are issued, a construction license is given with the building inspection. All these desired projects and documents are submitted to the municipality in a complete manner and it is committed to the municipality where these procedures will be implemented in accordance with the requirements. After the completion of the construction, the municipal authorities supervise the applications and grant a residence permit to these buildings. However, any landscape architect's landscape project is not requested by the municipalities at any stage. For this reason, many buildings in the market are built without any landscape projects; Landscape projects are sometimes carried out by landscape architects and sometimes by different occupational groups without any supervision concerns. This situation is visually and functionally encountered in housing landscapes with various negativities. Even though the landscape projects requested by the municipalities after having passed the number of independent sections with the recent legal regulations have found their place in the positive parcels of high numbers, it is still worrying that the landscape projects cannot find a place in the construction licenses granted by the municipalities in all housing projects.

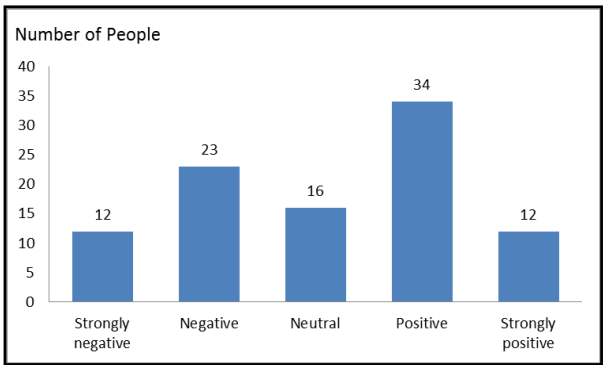

Figure 8
The opinions of the contractor companies about requesting the construction projects of the landscape projects

4.2. Results for Landscape Applications

When the Contractor raises questions within the scope of the opinions of the authorities on the necessity of landscape applications within the scope of housing projects; 2 people negative, 7 people neutral, 49 people positive, 39 people strongly positive (Figure 9). The contractor firms that compete with each other in housing sales are exposed to a wide variety of structural and plant applications in landscape applications. As can be seen from the results of the survey, contractor companies are quite aware of the necessity of landscape applications. However, during the survey period, the contractor firms we interviewed expressed their complaints that the landscaping applications they had made within the scope of the housing projects were not carried out properly in the later processes.

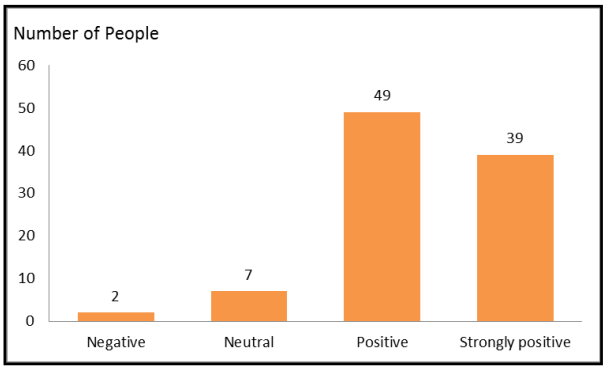

Figure 9
The opinions of contractor firms about the necessity of landscape applications within the scope of housing projects

Within the scope of housing projects, according to the answers given to the question about the occupational groups which the contractor company authorities have made the landscape applications; 44 people are landscape architects, 8 people are interior designers, 19 people are architects, 3 people are urban planners and 23 people are selected as other (Figure 10). Professional hands are needed to create accurate and qualified landscape areas. Although the contractor firms often make the landscape architects work with the landscape architect, the site supervisors he works with are involved in the landscape applications.

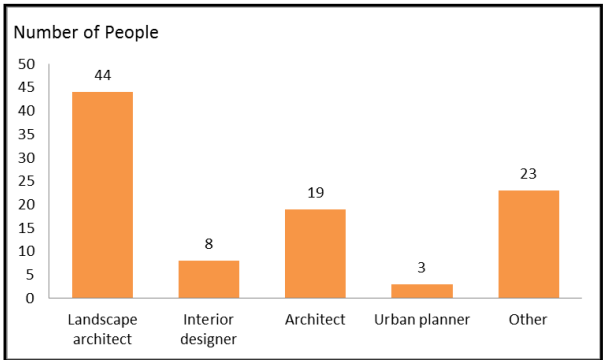

Figure 10
Professional groups in which the contractor firms have built landscape applications within the scope of housing projects

When asked about the opinions of the contractor firms about the implementation of landscape applications by a landscape architect, 5 people negative, 21 people neutral, 48 people positive and 23 people stated strongly positive (Figure 11). The results clearly show the awareness of contractor firms towards the landscape architecture profession.

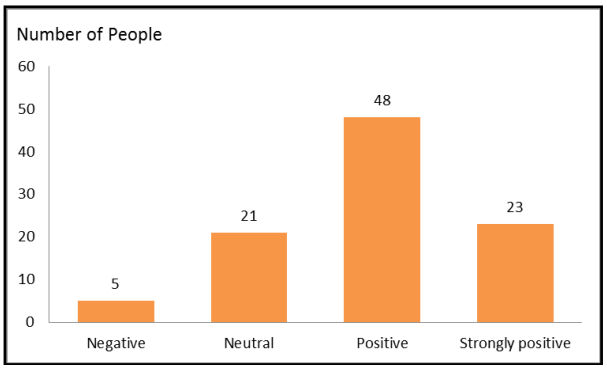

Figure 11
The opinions of the contractor firms about the implementation of landscape applications by a landscape architect

In the survey conducted on the quality of landscape practices in the sample of Konya, 97 contractor firms were asked, 4 of them were very unqualified, 23 were unqualified, 52 were normal and 18 were qualified (Figure 12). According to this result, it cannot be said that residential landscapes are qualified within the scope of Konya Province. Based on the nature of landscape applications, it is possible to say that the only factor here is not the contractor company. Landscape projectors and subcontractors, which are the other factors in practice, also share in the quality of landscape applications.

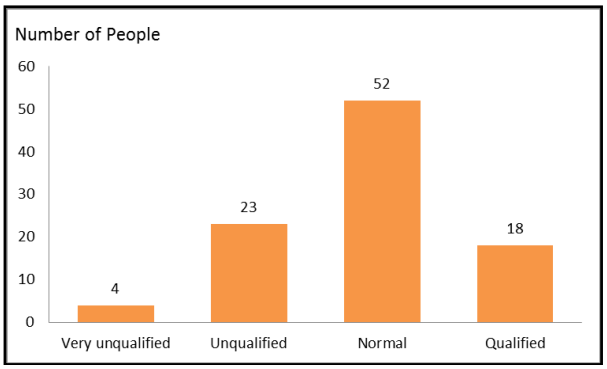

Figure 12
The opinions of the contractor companies about the quality of the landscape applications in the market

In the survey conducted in the sample of Konya province, in the survey conducted with 97 contractor company officials, 4 people never effective, 9 people stated that they were connected to landscape projects in landscaping applications at low level, 39 people at medium level, 39 people at high level and 6 people at very high level landscape applications (Figure 13). It is not very accurate to distinguish between project and application within the concept of landscape. In order to complete and correct the landscape application, a landscape architect must first make a landscape project. One of the reasons for not adhering to the landscape project in landscape applications is finance. Landscape applications, which come to the end of construction works, are one of the items that suffer most from this negativity when the financial resources of the contractor companies are exhausted. High budget plants and structural landscape elements are being replaced by their more economical counterparts. Another point is that landscape projects are not feasible.

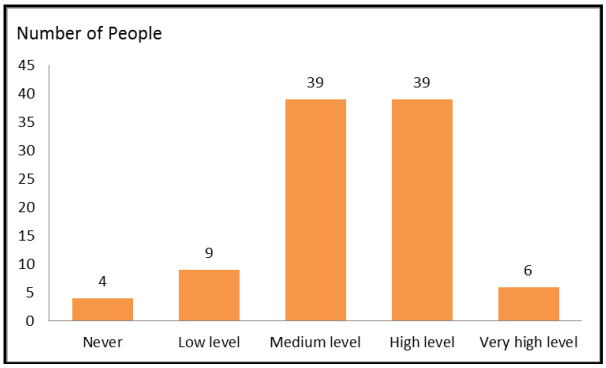

Figure 13
The level of commitment of the contractor firms to landscape projects in landscape applications

According to the answers given to the opinions of the contractor firms about the effectiveness of the landscape architect in the construction of the structural elements of the residential landscape; 2 people were never effective, 11 were low, 46 were moderate, 35 were high, 3 were very high (Figure 14). Landscape architects are obliged to design landscape areas as well as plant elements as well as structural elements. Solving these two elements in a qualified way is one of the main duties of landscape architects in their projects. A landscape architect should play an active role especially in plant applications.

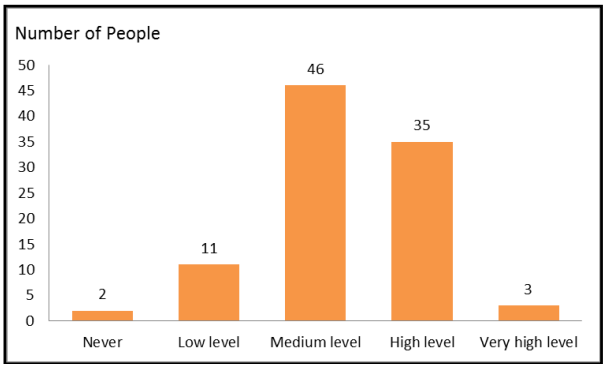

Figure 14
The opinions of the contractor firms about the effectiveness of the landscape architect in the construction of structural elements of the residential landscape

According to the answers given to the survey question which includes the opinions of the contractor firms about the effectiveness of the landscape architect on the residential landscape planting activities; 10 people were low, 42 were moderate, 40 were high, 5 were very high (Figure 15). Since the plants, which are the basic principles of residential landscape areas, are a living entity, species selection and plantation should be done with care. The landscape architect plays an active role from the project drawing stage to the application of the plant to the soil. Another important issue is to determine the characteristics of plants well.

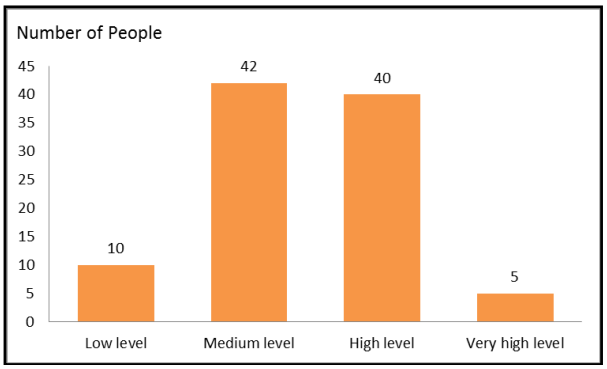

Figure 15
The opinions of the contractor firms about the effectiveness of the landscape architect on the residential landscape planting works

According to the opinions of the contractor companies in terms of their level of taking into consideration the characteristics of plant materials used in landscape applications; 2 people did not take into account at all, 10 people at low level, 33 people at medium level, 41 people at high level, 11 people stated that very high level (Figure 16). It is very important to consider the length and volume of plant materials used in landscape applications to reach their mature ages. It is seen that more than half of the contractor firms take this element into consideration. Sustainability of qualified landscapes requires to be valid not only in today's conditions but also in future periods.

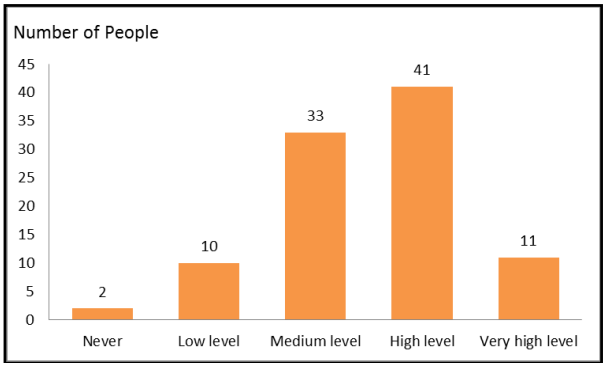

Figure 16
The level of consideration of the characteristics of plant materials used in landscape applications by contractor companies

The opinions of the contractor firms on the effectiveness of independent department sizes in landscape applications were revealed that 4 people did not affect at all, 12 people at low level, 49 people at medium level, 25 people at high level and 7 people at very high level (Figure 17). Assuming that user profiles are the most important factor in qualified residential landscape areas, it is possible for independent section sizes to affect landscaping applications, even indirectly. When this situation is taken as a basis, it is mainly at the moderate levels that the independent section sizes affect the landscaping applications in the houses constructed by the contractor firms in Konya. This shows that the mold projects are being implemented with small changes in many residential areas.

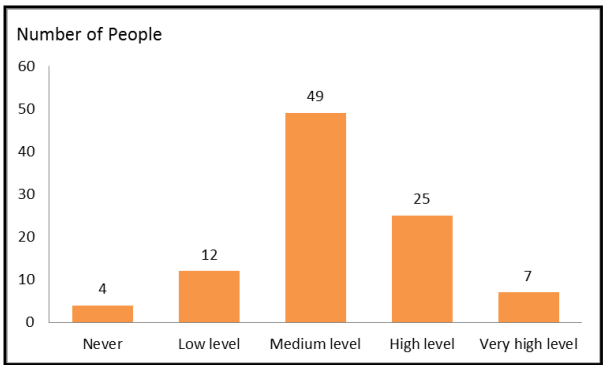

Figure 17
The opinions of the contractor firms on the effectiveness of independent department sizes in landscape applications

4.3. Economic Evaluations

When 97 contractor company officials were asked about the effectiveness of landscape in housing prices in Konya, 4 people had no effect, 13 people had low level, 31 people had medium level, 40 people had high level and 9 people had very high effect (Figure 18). The biggest purpose of the contractor companies in housing production is to sell the houses they produce at the prices they want. The difference that the landscape adds to the structures with its plant and structural qualities is one of the leading reasons that attract customers.

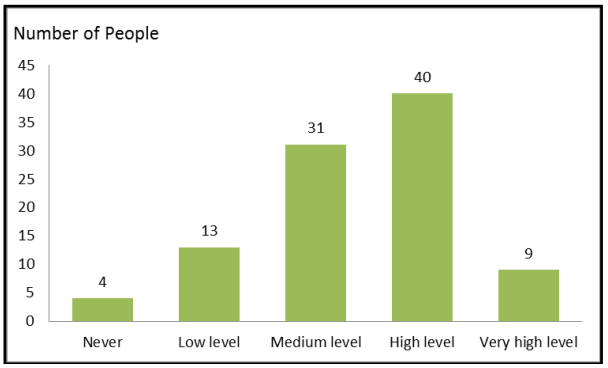

Figure 18
The opinions of the contractor firms on the effectiveness of landscape in housing prices

In the survey conducted in the Konya province, when asked to take into account the landscape costs in the cost analysis conducted before the contractor companies, 5 people were never present, 19 people were considered low, 41 people were considered medium level, 29 people were considered high level and 3 people were considered very high level (Figure 19). Housing prices need to be determined by various cost analyzes before they start work. This cost analysis is to collect various items of construction and calculate them with different methods. Considering the effect of landscaping on sales, it is quite possible to create a landscaping area in residential parcels.

These landscape areas should be put into the costs before starting the construction work. Cost analysis that is not well done either causes contractor firms to be damaged or requires certain items to be waived.

Landscape, which is one of the last items in terms of construction techniques, is the factor that receives the most from these negative situations.

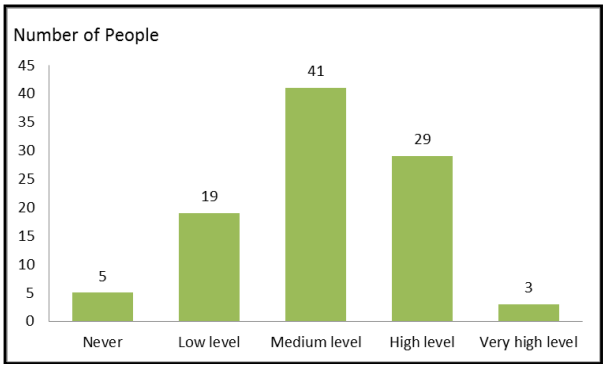

Figure 19
The degree of consideration of landscape costs in the cost analysis of the contractor firms before starting work

Considering the situation regarding the budget levels allocated by the contractor firms for landscape projects; 3 people did not allocate at all, 15 people at low level, 69 people at medium level, 9 people at high level, 1 person stated that they have a very high level budget (Figure 20). Necessary budgets are allocated for landscape projects in high number of residential works with high return and profit rates. According to this result, the contractor firms do landscape projects with moderate budgets without spending much money. Assuming that cost and prices are the focal point, it is important that contractor firms are able to produce quality jobs with moderate budgets.

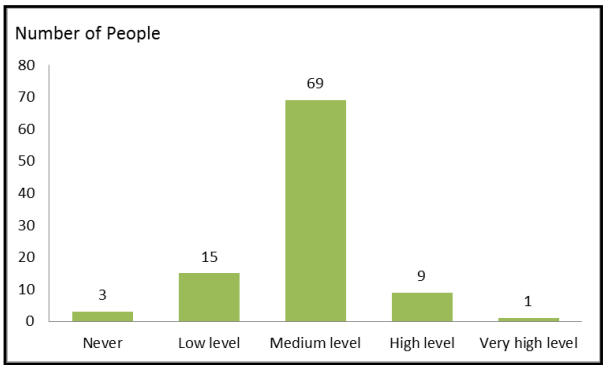

Figure 20
Budget levels allocated by contractor firms for landscape projects

In the survey conducted in Konya province, when asked the contractor firms about the budget levels allocated for landscaping applications in accordance with standards, they stated that 1 person did not allocate at all, 14 persons at low level, 67 persons at middle level, 14 people at high level and 1 person at very high level (Figure 21). In this case, contractor companies generally prefer to allocate a medium level budget in landscape applications according to the standards. Contractor companies are mostly aiming to do a lot of work with low cost. This is one of the most important factors in every stage of construction, not only in the landscape area. However, although cheap labor and materials provide economic advantages to the contractor in the short term, repairs and alterations due to cheap materials and labor in later periods create negative effects both for the housing users and the contractor companies.

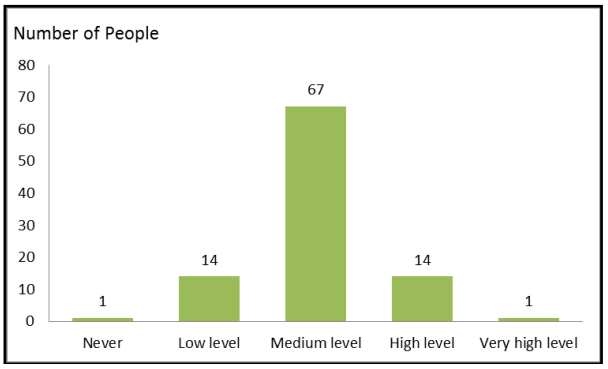

Figure 21
Budget levels allocated by contractor companies for landscape applications in accordance with standards

According to the answers of the questionnaire related to the level of taking into account the price relationship between the characteristics of plant materials (height, body thickness, appearance, root condition); 3 people do not take into account at all, 10 people at low level, 54 people at medium level, 26 people at high level, 4 people stated that very high level (Figure 22). Plants that are bulky in size and showy are always remarkable. However, these plants are more costly than plants of less volume and size. This value is determined by the age of the plant and the maintenance effect given up to that year. Contractor companies want to use quite showy and tall plants in the gardens of their houses. However, in view of cost and finance, this is often not possible. Although this difference is economically beneficial to contractor firms, it causes a lot of loss to the land users in terms of landscaping until they reach the standards of the plants.

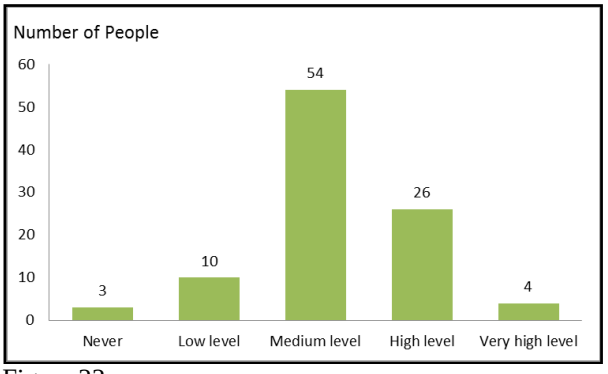

Figure 22
The level of the contractor firms to consider the relationship between the quality and price of plant materials

When asked the contractor firms the level of consideration of the quality of structural materials and price relations, 9 of them stated that they considered low level, 48 of them considered medium level, 36 of them considered high level and 4 of them considered very high level (Figure 23). The diversity in structural materials eliminates uniformity in landscape applica-

tions and projects. Providing a wide range of products to their customers, suppliers strengthen the hands of project architects and implementers. Concrete, wood and metal-containing materials are used in many structural areas of the landscape. Raw materials of this structure are processed and various landscape elements such as floor coverings, lighting, garden furniture, pergola and bench are created. These elements determine the type of material used, the design, the workmanship and the prices of the raw material products. At the same time, whether domestic or imported production is an important role in price. Contractors want to use these structural elements according to the housing classes they produce. Based on this result, the level of taking into account the relationship between the quality of the structural materials and the price shows a moderate and high tendency.

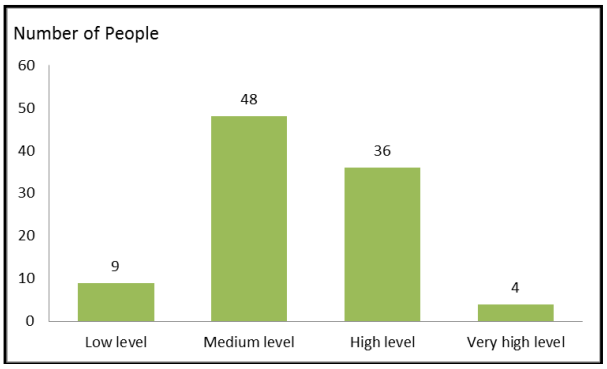

Figure 23
Contractor firms level of consideration of the relationship between the quality of structural materials and price

When asked the contractor firms about the contribution of landscape projects in housing sales; 2 people have no contribution, 5 people low contribution, 27 people normal, 43 people contribution, 20 people have stated that high contribution (Figure 24). Landscape projects affect housing sales in many ways. These effects are seen both in the pre-sales promotional catalog brochure signs and at the end of the construction. As it can be seen from the results of the survey, contractor firms believe in the contribution of landscape projects in housing sales.

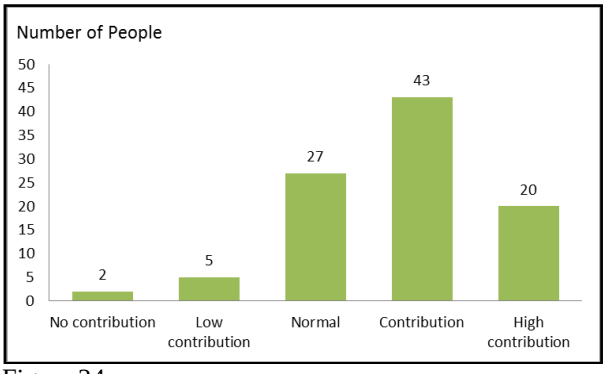

Figure 24
The opinions of the contractor firms on the contribution of landscape projects in housing sales

When asked about the contribution of the landscaping applications to the housing sales of the contractor companies; 2 people have no contribution, 5 people low contribution, 33 people have normal, 39 people contribution, 18 people have stated that high contribution (Figure 25). The landscape areas add a lot of quality to the houses but make the houses complex structures where children can play outside, families go out and spend time in the garden areas and even relieve the stress of the day in the sports fields. As can be seen from this result, the contribution of landscape applications to housing sales is quite high. It is accepted that one of the building blocks of qualified houses is landscaping.

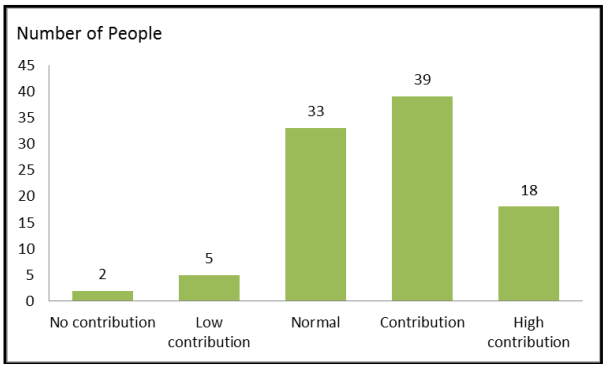

Figure 25
The opinions of the contractor firms on the contribution of landscaping applications in housing sales

4.4. Evaluation Based on Experience

When the satisfaction levels of the landscape projects undertaken by the contractor companies are examined, it is observed that 1 person is not satisfied at all, 15 people are at low level, 45 people are at medium level, 35 people are at high level and 1 person is at very high level (Figure 26). According to this result, it is observed that contractor companies are mostly satisfied with the projects they have commissioned.

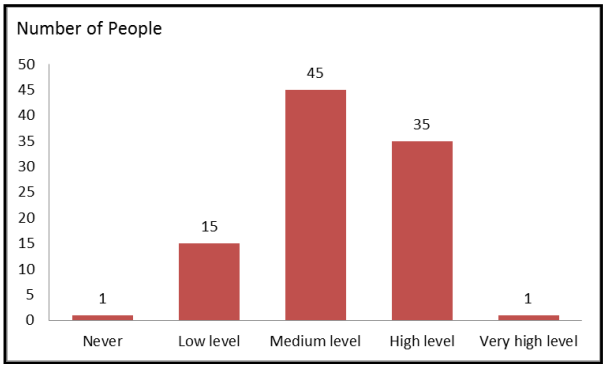

Figure 26
Satisfaction levels of landscape projects undertaken by contractor companies

When the satisfaction levels of the contractor firms for landscape applications are examined; 1 person was not satisfied at all, 12 people were at low level, 49 people were at medium level, 33 people were at high level, 2 people were at a very high level of satisfaction (Figure 27). According to this result, it is seen that the

contractor firms are satisfied with the landscaping applications at a moderate level.

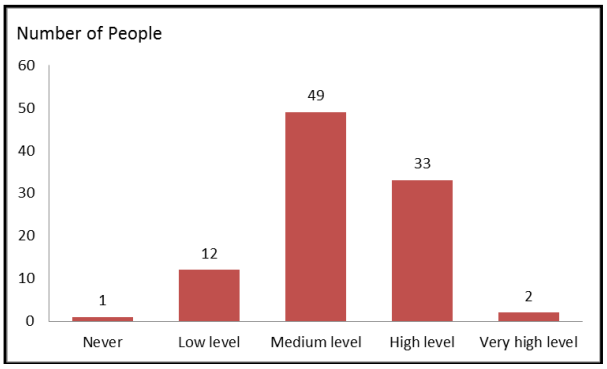

Figure 27
Satisfaction levels of the contractor firms for landscape applications

Satisfaction levels of the customers regarding the residential landscape of the contractor firms were found to be 2 people not satisfied at all, 7 people at low level, 38 people at medium level, 45 people at high level and 5 people at very high level (Figure 28). The housing sector, which has developed quite recently, increases the demands and expectations expected from the residence. However, the concept of satisfaction in contracting markets is very important for contractor companies. According to this result, it shows that contractor companies are highly satisfied with the landscape of their customers within the scope of housing projects.

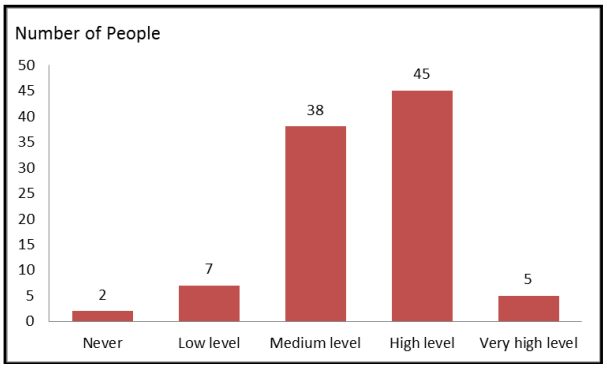

Figure 28
Satisfaction levels of customers related to residential landscape by contractor firms

When asked about the applicability percentages of the landscape projects of the contractors; 3 people were between 0-20%, 17 people were between 20-40%, 27 people were between 40-60%, 32 people were between 60-80%, and 18 people were between 80-100% (Figure 29). According to this result, the applicability of the landscape projects commissioned by the contractor firms shows a high tendency. It is reported that the landscape projects cannot be implemented in the options where the result is low, and the contractor companies cannot get the efficiency from the landscape projects they pay a certain price.

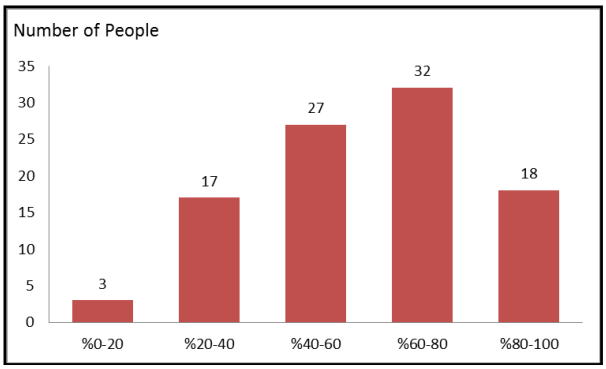

Figure 29
Applicability levels of landscape projects undertaken by contractors

5. Conclusion and Suggestion

The contractor firms have generally positive approaches to landscape projects within the scope of housing projects. This shows that the existence of landscape projects within the scope of housing projects will be seen more. Landscape projects are not considered in housing projects in most cases because they are not legally required. Therefore, a landscape architect is not needed for landscape projects under market conditions. This situation confirms the sensations that different professional groups of contractor firms are also doing landscape projects.

As it is seen in the survey, when the quality of the landscape projects of the contractor firms is asked, the landscape projects in the market are not considered sufficient in terms of quality. Landscape projects are not required in the construction permits issued by the municipalities unless the housing independent sections exceed a certain number. The negative effects of this situation mostly affect landscape architects and residential users. Projects carried out outside a certain authority often remain as non-feasible drawings, which are analyzed in unqualified complexities. Although a certain part of the contractor companies is aware of this and foresee that the landscape projects be requested by the municipalities, a certain part does not want to deal with the municipalities during the construction license stage of the landscape projects.

Landscape architects should transfer their acquired knowledge and experience to their work. Aware of the gains it brings, the contractor firms think that landscape architects have a high level of efficiency in residential landscape structural elements. Companies that do not have sufficient experience and awareness about this issue think negatively.

Plant elements in landscape applications require more knowledge and experience than structural elements. Professional discipline in this field is landscape architecture. The contractor companies, which are aware of this, see the impact of landscape architects at high levels in the planting of residential landscape. Since plants are a living entity, they show different developments after planting. Therefore, plants should

be planted according to the height and volume they will receive in the future. This issue is very important in landscape applications. Although some of the contractors that are aware of this issue pay attention to this element, this awareness is not seen much in practice yet.

Landscape has a direct impact on house sales prices within the scope of the quality it provides to the housing. The contractors that are aware of this place give the necessary importance to the landscape within the scope of housing projects.

Although landscape is now being implemented within the scope of most housing projects, it is not at the forefront of the cost of contractor companies in the cost analyzes made before starting work. In terms of construction techniques, landscape, which is implemented in the last stages, can bring extra burden to the contractor companies if the cost calculations are not done correctly. The budgets allocated for the landscape projects by the contractor firms remain at the middle and lower levels. The contractor firms that allocate middle and lower budgets for landscape projects follow the same path in landscape applications. Considering the contribution of landscape to house sales and prices, it is seen that the budgets allocated to projects and applications are insufficient.

Landscape applications have a direct contribution to housing sales. In today's conditions, landscape has an important place within the scope of housing projects. The contractor companies, which are aware of this, are one step ahead of their competitors with their landscape applications.

The contractor companies are satisfied with the landscape projects they have commissioned at medium and high levels. Here, it is important that contractor companies do not have their landscape projects completely done to landscape architects. Contractor companies are generally satisfied with medium and high levels in landscape applications as in landscape projects.

Many professional groups close to landscape architecture keep these works in their fields of activity. It is not right for individuals and legal persons who have not received training and experience who have not been trained in a job to do these works. Landscape architects should be more effective and have a say in the market share. Local authorities, professional chambers, universities and most importantly landscape architects have a great duty to do this

As a result of the survey conducted with contractor firms in Konya, it is seen that landscape architects are not so easily reached. Considering that the cake share is also limited, landscape architects in the market need to increase their accessibility.

The quality of the landscape projects and implementations in the market should be increased. The easiest and simplest way to increase this is by subcontracting contractors' landscape projects to skilled landscape architects.

Within the scope of obtaining construction permits by local authorities, landscape projects must be requested. Even if municipalities want landscape projects up to a certain number of independent departments, it is absolutely necessary to request these projects in all residences within the scope of housing projects. When this requirement is fulfilled, since the landscape architects will sign the landscape projects, the contractor firms' working rates with the landscape architects will also increase substantially.

The activities of landscape architects on plant and structural materials and implementation of a landscape application by the landscape architect should be explained to the contractor companies in detail. When contractor firms realize the importance of working with landscape architects, they will inevitably see positive results in their work.

Contractors mostly want to reduce the cost of their landscape applications within the scope of housing projects. However, in some cases, the quality decreases while the cost decreases. Decreasing quality means going beyond the standards in landscape applications. This is especially the case with herbal elements. The contractor companies prefer small plants in their applications because of their favorable prices. While preferring these particular plants, they often sow the plants without considering the height and volume they will receive in future periods. In order to prevent this situation, the necessary institutions, organizations, professional chambers and local administrations should be given training to the contractor companies.

With this research, it has been determined that the approaches of the contractor companies towards landscape projects and applications are positive. This result shows that landscape works in the housing sector will progress rapidly in terms of quality and quantity in the coming years.

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Evaluation of Ovicidal Effect of Extracts from Hop, Oregano, Lemon Balm and Clove on the Sunn Pest, *Eurygaster maura* L. (Hemiptera: Scutelleridae)**

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ABSTRACT

Botanical insecticides may be an alternative to minimize or replace the use of synthetic chemical insecticides against pests of agricultural importance. In this search, the ovicidal effects of four plant extracts Lemon Balm *Melissa officinalis* L, Hop *Humulus lupulus* L, Oregano *Origanum vulgare* L. and clove *Syzygium aromaticum* (L.) were tested against *Eurygaster maura* L. (Hemiptera:Scutelleridae) under laboratory conditions. One to three-day-old eggs were dipped in plant extracts. The effects of three concentrations of plant extracts 2.5, 5 and 10% were studied. It was observed that as the concentration increased, the inhibition of egg hatchability increased. Lemon Balm extract didn't show significant ovicidal effect. On the other hand, Oregano and clove extracts moderately showed ovicidal effect. Hop extract revealed the best result in inhibiting egg hatchability (57.49%) at 10% concentration. It can beconcluded that hop extract may be used as supportive in an integrated pest management programme aimed at controlling *E.maura*.

1. Introduction

The Sunn pest, *E. maura* is a very damaging insect pest of wheat and barley which are important crops in Turkey (Lodos, 1982). It has occurred a trouble in Middle Anatolia, particularly in Aksaray, Konya, Ankara and Kırşehir since 1995 (Şimşek et al, 1996). The Sunn pest feeds on ripenning wheat grains, damaged grains largely fall the quality of the cooking of the leaven. The stages of late nymphal development and the intensive feeding of newly emerged adults are important phases in the biological cycles for *Eurygaster* spp. In the early instars nymphs don't feed intensely. Feeding densities and the damage to crops increases rapidly after the third instar. The newly emerged adult insects begin to feed on wheat grains intensively (Paulian and Popov, 1980; Popov et al, 1996). The Sunn pest, during feeding with its piercing-sucking mouthparts, injects protein-degrading enzymes from salivary glands into the cereals to soften the food. As a result of feeding, the enzymes induce quick relaxation of dough, which concludes in the production of bread with a low volume and coarse texture (Boyd et al, 2002).

Many plants have been demonstrated to have insecticidal, ovicidal, anti-ovipositional effect, antifeeding and other features, which are helpful in pest management (Ertürk et al, 2006; Yanar and Düzdemir, 2012; Elma and Alaoğlu, 2014a; Taş et al, 2015). Plants consist of a plentiful source of bioactive chemicals (Kim et al, 2005). Monoterpenes, triterpenes and sesquiterpene lactones are samples of such metabolites that may have the commercial application (Heywood et al, 1977; Barney et al, 2005).

Turkey has an extraordinarily rich flora (Şimşek et al, 1996). In this study, the ovicidal effect of extracts of four plants, which exist in Turkish flora were determined under laboratory conditions against the sunn pest *Eurygaster maura* L. (Heteroptera: Scutellaridae).

2. Materials and Methods

2.1. Insect rearing and egg production

Eurygaster maura adults were collected from overwintering sites in Karadağ - Karaman Province, Turkey, and proceed with plucked fresh wheat plants in the laboratory at 26±1° C under long day photoperiod

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(16:8 h light and dark). After the eggs were laid by the adults, on the wheat leaves and white paper napkins, these eggs were collected daily and used in this study (Kıvan, 2005).

2.2. Plants and sample preparation

The different parts (from leaves, flower buds or aerial parts) of lemon balm, hop, oregano and clove are used in this study (Table 1).

Table 1
List of the plant materials used against *Eurygaster maura* eggs.

Family	Plant name	Tissue Used
Lamiaceae	Lemon Balm	Leaves
Cannabaceae	Hop	Flower buds
Lamiaceae	Oregano	Aerial parts
Myrtaceae	Clove	Flower buds

They were dried at room temperature and were shredded to small size with a grinder (Retsch SM100). Five hundred grams of methanol (Merck % 99.5) is added to 50 grams of dried plant and allowed to stand for six days in the dark. Then the plant suspension was sieved through Whatman No.1 filter paper before methanol was vaporized in a rotary evaporator (Heidolp-VAP Precision) at 35 ± 2°C. The resulting residue was dissolved in the pure water including 10% acetone (v/v) to yield doses containing 2.5%, 5%, and 10% (w/w) plant extract. The control solution consisted of 10% acetone in distilled water (v/v).

2.3. Ovicidal activity of plant extracts on eggs

The ovicidal activity of plant extracts was assessed against *E.maura* egg mass, aged one to three days old three egg masses (41-42 eggs) were dipped into different concentrations of plant extracts for three-five minutes. Eggs were then directly taken to a filter paper to soak in the surplus solution and dried for half an hour at the room temperature. After that, these eggs were placed in a petri dish. The eggs were incubated conditions at 26±1°C, 16 h light: 8 h dark for 7-8 days. The numbers opened and unopened eggs were counted. The experiment was repeated three times. Each assay was consisted of three concentrations of plant extracts and one control. Unopened eggs were counted as dead. The ovicidal activity evaluating experiment data were calculated by emergence inhibition index (EII) (Ma, 2001) and calculated by the formula: EII= [(C – T)/C] 100%, Where T is emergence in the treatment and C is emergence in the untreated control (Mulla and Darwazeh, 1979).

3. Results and Discussion

The ovicidal effect on *E. maura* eggs of plant extracts, lemon Balm, hop, oregano and clove, is presented in table 2. Plant extracts showed variable toxicity to eggs of *E. maura* (ranged from 2.49 to 57.49%). The inhibition of egg hatchability decreased significantly with plant extract concentration. Hop extract revealed the best result in inhibiting egg hatchability (57.49%) at 10% concentration. Ovicidal effect for oregano and clove extracts was moderate and EII was 35%, 32.5% at 10% concentration, respectively. The inhibition of hatchability of the Lemon Balm extract was low and ranged from 2.49 to 15%.

Table 2
Ovicidal effects of different concentrations of plant extracts against the eggs of *E. maura* (expressed by emergence inhibition index % (EII))

Materials	EII (Mean ± SE) Concentrations (%)		
	%2.5	%5	%10
Lemon balm extract	2.49±0.57	10±0.57	15.01±0.33
Hop extract	12.49±0.66	30±0.88	57.49±1.20
Oregano extract	4.99±0.33	17.49±0.57	35±0.33
Clove extract	7.49±0.66	22.50±0.33	32.50±0.57

The results showed that the percent kill of egg masses of extracts were constantly increased by depending on the extract concentration. Similar results were reported by other studies in which different extracts had a dose-dependent effect on insect (Ouda et al, 1998; Phasomkusolsil and Soonwera, 2012; Zambare, 2012).

Secondary organic compounds contained in plants have a significant potential in pest management. It has been reported that these compounds exhibit toxins, ovicidal, repellent, oviposition deterrents and feeding deterrents on pests (Isman, 2006). There have been many studies on the ovicidal effect of the plant extracts to several species in different insect orders. (Javaregowda and Krishna Naik, 2007; Zambare et al, 2012; Yorulmaz Salman et al, 2014; Yorulmaz Salman et al, 2015; Alkan and Gökçe, 2017). But few studies reported on ovicidal effect of plant extracts against Sunn pest. Kıvan (2005) reported that the toxic effect of azadirachtin (NeemAzal T/S) were investigated on egg, nymph and adult stages of the Sunn pest *Eurygaster integriceps* Put, and also reported that the mortality of eggs was recorded 36%. In another study for ovicidal properties against *E. maura* reported that *Foeniculum vulgare* extract was found effective in causing 76.22% egg mortality among the methanol extracts of eight plants. (Elma and Alaoğlu, 2014b).

Hops includes alpha acids, prenylflavanoids, beta acids and proanthocyanidins (Hoek et al, 2001; Taylor et al, 2003). The beta acid derivative of hop avoids plants from chewing and piercing-sucking insect pests (Hampton et al, 2002) and the two-spotted spider mite, *Tetranychus urticae* Koch (Jones et al, 1996; Jones et al, 2003). Future studies will need to be performed to detect whether the activity of Hop against egg of sunn pest is interceded by the acid compound. Moreover, recognition of the bioactive compounds of hop may enable to development of botanical insecticides.

4. Conclusion

In this study, ovicidal activity of some plant extracts against sunn pest, E. maura were investigated. Data showed that hop extract has potential to be used as part of an integrated pest management against sunn pest because they had the highest effect among the four plant extracts tested. In addition, these results could support the search for new natural products providing an alternative to synthetic ovicidal from other Turkish indigenous plants. However future studies are needed to study the chemical structure and action mechanism of the active principle. Moreover, it is necessary to investigate the extract's efficacy, usefulness and chemical stability in field conditions.

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Problems Experienced By Agricultural Enterprises in Çumra Town of Konya Province in Utilization of Field Sprayers**

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ABSTRACT

The primary objective of the present study was to identify the problems experienced by agricultural enterprises in Çumra town of Konya province in utilization of PTO shaft-driven field sprayers. Data were gathered through face-to-face questionnaires applied to 119 agricultural enterprises selected by stratified randomized sampling procedure from the town. Present findings revealed that 50.4% of sprayers had a tank capacity of 600 L, 89.9% of tanks were made of plastic material and 26.9% of the sprayers had an operational width of 10 m. Cracks or fractures were reported on boom by 31.9% and on both boom and chassis by 46.2%. About 24.4% indicated that they replaced the nozzles in case of a plug, 52.1% indicated regulator problems on rod, 26% indicated pump problems on pump lid and 91.6% indicated that they replaced at least one part. It was concluded based on present findings that farmers should be trained about utilization of sprayers to change their routines on sprayers. They should perform sprayer maintenance and repairs in accordance with user manual.

1. Introduction

Agricultural commodities play a significant role in human nutrition. Agricultural practices should be performed consciously, and producers should be donated with sufficient knowledge and information. Pests, diseases and weeds most of the time reduce yields and hinder product quality and health. Chemicals are commonly used against these factors and sprayers are commonly used to apply chemicals for pests and diseases. These machines should be manufactured from good quality materials, used appropriately and their repair and maintenance practices should be performed on time. Failure in these issues may result in various problems. In such cases, then quality pulverization will not be possible.

There are 358 407 sprayers in Turkey in 2018 (TUIK 2019). The projection coefficient for the number of tractor PTO shaft driven sprayers of Central Anatolia Region until the year 2023 is 1.58%, the rate increase in number of sprayers is 2.92% and number of sprayers is expected to reach 417 070 (Demir 2015).

There are limited number of studies available about the current status of sprayers. There are some researches about status of use of sprayers, their types and problems experienced in Tekirdağ province (Demir and Çelen, 2006), in greenhouses of Erdemli town of Mersin province (Demir and Öztürk 2009), in Çanakkale province (Ürkmez and Özpınar 2013) and Şanlıurfa province (Tobi and Sağlam 2013). General status of Turkish field sprayer manufacturers was identified by Bayat and İtmeç (2018).

In this study, characteristics, faults in boom and chassis, nozzle, regulator and pump and number of replaced parts were determined, and solutions were proposed for identified problems.

2. Materials and Methods

This study was conducted in Çumra town of Konya province. The agricultural enterprises registered in Farmer Registration System of Çumra town constituted the research population. The research site is composed of 42 settlement units. Based on mountainous nature,

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** This study was produced from Master's thesis of Yavuz ŞAHİN

irrigation status, number of plots, plot sizes and land consolidation statuses, nine districts were selected with the aid of purposeful sampling procedure.

The enterprises with a land size less than 10 decares were removed from the population. Based on frequency distribution of the population, land sizes were assessed in three layers as of: 10-50 da, 51-250 and > 251 da. Number of enterprises to be selected from population and included into the sample was calculated by a stratified sampling procedure (Neyman method) with the aid of the following equation (Yamane 1967):

$$n = \frac{\Sigma\,(Nh.Sh)^2}{N^2.D^2\ + \Sigma\,(Nh.Sh^2)} \qquad (1)$$

$$D^2 = \frac{d^2}{z^2} \qquad (2)$$

where;

n : Number of samples,

N : Number of enterprises in population,

Nh : Number of enterprises in hth strata,

Sh : Variance of hth strata,

d : Error from population mean,

z : "z" value from the standard normal distribution table based on error ratio.

Number of samples as to represent the population was identified as 119 at 5% error ratio and 95% confidence interval and sample enterprises were selected randomly. Questionnaires were applied to selected enterprises through face-to-face interviews. Data were gathered about characteristics of filed sprayers and the problems experienced. Resultant data were also supported by observations. SPSS software was used for statistical analyses of the experimental data.

3. Results and Discussion

Questionnaires applied in Çumra town revealed that ages of enterprise owners varied between 20 -78 years with an average value of 45.7 years. The ratio of uneducated enterprise owners was 4.2%, ratio of primary school graduates was 56.3%, secondary school graduates was 10.1%, high school graduates was 18.5% and university graduates was 10.9%. Such a high university graduates for a town pointed out open-minded fashion of enterprise owners for new technologies and practices.

Tank capacity, material of manufacture, current status and nozzle type of sprayers are provided in Table 1. Sprayer tank capacities varied between 400 – 1000 L and 50.4% of the present enterprises had a tank capacity of 600 L.

Sprayer tank material was mostly plastic (89.1%), but 7.6% was made of polyester and 3.4% was made of galvanized metal. Sprayer tanks were mostly durable (73.9%), but 10.1% had leakages and 16% had deformations at outer surfaces. The leakages in 12 sprayers were mostly coming from the hose gaskets at inlet and outlets of the tank. The deformations over the outer surfaces were mostly because of storage of the sprayer at open spaces directly under atmospheric conditions.

Table 1
Properties of sprayers

Properties	General
Tank capacity (L)	
400	9.2%
500	9.2%
600	50.4%
800	28.6%
1 000	2.5%
Tank material	
Plastic	89.15
Polyester	7.6%
Galvanized metal	3.4%
Status of tank	
Highly durable	73.95%
There is a leakage	10.1%
There are deformations at outer surface	16.0%
Nozzle type	
Flat-fan	39.5%
Hollow cone	42.9%
No idea	17.6%

Of the investigated sprayers, 39.5% had flat-fan nozzles, 42.9% had hollow cone nozzles and 17.6% of participant enterprises indicated that they had no idea about the type of nozzle. The nozzle material was mostly brass, but 55 was made of plastic.

Operating width of the sprayers varied between 6 – 24 m and the ratio of sprayers with an operational width of 10 m was 26.9% (Figure 1).

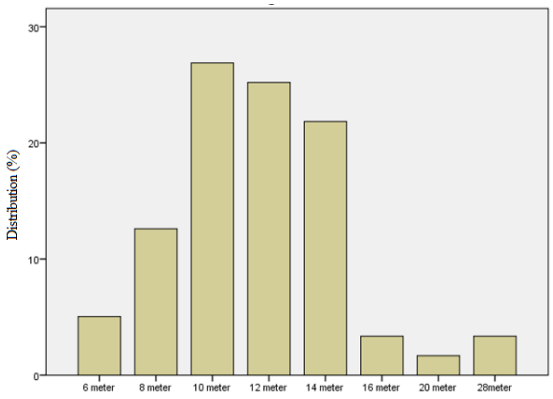

Figure 1
Operational width of sprayers

Questionnaire results revealed that there were not any cracks and fractures on spray boom and chassis of 21.8% of the sprayers (Figure 2). However, there were cracks on spray boom of 31.9% of the enterprises and there were cracks or fractures both on spray boom and chassis of 46.2% of the enterprises. Ürkmez and Özpınar (2013) conducted a study in Çanakkale province and reported fractures on spray boom of sprayers in 22.6% of the enterprises. Bayat and İtmeç (2018) reported cracks or fractures on spray boom of 36.84 of the enterprises and on sprayer chassis of 78.95% of the enterprises. Such a high rate of fractures was mostly

because of undulated nature of the field, high operational speeds and reckless use of open spray boom during maneuvers.

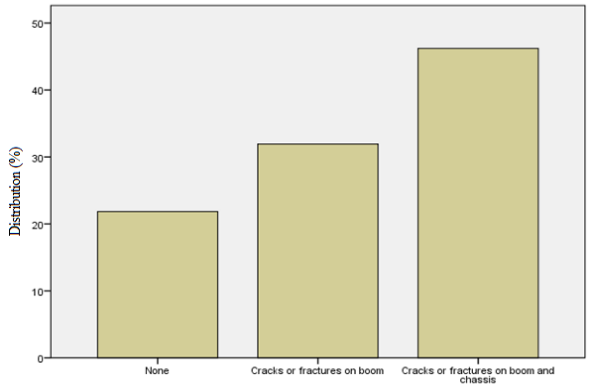

Figure 2
Repair of sprayer booms and chassis

Information about replacement of spray nozzles are provided in Table 2. In general, 5% of enterprises indicated that they haven't replaced nozzles, 22.7% indicated that they replaced on purpose, 24.45 indicated that they replaced nozzles in case of clogging, 23.55 indicated that they replaced the nozzles in case of clogging and flow offs, 8.4% indicated that they replaced only the screens of the nozzles and 8.4% indicated that they replaced the nozzles in case of irregular sprays. Similarly, Ürkmez and Özpınar (2013) indicated that 56.9% of pto shaft-driven sprayers in Çanakkale province experienced frequent clogging. Bayat and İtmeç (2018) indicated that 36.84% of sprayer manufacturers experienced abrasion problems in nozzles. Tobi and Sağlam (2013) indicated that 28.30% of the agricultural enterprises of Şanlıurfa province did not have screens in nozzles or experienced problems in screens. Such problems were mostly attributed to brass material and thus easy abrasion of the nozzles, abrasive effects of agro-chemicals and pollution of sprayer water. Therefore, filter maintenance should be performed regularly, and nozzles should be replaced on time.

Regulator problems of sprayers in investigated enterprises are provided in Table 3. Of the participant enterprises, 20.2% indicated that they experienced problems with the springs of the regulator, 12.6% with regulator gaskets, 15.1% with regulator pad and 52.1% with regulator rod because of gasket and spring. In Turkey, 21.05% of sprayer producers indicated that they experienced regulator-originated problems (Bayat and İtmeç, 2018). Manufacture of regulator rod from chrome nickel material and low quality of the other regulator materials trigger such problems.

Table 2
Replacement of sprayers

Replacement of sprayers	General
I don't replace	5.0%
Replace on purpose	22.7%
Replace in case of clogging	24.4%
Replace in case of abrasion or flow offs	23.5%
Replace the screen of the nozzles	16.0%
Replace in case of irregular spray	8.4%

Table 3
Regulator problems

Regulator problems	General
Spring was abraded / broken	20.25
Gasket was abraded	12.6%
Plastic pad was abraded	15.1%
Rod was deformed	52.1%

The problems experienced in piston-membrane pumps are provided in Table 4. In general, 26.1% of the participants indicated that they changed the valves, 20.2% indicated that pump block was cracked, 19.3% indicated membrane tear off, 26.1% indicated cracked pump lid and 8.4% indicated leakage from head pad of pump shaft. In Turkey, 78.95% of sprayer manufacturers indicated pump-originated problems (Bayat and İtmeç, 2018). In a previous study conducted in Çanakkale province, 11.7% indicated pump freeze at cold weather, 15.4% indicated leakage, 7.1% indicated pump failure in a short time (Ürkmez and Özpınar, 2013). When the desired or sufficient pressure was not supplied because of failures in any parts of the regulator during the operation of the sprayer, pump speed is increased. Increasing pump speeds then increase pump piston speeds and ultimately end up with various problems in pumps and especially tear membranes. Insufficient clean out of sprayers in winter season and leaving water in them result in cracks on pump rear lids and blocks and tears in pump membranes. Therefore, antifreeze should be placed in pumps during the winter. Balanced rotation of shaft used in operation of sprayer and clampy operation (in raising and lowering three points) result in deformation of head pad of pump shaft and destruction of crank bearing.

In general, 40.3% (48 enterprises) of the enterprises indicated that they checked the oil level of the sprayer and 59.7% (71 enterprises) indicated that they did not checked the oil level. Of 48 enterprises, oil level check durations varied between 6 month (60.4%) and 1 year (39.6%). The oil added to pump varied between 100 – 900 ml with an average value of 268 ml, mostly (64.6%) 250 ml oil was added. About 75% of the enterprises were using 20W-50 motor oil and the rest (25%) were using different types of oil. Excessive oil addition result in oil extraction from the lid and excessive heat up of the pump. Different and off grade oils reduce pump performance and result in different failures.

Table 4
Pump problems

Pump problems	General
Pump valves were replaced	26.1%
Pump block cracked	20.2%
Membrane was torn	19.3%
Pump lid cracked	26.1%
Head pad of pump shaft is leaking	8.4%

Within the scope of this questionnaire study conduction in Çumra town, 8.4% of the enterprises indicated that they did not replace any parts of the sprayer (Figure 3). In other words, 91.6% of the enterprises

changed at least one part of the sprayer. It was reported in a previous study conducted in Çanakkale province that 82.3% of the enterprises experienced at least one problem with their sprayers and they indicated that they either eliminated the problem by repair or let the problem go on (Ürkmez and Özpınar, 2013). The ratio of the enterprises replacing at least one part in Çumra town was greater than those earlier ones.

Among the replaced parts, nozzles had the first place with a ratio of 31.1% and they were respectively followed by sprayer valve, hose and filter (24.4%) and regulator and its parts (16.8%). For pumps, 8.4% replaced pump valves and membranes, 5% replaced pump pistons and membranes, 2.5% replaced pump block, 1.7% replaced block, piston and membrane together and 0.8% replaced oil filler plug and back pump lid. In pump repairs, replacement of membranes and valve O-rings were especially pointed out.

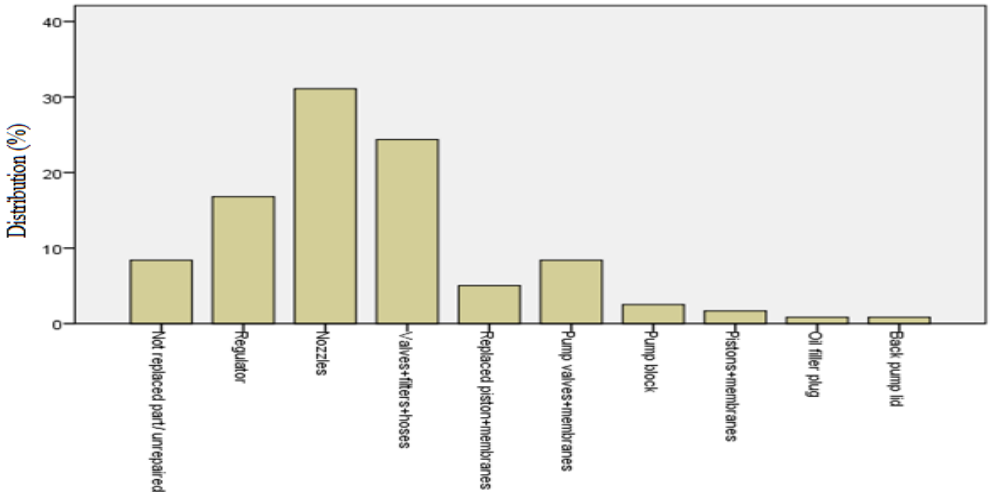

Figure 3
Replaced parts of sprayers

Number of parts replaced in sprayers of the enterprises is presented in Figure 4. In general, 47.2% replaced two parts, 33.6% replaced one part, 10.1% replaced three parts and 0.8% replaced five parts.

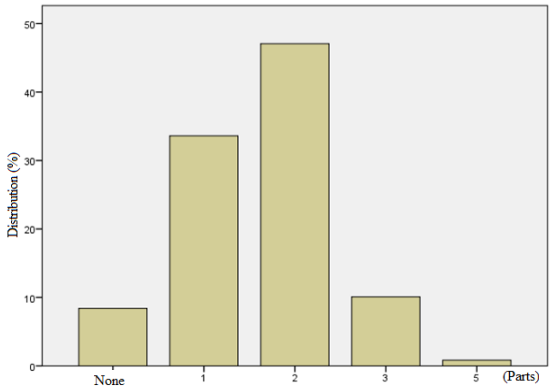

Figure 4
Number of replaced or repaired parts

4. Conclusion

Present findings revealed that educational level of the investigated enterprise owners was low. Thus, their routines on sprayers should be changed. They should perform sprayer maintenance and repair in accordance with the user manual. Trainings should be provided on this issue. Own manufacture or export of sprayer parts by manufacturers may lead to quality problems in sprayer parts. Competitive market conditions and low-cost manufacturing concerns also end up with quality problems in sprayer parts. A price stability should be set in markets to eliminate such quality problems.

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Machinery Levels of Black Carrot-Producing Agricultural Enterprises in Ereğli and Karapınar Towns of Konya Province**

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ABSTRACT

The primary objective of the present study was to generate a database for mechanization levels of black carrot-producing agricultural enterprises in Konya region. Sample villages were selected purposefully, and 37 enterprises were visited to apply face-to-face questionnaires. Present findings revealed that land size per enterprise was 1124.6 da, average number of plots was 10.2, total number of plots was 379 and average plot size was 78.8 da. About 62.69% of total cultivated lands was used for black carrot production and it was respectively followed by irrigated wheat farming (15.39%), tomato cultivation (7.09%) and irrigated barley farming (6.61%). With regard to mechanization level of the present enterprises, number of tractors per enterprise was 2.81, average tractor power was 68.65 kW, number of tools and machines per tractor was 6.52, mass of tool-machine per tractor was 9.45 tons, average engine power per unit area was 1.72 kW ha^{-1}, number of tractors per 1 000 ha land area was 24.99 and cultivated land per tractor was calculated as 40.01 ha.

1. Introduction

Black carrot is largely consumed in Turkey. Black carrot is not consumed much as fresh vegetable, it is mostly used as fermented juice. Carrot is a root-crop. Central Anatolia region and especially Konya province is the greatest carrot producer of Turkey. Yellow carrot is produced in Kaşınhanı town of Konya and black carrot is commonly produced in Ereğli and Karapınar towns of Konya. Reliable data are not available for the carrot production of the region.

It was estimated that companies had growers performed black carrot cultivation for concentrate juice production over 40 thousand da land area of the region in 2018 and purchased about 160 thousands of black carrot (130 thousand tons for concentrate and 30 thousand tons for turnip) and such a quantity corresponded about 40 thousand decares.

Black carrot contains 26.40 mg $(100\ ml)^{-1}$ ascorbic acid (Kırca 2004). Turnip juice produced from black carrot is a fermented product and has an appetizing characteristic (Canbaş and Deryaoğlu 1993). Turnip juice also contains lactic acid. Lactic acid gives a sour taste to turnip juice, facilitates mineral use of the body and regulates pH of digestive system. It is a peptic and refreshing product (Miişoğlu 2004). Black carrot has a quite high antioxidant activity and it is a good source of anthocyanin pigment. It is a remarkable product with a high anthocyanin content (1750 mg kg^{-1}) and special quality parameters (Kırca et al 2006). Anthocyanins are the most natural food dies providing shiny red color to foodstuffs and commonly used as an alternative to synthetic colorants (Bridle and Timberlake 1997, Giusti and Wrolstad 2003). Black carrot concentrate is also used as a natural fabric dye.

Agricultural structures of the regions are generally assessed through number of agricultural enterprises, land sizes of these enterprises, number of plots of each enterprise, credit supply, household share, number, age, gender and education of workers of enterprises. Agricultural mechanization levels should also be put forth in such assessments.

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** This study was produced from Master's thesis of Mahmut YILMAZ

In previous studies, mechanization levels of carrot (yellow) producing enterprises of Konya province (Yokuş et al 2015), Çumra town of Konya province (Keleş and Hacıseferoğulları 2016), enterprises of Şanlıurfa-Harran plain (Bozkurt and Aybek 2016), enterprises of Muş plain (Akar and Çelik 2017), Kırklareli province (Kayhan et al 2017), Malatya province (Aslantürk and Altuntaş 2018), sunflower-producing enterprises of Çorum province (Altuntaş and Bal 2018) and Karaman province (Kirpitçi et al 2018) were investigated.

Among the agricultural inputs of black carrot production, mechanization investments constitute a significant place. Therefore, structure and mechanization characteristics of the producer enterprises should be well analyzed for planned and properly mechanization investment in carrot production. There aren't any studies in literature about mechanization levels of black carrot-producing enterprises. Thus, in this study, tractor and agricultural machinery inventories and agricultural mechanization levels of agricultural enterprises were determined.

2. Materials and Methods

Four districts (villages) of Ereğli and Karapınar towns of Konya province were selected as the research sites of the present study. Black carrot is produced in these villages (Kuzukuyu and Beyören districts of Ereğli town and Akören and Oymalı districts of Karapınar town. Black carrot-producing agricultural enterprises of these districts constituted the research population. About 90% of regional production come from these four villages. Therefore, these villages (Kuzukuyu, Beyören, Oymalı and Akören) were selected purposefully. Questionnaire forms were applied to enterprise managers through face-to-face meetings in November and December of 2018.

Interviews were made with the local authority (mukhtar) of these villages and 2018 Farmer's Registration System records were assessed and ultimately 75 black carrot-producing agricultural enterprises were determined. While selecting these enterprises, enterprises with small land sizes and different enterprises of the same family were not taken into consideration. Full-count method was applied to these enterprises. However, some enterprises rejected to participate into the survey and some were not able to be found in their places. Therefore, questionnaires were applied to 37 black carrot-producing agricultural enterprises. Resultant data were also supported with observation technique. Total sowing area of black carrot-producing agricultural enterprises of the region is around 40 000 da. Sowing area of questionnaire-applied 37 enterprises is 26 090 da corresponding to 65% of total sowing area of the region.

Annual total fuel consumptions were used for better assessment of annual tractor operational durations of the enterprises. Engine power and specific fuel consumption of the enterprise tractors were also taken into consideration and the following equations were used in relevant calculations (Işık and Atun 1998):

$$AOD = AFC/(SFC \times LR \times Pm) \quad (1)$$

AOD :Annual operational duration (h $year^{-1}$),
AFC : Annual total fuel consumption (L $year^{-1}$),
SFC : :Specific fuel consumption (LkWh^{-1}),
LR :Tractor loading rate, taken as 0.40,
Pm : Tractor engine power (kW).

SPSS software was used for statistical analyses of survey data. Frequency, percentiles and mean values were used in data analysis.

3. Results and Discussion

General characteristics

Of the participant enterprises, 43.2% were doing this business for ≥21 years, 21.6% for 16-20 years, 16.2% for 6-10 years, 16.2% for 11-15 years and 2.7% for 1-5 years. In general, present enterprises were quite experienced in black carrot production.

Ages of enterprise owners varied between 25 -61 years with an average age of 43.6 year. As compared to average farmer's age of International Labor Organization (ILO) (58 years), average age of enterprise owners was low (Evcim et al 2015).

Of the participant enterprise owners, 51.4% had primary school education, 10.8% had secondary school education, 29.7% had high school education and 8.1% had university education. Survey results revealed that households contributed to agricultural productions in 91.9% of the enterprises and did not have any contributions in 8.1% of the enterprises.

Total sowing area of the present enterprises was 41 610 da corresponding to a land size of 1 124.6 da per enterprise. Total sowing area of the enterprises varied between 40 – 500 da and land size was mostly (8.1%) 200 da. Number of plots varied between 1- 32 with an average value of 10.2. Total number of plots was 379 and average plot size was 78.8 da.

Plant production status of black carrot-producing enterprises is provided in Table 1. Black carrot production was performed on 62.69% of total sowing area. It was respectively followed by irrigated wheat farming (15.39%), tomato cultivation (7.09%) and irrigated barley farming (6.61%). Apart from these products, maize (2.64%), alfalfa (2.27%), potato (1.20%), silage maize (1.17%) and sugar beet (0.73%) were cultivated by the present enterprises.

Table 1
Plant production over the agricultural fields

Type of crop	Sowing area (da)	Yield (kg da^{-1})	Total number of Enterprises	Frequency (%)
Irrigated farming				
Black carrot	26 090	4 028.4	37	62.69
Wheat	6 405	788.2	20	15.39
Barley	2 750	599	12	6.61
Silage maize	486	5714	7	1.17
Alfalfa	944	1 800	13	2.27
Kernel maize	1 100	1 500	2	2.64
Tomato	2 950	10 899	9	7.09
Potato	500	4 500	1	1.20
Sugar beet	305	9 333	3	0.73
Dry farming				
Barley	80	250	1	0.19

Tractor inventory of the enterprises

Total number of tractors of black carrot-producing enterprises was 104, thus the number of tractors per enterprise was 2.81. Number of tractors varied between 1-7 and 27% of enterprises had 1-3 tractors, 18.95% had 4 tractors, 16.2% had 2 tractors and 5.4% had 5-7 tractors.

Distribution of tractor model years are presented in Figure 1. Of available tractors, 12.5% was 2013 model, 10.6% was 2016 model, 8.7% was 2014 and 2015 model, 6.7% was 2017 model, 5.8% was 2012 model, 4.8% was 1998 and 2011 model and 3.8% was 2018 model. Tractor models varied between 1969 - 2018 and average tractor model was 2007. In other words, average age of tractors was 12 years. The ratio of 10-years old tractors was 66.5%. In Turkey, there were 1 254 190 rubber-tired two-axial tractors with different power groups in 2018 and average tractor age was over 25 years (TUIK 2019; Anonymous 2019). Average tractor age in present study was lower than the country average.

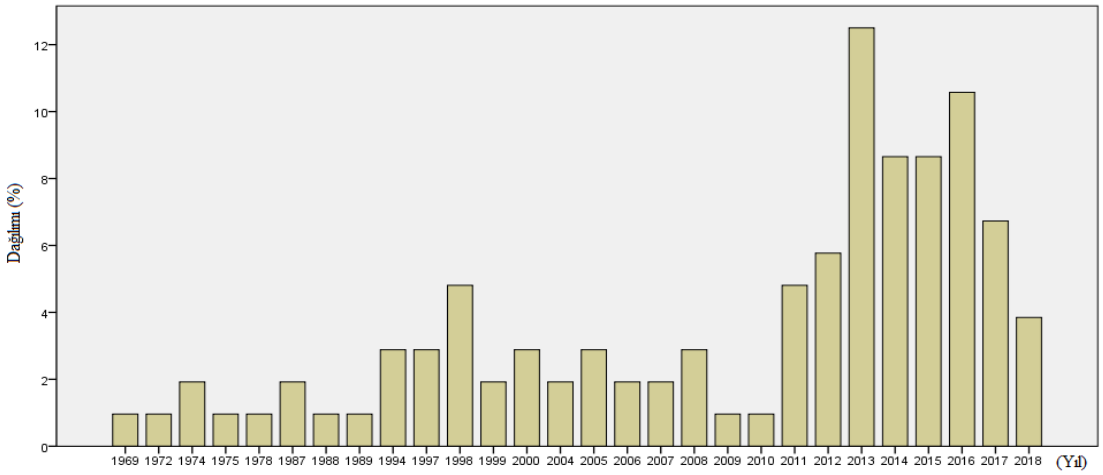

Figure 1
Distribution of tractor models

In Turkey, about 30 companies are in tractor market with about 40 brands. Therefore, there different brands of different companies in tractor parks of the enterprises. Of these tractors, 29.8% was New Holland, 24% was Massey Ferguson, 18.3% Tümosan, 16.3% Fiat, 2.9% John Deere, 1.9% Ford, Erkunt and Hattat and about 1% was Kubato, Deutz and Claas Arion (Figure 2).

Average tractor power was 68.63 kW. Average tractor power of Turkey is 44.2 kW (60 BG) (Anonymous, 2019). Power distribution of present tractors is provided in Table 2. About 63.46% of tractors had a power of between 40.1 - 70 kW. Evcim et al (2015) reported that 10% of Turkish tractor park had a power of greater than 51.5 kW. In present study, 76.92% of tractors had a power of greater than 50.1 kW. Present tractor powers and power distribution values were quite greater than the average of Turkey

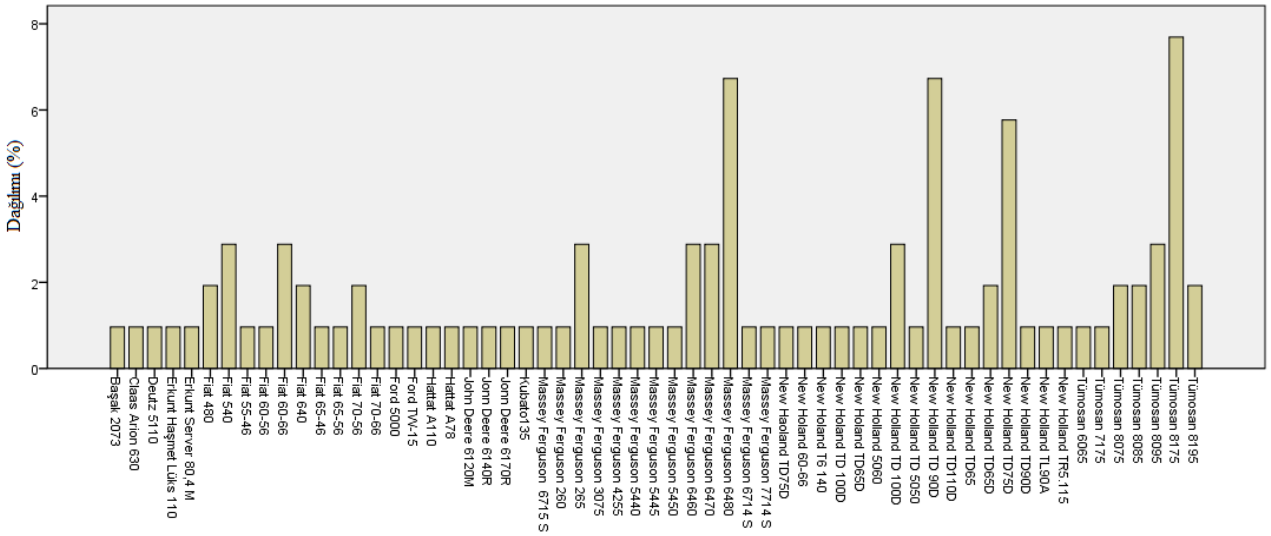

Figure 2
Distribution of tractor brands

Table 2
Power distribution of tractors of the enterprises

Power (kW)	Number of tractors	Percentage (%)	Average power of the groups (kW)
35-40	4	3.85	35.29
40.1-50	20	19.23	45.73
50.1-60	26	25.00	55.29
60.1-70	20	19.23	65.93
70.1-80	7	6.73	75.20
80.1-90	9	8.65	84.56
90.1-100	2	1.92	97.44
100.1-110	6	5.77	105.52
110.1-120	5	4.81	113.2
121.1-130	5	4.81	122.8
Total	104	100	-

Annual operational duration of tractors

Annual fuel consumptions of the enterprises were determined. Among the annual fuel consumptions, fuel consumed by the diesel vehicles and trucks were not able to be clearly identified. Therefore, 12 enterprises with a truck were not taken into consideration and fuel consumptions of 55 tractors of only 25 enterprises were taken into consideration. Annual operational durations of the tractors varied between 147.7 - 1 189.9 h with an average value of 657.2 h year^{-1}. Annual operational duration of tractors in Çumra town was reported as 532.5 h year^{-1} (Keleş and Hacıseferoğulları 2016). High operational hours of black carrot-producing enterprises were attributed to large land size of the enterprises and contracting services for harvest-like mechanization practices.

Agricultural machinery inventory

Number of agricultural machines, common types, number of machines per tractor and enterprise are provided in Table 3.

There was a total of 678 agricultural tool - machine in present enterprises. Number of tool-machines per tractor was calculated as 6.52 and number of tool-machines per enterprise was calculated as 18.32.

Distribution of the most common agricultural tool and machines of the enterprises were as follows: 116 trailer, 68 moldboard plough, 42 centrifuge-type fertilizer distributor, 43 vertical and horizontal-shaft rototiller, 40 pulverizator, 32 hoeing machine without fertilizer, 32 hoeing machine with fertilizer, 29 horizontal weeding machine, 25 silage machine and 22 cultivator. Number of these machines per enterprise was respectively calculated as 3.14, 1.84, 1.08, 1.14, 0.86, 0.72, 0.78, 0.68 and 0.59. The other tools and machines followed these previous ones.

The black carrot-producing enterprises of Ereğli and Karapınar towns also produce cereals, feed crops and tomato. Moldboard plough and conventional soil tillage are commonly used in production of these commodities. Such a case can clearly be inferred from the number of moldboard ploughs in machine parks. Conventional soil tillage in black carrot production requires intensive tillage and thus generates soil compaction.

Just based on production chain of black carrot, among the conservation soil tillage machines, there were 47 rototillers (25 horizontal-shaft and 18 vertical-shaft) and they were used in seedbed preparations. Of the moldboard ploughs, 10.3% (7 ploughs) were rotary-type and 4 of them had 4 bodies and two of them had 2 bodies. Sandy soil texture of the region generally generates soil compaction problems.

Sowing was performed with pneumatic precise vegetable sowing machines in almost half (46%) of the enterprises. About 70% of precise sowing machines were local brands and the other vegetable sowing machines were imported. Combined cereal sowing machines and pneumatic precise sowing machines were used in sowing of the other products and number of such machines per enterprise was 0.41 and 0.22.

The enterprises without a pneumatic precise vegetable sowing machine generally purchased the service of pneumatic machines.

Enterprises cut carrot leaves with a hay silage machine, clean carrot heads with a horizontal chopper and collect leaves with hay rakes and number of such machines per enterprise was 0.68, 0.78 and 0.57, respectively

Table 3
Number of agricultural machines, common types and number of machines per tractor and enterprise

Agricultural machines	Number	Type / capacity	Range	Common type	Common type ratio (%)	Machine/ tractor	Machine / enterprise	Total mass (kg)
Moldboard plough	68	Body	3-6	4 bodies	60.65	0.65	1.84	41 606
Subsoiler + chisel blaster	14	Leg	5-13	9 legs	28.57	0.13	0.38	12 567
Cultivator	22	Leg	9 - 17 legs	13 legs	40.90	0.21	0.59	21 860
Horizontal shaft rototiller	25	Blade	54 - 84 blades	72 blades	48.00	0.24	0.68	30 055
Vertical shaft rototiller	18	Blade	16 - 32 blades	24 blades	55.56	0.17	0.49	28 435
Ridge making machine	23	Unit	4 units	4 units	100	0.22	0.62	27 600
Hoeing machine with fertilizer	29	Unit	5-7 units	5 units	65.51	0.28	0.78	25 260
Hoeing machine without fertilizer	32	Leg	4	4	100	0.31	0.86	8 000
Trailer	116	Capacity	3-10 tons	8 tons	68.10	1.11	3.14	290 605
Pneumatic vegetable planting machine	17	Row	4 rows	4 rows – mechanical	100	0.16	0.46	8 925
Centrifuge-type fertilizer distributor	40	Tank capacity	250-1000 L	1 000 L	42.5	0.38	1.08	8 043
Pulverizator	42	Tank capacity	600-2 000 L	1 000 L	57.14	0.40	1.14	12 840
Silage machine	25	Number of blades	21	21	100	0.24	0.68	12 500
Hay rake	21	Unit	3-8	5	42.85	0.20	0.57	4 180
Horizontal straw chopper	29	Number of blades	24	24	100	0.28	0.78	32 480
Suspended-type carrot harvester	18	Two-row	2 rows	2 rows	100	0.17	0.49	12 420
Pull-type carrot harvester	19	Number of rows	1-2	2	57.90	0.18	0.51	142 800
Self-propelled carrot harvester	4	Two-row	2 rows	2 rows	100	0.04	0.11	77 000
Combined cereal harvester	15	Row	16-32	20 rows	33.33	0.14	0.41	20 701
Mechanical carrot planting machine	1	Row	4 rows triple	4	100	0.01	0.03	500
Maize silage machine	7	Row	1-2 rows	1 row	85.71	0.06	0.19	4 850
Roller	4	Operational width (m)	2.5-3.5	3 m	50.00	0.04	0.11	455
Pneumatic precise sowing machine	8	Unit (fertilizer)	4-6	4 units	62.50	0.08	0.22	7 475
Feed mixer and distributor	12	Tank capacity	6-12 m^3	8 m^3	41.67	0.12	0.32	37 750
Rotary drum mower	8	Operational width	1.35-1.90	1.65	62.5	0.08	0.22	3 465
Disk mower	3	Number of disks	6 disks	6 disks	100	0.03	0.08	2 400
Double serrate blade mower	5	Number of blades	22	22	100	0.05	0.14	900
Baler	8	Rectangular and roll	Rectangular and roll	Rectangular	87.50	0.08	0.22	20 580
Front loader	15	Tank capacity	0.58-0.72 m^3	0.72 m^3	66.67	0.14	0.41	5 560
Rear loader	5	Number of lifts	1-2	Double lift (0.28 m^3)	80.0	0.05	0.14	1 800
Leveling blade	21	Operational width	2-3 m	2.4 m	52.38	0.20	0.57	5 770
Solid fertilizer distributor	4	Capacity	6.5-15 m^3	10 m^3	50.00	0.04	0.11	19 335
Fixed milking facility*	14	Number of heads	7-20	10 heads	42.86	-	-	-
Truck*	23	Capacity	20 – 30 tons	20 tons	69.56	-	-	-
Beko loader*	4	Front loader and scraper	-	-	-	-	--	
Total	678							982 717

*Number and mass were not included in calculations

In black carrot harvest, 10.8% of the enterprises were using self-propelled harvesters, 51.4% were using pull-type harvesters and 48.6% were using suspended-type harvesters. All of the self-propelled harvesters and 94.7% of pull-type harvesters were imported. Suspended-type harvesters were local brands and some enterprises commonly use them for pull-out and boxing of black carrots.

Trailers are commonly used to transport pulled out black carrots to washing facilities. Therefore, number of trailers per tractor (1.11 trailers) and enterprise (3.14 trailers) had the greatest ratios.

Indicators of agricultural mechanization levels

Indicators of mechanization levels for black carrot-producing enterprises are provided in Table 4. Number of tractors per enterprise was 2.81, number of tool-machines per enterprise was 18.32, average tractor power was 68.63 kW, tractor power per enterprise was 192.89 kW, number of machines per tractor was 6.52, cultivated land per tractor was 40.01 ha tractor^{-1}, machine mass per tractor was 9.45 tons, tractor power per unit of cultivated land was 1.72 kW ha^{-1} and number of tractors per 1 000 ha cultivated land was 24.99.

Table 4
Agricultural mechanization level of black carrot-producing enterprises

Mechanization criteria	Value
Number of enterprises	37
Cultivated land (ha)	4161
Number of tractors	104
Number of tractors per enterprise	2.81
Number of tool-machines per enterprise	18.32*
Average tractor power (kW)	68.63
Power per enterprise (kW enterprise^{-1})	192.89
Number of machines per tractor	6.52*
Cultivated land per tractor (ha tractor^{-1})	40.01
Machine mass per tractor (ton tractor^{-1})	9.45
Tractor power per unit of cultivated land (kW ha^{-1})	1.72
Number of tractors per 1 000 ha of cultivated land [(tractor (1 000 ha)$^{-1}$]	24.99

It was reported in previous studies for Kadınhanı and Çumra towns of Konya province, number of tractors per enterprise was respectively 0.81 and 1.0, number of tool-machines per tractor was 11.50 and 14.92, tractor power per enterprise was 39.92 and 60.89 kW, average tractor power was 49.06 and 58.70 kW, machine mass per tractor was 6.43 and 10.77 tons, average engine power per unit area was 1.91 and 4.08 kW ha^{-1}, number of tractors per 1 000 ha cultivated land was 38.91 and 69.47 and cultivated land per tractor was 25.69 and 14.39 ha (Yalmancı 2008; Keleş and Hacıseferoğulları 2016). It was reported in another study conducted with sunflower-producing enterprises of Çorum province that average tractor power of enterprises was 44.78 kW, number of tool-machines per tractor was 5.2, average power per unit area was 3.99 kW ha^{-1} and cultivated land per tractor was 10.78 ha (Bal and Altuntaş 2018). The present tractor power per unit of cultivated land and number of tractors per 1 000 ha cultivated land were greater and the other parameters were lower than those earlier ones. Lower values were attributed to recently performed land consolidation in Akören village, thus intensive production and greater land size of enterprises (112.5 ha enterprise^{-1}).

For Turkey in general, number of tractors per 1 000 ha cultivated land is 45, cultivated land per tractor is 26 ha, tractor power per unit area is 1.68 kW ha^{-1}, number of tool-machines per tractor is 5.2, machine mass per tractor is 4.2 tons and average tractor power is 44.2 kW (60 BG) (Anonymous, 2019). As compared to these values, present number of tractors per 1 000 ha was lower and the other parameters were greater than country averages.

4. Conclusion

The present study was conducted to determine agricultural mechanization characteristics of black carrot-producing agricultural enterprises. A database was generated with the aid of present data for mechanization planning of enterprises. Present parameters should be updated regularly to provide contributions to enterprise economies. For mechanization planning, some other variables such as climate data, time factors, energy needs of agricultural machines should be added to present database. In this way, optimum capacity tractors and machines suitable for enterprise sizes should be supplied to enterprises.

Land size of present enterprises were remarkable (112.5 ha enterprise-1). Over the black carrot-producing lands, land consolidation was performed only in Akören village. Land consolidation hasn't been performed in the other three villages. Therefore, number of plots varied between 1 – 32 with an average value of 10.2. Total number of plots was 379 and average plot size was 78.8 da. Such a case makes the purchase of expensive agricultural machines difficult and also limits the size of agricultural tools and machines. Such small plots increase agricultural inputs and unit costs. Therefore, land consolidation works should be accelerated in the region.

Average age of available tractors was 11 years. Such a value is lower than county (Turkey) average (25 years). It should be pointed out that data on tractor park and mechanization indicators were generally greater than country averages.

Further research is recommended about the average ages and economic lives of agricultural machines. Machines should be so selected as to comply with the tractor powers. Ratio of imported sowing and harvest machines is also remarkable. Such ratios should be reduced through manufacture and purchase of local brands. Number of different tool and machines for tomato, feed crops and cereals was sufficient in number and diversity.

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Some Phenotypic Parameters of Marketable Common Carp (*Cyprinus Carpio L.*, 1758) Reared In the Carp Farm Pools in Kirkuk Province of Iraq**

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ABSTRACT

Common carp (Cyprinus carpio) is one of the most important cultured fish in the world aquaculture industry. The aim of this study was to determine the phenotypic parameters of some body measurements in common carp (*Cyprinus carpio L.*, 1758) reared in pools in Kirkuk province of Iraq. In this study, the means of body weight, total length, body depth and fork length in common carps were determined as, 2.097±0.034 kg, 45.820±0.242 cm, 14.446±0.240 cm and 38.040±0.210 cm for male and 2.050±0.033 kg, 45.850±0.277 cm, 14.120±0.154 cm and 37.960±0.227 cm for female (P>0.05), respectively. Besides, condition factor was determined as 2.1829±0.0338 for male and 2.1383±0.0409 for females (P>0.05), respectively.

1. Introduction

The food requirement is the outcome of basic needs that human populations needs for living. Considering the fact that 55 percent of the global world population currently consists of urban dwellers, and the rate of increase in the human population considering global climate change, food needs for human will become more important and strategic day after day. Fish is an important component in people's diets, providing about 3.2 billion people with almost 20 percent of their average intake of animal protein. Capture fisheries continue to dominate world output, but aquaculture accounts for a growing percentage of total fish supply. Fishery and aquaculture sectors are particularly important in developing countries, providing both food and livelihoods (FAO 2019). Commercial fishing activities have been implemented for a long time in the lakes, sea and pools. For fishing, lake and sea are an important natural resource for local people and rural settlement in its surrounding. However, fish farming in some regions has been inevitable in order to meet human needs.

Wohlfarth (1984) stated that the common carp is probably the oldest cultured and most domesticated fish in the world; they have been farmed for about 4000 years in China and for several hundred years in Europe.

In the world, carp is commercially caught by hunting and also it is also cultivated for commercial purposes such as survival, disease tolerance and resistance to stress or virus (Jeney & Jeney, 1995; De Boeck et al 2000; Lian & Sun, 2003; Jeney et al 2009; Falco et al 2012; Hoseinifar et al 2014; Sung et al 2014; Kamali-Sanzighi et al 2018). Systematic crossbreeding has been performed only among common carp varieties, since the other cyprinids are devoid of distinct strains or varieties. (Hulata 1995). A feature of the carp, which has economic importance in the temperate climatic zones, is that it can live in both hot water and cold water. The homeland of the carp is spread over a wide area starting from Anatolia to South Japan (FAO 2018). There are different varieties of cultured carps in the world. According to their distribution areas, cultured carp includes seven primary species such as the common carp, the grass carp, the silver carp, the bighead carp (Chinese carps), the catla carp, the rohu carp and the mrigal carp (Indian major carps). Carp farming in the world varies depending on the consumption habits of people or satisfying the needs of the people through hunting.

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Common carps grown in pools in Kirkuk district of Iraq are an important source of animal protein for the people of the region. Briefly, common carps play an important role as agricultural products in Kirkuk economy today. The aim of this study was to determine the phenotypic parameters of some body measurements in common carp (*Cyprinus carpio L*., 1758) reared in pools in Kirkuk province of Iraq.

2. Materials and Methods

Cyprinus carpio samples in four carp farm pools were reared in concrete basins of 15x20x2 meter for 180 days. Fish were fed on commercial diet containing 21.1% proteins, 3.7% fats, 5.3% cellulose and 3200 kcal/kg metobolic energy. A total of 100 male and females common carp reared in fish pools were caught to determine some body measurements before pre-sales to consumers in this study. Some body measurements such as body weight (BW), total length (TL), body depth (BD) and fork length (FL) were taken from each common carps. From the body measurements, the length and depth measurements were obtained using a measuring tape with a sensitivity of 1 mm and weight measurements were obtained with a digital weight scale with a sensitivity of 1 g.

As one of the population parameters, the condition factor (K) is used as an important criterion since it contains both live weight and total length. Therefore, these properties are used in decision making in marketable aquaculture products suitable for human consumption. Fulton's condition factor (K) was calculated as reported by Nash et al (2006).

$$K = 100\ BWxBL{-}3$$

Statistical analysis of some body measurements via sex were calculated by using the independent samples t-test, and descriptive statistics of some body measurements with the MINITAB statistical package program (Minitab 2010).

3. Results and Discussion

Descriptive statistics with regard to some body measurements in common carp (*Cyprinus carpio L.*, 1758) were given in Table 1. Table 1 show that somebody measurements such as BW, TL, BD, FL and K in both the male and female common carps.

Table 1
Statistical analysis and descriptive statistics of some body measurements in common carp (Cyprinus carpio L., 1758)

Traits	Unit	Sex	N	$\bar{X} \pm S_{\bar{x}}$	$\bar{X} \pm S_X$	Min	Max	CV
BW	kg	M	50	2.097±0.034	2.074 ± 0.233	1.500	2.650	11.26
		F	50	2.050±0.033				
			P value	0.255				
TL	cm	M	50	45.820±0.242	45.835± 1.831	41.000	49.500	4.00
		F	50	45.850±0.277				
			P value	0.921				
BD	cm	M	50	14.446±0.240	14.283 ±1.427	10.000	24.500	9.99
		F	50	14.120±0.154				
			P value	0.294				
FL	cm	M	50	38.040± 0.210	38.000± 1.537	35.000	38.000	4.05
		F	50	37.960±0.227				
			P value	0.313				
K		M	50	2.1829±0.0338	2.161 ± 0.265	1.537	3.047	12.26
		F	50	2.1383±0.0409				
			P value	0.351				

BW: Body weight, TL: Total length, BD: Body depth, FL: Fork length and K: Condition factor

According to Table 1, the means and standard errors of BW, TL, BD and FL in common carps were determined as 2.097±0.034 kg, 45.820±0.242 cm, 14.446±0.240 cm and 38.040±0.210 cm for males and 2.050±0.033 kg, 45.850±0.277 cm, 14.120±0.154 cm and 37.960±0.227 cm for females, respectively (P>0.05). K in both the male and female common carps were found to be as 2.1829±0.0338 and 2.1383±0.0409 respectively (P>0.05). Briefly, the traits were not statistically significant in terms of sex.

For descriptive statistics, the means and standart devision of BW, TL, BD and FL in common carps were determined as 2.074 ± 0.233, 45.835± 1.831, 14.283 ±1.427 and 38.000± 1.537, respectively. K in common carps was determined as 2.161 ± 0.265.

Sahtout et al (2017) studied some biological parameters of *Cyprinus carpio* in Algeria. Researchers reported that age frequency distributions in total length and weights of carps. Researchers stated that TL and BW for different ages (I-VII) to be 27.28±0.23, 29.92±0.07, 35.55±0.27, 42.93±0.48, 48.65±0.71 and 53.75±1.15 and 238.52±3.85, 299.08±2.55, 515.13±11.86, 846.13±26.02, 1179.25±50.10 and 1562±27, respectively. They found that TL of the carps in the 6 and 7 age groups had higher, but their weight in all age groups was lower than in this study.

Al-jebory et al (2018) reported that a negative and positive allometric growth pattern was obtained, where the TL ranged from 25.91 cm to 33.53 cm, and BW ranged from 700 g to 1423 g. Meanwhile, the lowest of

1.03 and highest of 3.54 in "b" value that is the length exponent or slope in the equation of length-weight relationships for weight was recorded in group F (Al-Muthanna) and group C (Karbala), respectively. Therefore, Fulton condition factor (K) range from 2.57 to 4.94. While, relative condition factor (K) was in the ranged of 0.95 to 1.01. A linear relationship between TL and standard length (SL) among the provinces for fish groups were obtained. The variances in "b" value ranged from 0.10 to 0.93 with the coefficient of correlation of 0.02 to 0.97. In addition these researchers stated that these results will serve as a guide in ecological and biological study of common carp (*Cyprinus carpio L.* 1758*)* in the middle and Southern Iraq provinces and environs. Table 2 showed differences between province in TL, BW and K.

Table 2
Differences between the province in TL, BW and K (Al-jebory et al 2018)

Province	TL (cm)		BW (g)		K	SD of K
	Min	Max	Min	Max		
Baghdad	26.60	29.70	890	1423	4.94	0.53
Babil	26.36	29.88	820	1120	4.41	0.45
Karbala	26.21	28.45	700	1010	4.29	0.56
Al-Najaf	25.91	28.92	790	1090	4.61	0.32
Dhi Qar	28.90	33.50	770	990	2.66	0.28
Al-Muthanna	29.13	33.53	727	925	2.57	0.27
Al-Basrah	25.60	30.30	800	1080	4.38	0.41

BW: Body weight, TL: Total length and K: Condition factor

Considering the total length and body weight in Table 2, these traits in this study were found higher than reported by Al-jebory et al (2018).But, condition factors in this study were lower than in all provinces reported by Al-jebory et al (2018). Also, researchers stated that the factors affecting the variation values of K may include sex, stages of maturity, and state of stomach contents.

Fishery resources are an important source of proteins, vitamins and micronutrients that are not available in such quantity and diversity either in cropsor in other animal products (Lauria et al 2018). Fish consumption varies substantially from country to country depending on local traditions. Fish populations that live in inland waters and commercial pools is vital for human consumption as a source of animal protein. The common carp can be grown more easily than other fish in pools, especially in case of failure to adapt to climate change in ecological environments in inland waters. Considering the adaptability of carp compared to other fish, with this perspective, carp can be an indispensable species of fish in the future. In short, it is important to monitor growth and development of carp in both ecological and commercial environments. Body measurements discussed in this study such as body weight, total.

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Determination of Factors Affecting Mastitis in Holstein Friesian and Brown Swiss by Using Logistic Regression Analysis**

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ABSTRACT

The aim of this study was to determine subclinical mastitis with the help of logistic regression of milk quality determined factors and some features the research material consisted of 204 (145 Holstein, 59 Brown Swiss) dairy cattle raised in a private cattle farm in Konya Province, Turkey. The independent variables considered for the detection of subclinical mastitis are breed, somatic cell number (SCC), color values (L, a, b, H, C), freezing point (FP), pH, electrical conductivity (EC), milking day (MD), lactation order (LO). The dependent variable of logistic regression was CMT score. According to the results of the study, the spescifity was 95.7% and the sensitivity was 57.6%. In general, the predicted value of the accuracy of all data was 83.3%.

1. Introduction

Mastitis is an udder disease that causes significant economic losses in dairy cattle holdings (Duval, 1969; Aytekin, 2014; Şahin, 2014). It is estimated that 20-30% of the economic losses of mastitis are due to clinical mastitis, while the remaining losses are estimated to be caused by subclinical mastitis (Tekeli, 2005; Mammadova, 2013). The main objective of dairy cattle enterprises is to make a profit and increase productivity (Boztepe, 2015). For this reason, avoiding the average milk loss due to mastitis and predicting the risks that may occur both increases the profitability in the enterprise and provides great benefit in taking precautions against an undesired possible situation.

Regression analysis investigates the relationship be- tween independent variable or variables and dependent variable; can be simple or multiple and can be applied after the assumption of linearity, normality, homogene ity, summability (Menard, 2002). The dependent variable is the variable that is explained or estimated in the regression model, and this variable is assumed to be related to the independent variable or variables. The dependent variable must be continuous (data obtained from measurement, weighing or analysis). However, in some cases, it may be encountered that the dependent variable is discrete (data obtained by counting). In such cases, the relationship between dependent and independent variables can be examined with the help of logistic regression. The independent variable is the explanatory variable in the regression model and is used to estimate the value of the dependent variable (Korkmaz, 2012). In recent years, logistic regression analysis has been widely used in social, health and natural sciences with the use of statistical package programs (Bircan, 2004; Akın, 2018).

The aim of this study is to determine the relationship between the presence of mastitis disease and milk quality factors of the Holstein and Brown Swiss cattle during different lactation in a private enterprise in Konya using logistic regression analysis.

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2. Materials and Methods

In this study, the research material consisted of 204 (145 Holstein, 59 Brown Swiss) dairy cattle raised in a private cattle farm in Konya Province, Turkey. There are 95 cows in the 1st lactation, 38 in the 2nd lactation, 27 in the 3rd lactation, 9 in the 4th lactation, 22 in the 5th lactation and 13 in the 6th and above lactation.

The California mastitis test was first described in 1957 and quickly and easily detects the disease. (Schalm and Noorlander, 1957; Sanford et al., 2006). The presence of mastitis in the dairy cattle was determined by the California Mastitis Test (CMT) and the factors thought to be effective in the presence of mastitis in cows (breeding, somatic cell number (SCC), color values (L, a, b, H, C), freezing point (FP), pH, electrical conductivity (EC), milking day (MD), lactation order (LO)) were examined by logistic regression analysis. According to the CMT score, cows with mastitis were coded as 1 and cows without mastitis were coded as 0 and analyzes were performed accordingly.

As a result of logistic regression analysis, risk factors affecting subclinical mastitis were determined. In logistic regression analysis, the model is as follows.

$$P(Y=1/X=x) = [1+ e^{-(b0 + b1\ X1 + b2\ X2 + ... + bp\ Xp)}]^{-1}$$

where,

P(Y=1/X=x) = Probability of Y = 1 when X = x

(X independent variable probability of mastitis when it receives x value)

b_0 = Constant of regression

e = Natural logarithm

Linear and nonlinear relationships between dependent and independent variables can be estimated by regression analysis. In simple terms regression, the dependent variable is obtained from different data types (continuous and discrete) and linear and nonlinear regressions according to the status of the relationship with independent variables (linear, quadratic, cubic, etc.), and one and more independent variables means simple and multiple regression.

The basis of logistic regression also called logit models, is based on odds raito. Odds ratio compares the likelihood that an event will occur and the probability that it will not. In linear models, the logistic regression is obtained by taking natural logarithm because probability ratios cannot be included in the model. The maximum likelihood, which is the most commonly used method, was used in the parameter estimation of the logistic regression model. The evaluation of the data was obtained using SPSS version 18 (SPSS Inc., IL, USA).

Logistic regression, which is one of the nonlinear regression methods, is widely used since it is not affected by the assumptions of linear models. If the dependent variable shows poisson distribution as binary (0-1), it means logistic regression. In other words, the expected value of the dependent variable according to independent variables is to calculate as the probability (Tatlıdil, 1996). Logistic regression tries to estimate the probability of taking the value of 1 instead of estimating the dependent variable (Alpar, 2011). Since the results are a probability value, they take values between 0-1 (Eyduran, 2005). As predicted by linear regression coefficients, in estimating regression coefficients, weighted least squares are obtained by maximum likelihood method and discriminate function rather than least squares method (Eyduran, 2008). The significance test of the regression coefficients in the model can be examined with the help of the Likelihood Ratio, Wald and Score (Lagrange multiplier) tests (Alpar, 2011). In addition, regression coefficients are important if the odds ratio includes a confidence interval value of 1.

3. Results and Discussion

In the logit model for the detection of mastitis, a base model was created in the first stage and an enter method was used in which all the independent variables were combined. When the base model was examined, 138 animals without mastitis were correctly estimated and the correct classification rate was 100%. All 66 specimens with mastitis were incorrectly estimated, the correct classification rate was 0% and the correct classification rate of 204 cows was 67.6%. Maximum likelihood method was used in the analysis of the logit model, in which all independent variables were considered. The significance control of the model was checked by the Chi-square test and was found to be statistically significant ($P < 0.05$).

In analyzing the fit of the model, L (likelihood) is likely to be estimated by independent variables and L + (- 2 Log likelihood) = 1. In this case, the -2 Log likelihood value decreases the fit of the model increases. If -2 Log likelihood is 0, the model is perfectly compatible. -2 Log likelihood value of the study model was found to be 161.749.

Another criterion of the fit of the model is Cox - Snell R^2 and Nagelkerke R^2 value. According to the results of the analysis, Cox - Snell R^2 and Nagelkerke R^2 values were used to determine the percentage change of the independent variables in the dependent variable, and the values were 38.6% and 53.9% respectively. The reason for the low coefficients of determination in the logit model is thought to be due to the fact that the range of variation of the independent variables considered is too high. It is also an indication that the presence of other factors affecting the dependent variable is undeniable.

The established model for the detection of mastitis is P(y) = [1+ e-(-6.744 + 0.0000109*SCC + -0.140*L+ -0.672*a + 1.527*b + 0.025*H + -1.452*C + -10.724*FP + 0.092*pH + 2.026*EC + 0.001*MD +0.799*Breed(1) + 0.532*L0(1) + 0.690*L0(2) + 1.190*L0(3) - 0.605*L0(4) 0.441*L0(5))]-1].

After estimates made with the help of this model, of the 138 animals without mastitis (0), 132 (0) and 6 (1) were found to have mastitis. Of the 66 animals with mastitis (1), 38 were mastitis (1) and 28 were healthy (0).According to the results of the study, the spescifity was 95.7% and the sensitivity was 57.6%. In general, the predicted value of the accuracy of all data was 83.3%..

Table 1
Logistic regression parameter estimates and odds ratios results

Variables	B	S.E	Wald	df	Sig.	Exp(B)	95 % CI for Exp (B)	
							Lower	Upper
Step 1[a] Breed(1)	0.799	0.562	2.023	1	0.155	0.450	0.150	1.352
SCC	0.0000109	0.0000023	19.934	1	0.000	1.000	1.000	1.000
L	-0.140	0.206	0.463	1	0.496	0.869	0.581	1.301
a	-0.672	1.174	0.327	1	0.567	0.511	0.051	5.100
b	1.527	2.043	0.559	1	0.455	4.606	0.084	252.560
H	0.025	0.025	0.237	1	0.626	1.026	0.926	1.135
C	-1.452	2.161	0.451	1	0.502	0.234	0.003	16.181
FP	-10.724	9.217	1.354	1	0.245	0.000	0.000	1542.631
pH	0.092	2.798	0.001	1	0.974	1.096	0.005	263.820
EC	2.026	0.865	5.482	1	0.019	7.586	1.391	41.374
MD	0.001	0.002	0.108	1	0.742	0.999	0.996	1.003
LO			4.398	5	0.494			
LO(1)	0.532	0.579	0.845	1	0.358	1.702	0.548	5.290
LO(2)	0.690	0.664	1.079	1	0.299	1.993	0.543	7.322
LO(3)	1.190	1.018	1.366	1	0.242	3.287	0.447	24.183
LO(4)	-0.605	0.800	0.572	1	0.449	0.546	0.114	2.620
LO(5)	-0.441	0.933	0.224	1	0.636	0.643	0.103	4.006
Constant	-6.744	27.767	0.059	1	0.808	0.001		

[a] Variable enterned on step 1; Breed, SCC, L, a, b, H, C, FP, pH, EC, MD, LO.

Table 1 shows the beta coefficients (B), standard error (SE), Chi-square values according to Wald statistics (Wald), degrees of freedom (df), significance (P value), odds ratios (Exp (B)) and confidence intervals of odds rates. It was seen that SCC variable had statistically significant effect on mastitis (P <0.05). Other independent variables had no statistically significant effect (P> 0.05).

4. Conclusions

In cases where the dependent variable is discrete, it is not correct to examine the relationship between the dependent and independent variables by classical regression analysis. In such cases, one of the ways to be used is logistic regression analysis. Logistic regression analysis, classification and assignment process can be done and they do not require the assumption of normal distribution and continuity provides some advantages.

As a result of this study, cows were found to be as high as 83.3% in determining whether mastitis. It was found that SCC and EC were effective on mastitis and other independent variables had no statistically significant effects. Only the SCC and EC independent variables explain whether or not mastitis is an advantage. It should also be remembered that the accuracy of the obtained model depends on factors such as the consistency of the analyzed data and the number of variables.

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Determination of Population Development and Infestation Rate of The Beet Armyworm [*Spodoptera exigua* (Lepidoptera: Noctuidae)] in Sugarbeet Fields in Ilgın (Konya) District

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ABSTRACT

This study was carried out in sugar beet fields (Centrum, Düger and Karaköy) in the center of Ilgın, the district of Konya between the years of 2017-2018. With this study, it is aimed to determine infestation rate, the first adult emergence time, adult population abundance, adult population peaks and adult activity duration in nature, which are essential criteria required for the management of Beet armyworm [*Spodoptera exigua* (Lep.: Noctuidae)] in Ilgın. The population development of *S. exigua* was monitored by sexual attractive pheromone traps. As a result of the study, it was determined that the adults of *Spodoptera exigua* were first caught in sexual attractive traps in the first half of May. In order to determine the infestation rate caused by the pest, weekly beans were sampled from the period of sugarbeet with 8-10 leaves. The adult population peaked twice during the all years, including June and July. The date when adults were caught in traps was in the first half of September every two years. With these results, it was determined that *S. exigua* adults were active in nature for at least four months (May-September). The average infestation rate of the fields in 2017-2018 was 0.0- 0.1%, 0.1- 0.1% in Düger and 0.2- 0.2% in Karaköy, respectively. Although the population of the pest does not increase every year, it might create an outbreak in some years. It is recommended that our producers continuously monitor the population of the pest.

1. Introduction

Sugar beet (*Beta vulgaris* L.) is a two-year, summer industrial crop from the family of Chenopodiaceae. Sugar Beet is not only the raw material of industry, but also a fodder crop with its leaf, head and pulp which is very valuable food in livestock fattening. It is grown as a raw material of sugar in our country (Özer & Ertunç 2005).

Sugar beets are produced in 55 countries around the world, Turkey ranks 5th with 6.2% market share. Sugar beet, which ranks second in terms of the added value it provides in industrial crops, is a rotation crop and has been cultivated every four years since 2001.Sugar beet production in 2017 was 21 million 149 thousand tons and 29% of this production was realized in Konya (Tosun, 2018).

Beet armyworm is within the order of Lepidoptera (Noctuidae). The species among pests especially from the order of Lepidoptera, due to the damage they have created in recent years has begun to attract attention. As a result of the study, it is determined that Şanlıurfa is rich in the species of Noctuidae family and *S. exigua*, which is one of the important pests, has caused economic damages in the cotton areas of Şanlıurfa (Ünlü & Kornoşor 2003).

Spodoptera exigua polyphag is a pest and its host range includes cotton, corn, sunflower, tobacco, vegetables; and chenopodium album, black nightshade, celosia argentea among weeds. It can also be pest in forest and fruit trees (Anonymous, 2008). There are a number of studies on *S. exigua*, which have been reported by various investigators (Hassanein et al., 1972; Aarvik, 1981; Stewart et al., 1996) that it causes significant damages to different host plants in various ecosystems including potatoes. For example, Kıray (1964) reported that this species caused damage not to be underestimated in many cultigens in our country, especially in industrial crops. Iyriboz (1971) and Sertkaya et al. (2004) reported that it is one of the most important pests of cotton fields in our country but it has also caused significant damage in potato areas in various parts of our country. Yıldırım et al. (1998) reported

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that they cause significant damage in sugar beet fields in Erzurum and its surroundings.

Sugar beet is one of the leading products in Konya and its surroundings due to the fact that ecological conditions in Ilgın (Konya) district are suitable for sugar beet production and there is a sugar factory in the district. This issue has been studied because there has been no study on the development of beet armyworm populations in sugar beet areas in the Konya region.

2. Materials and Methods

2.1 Materials

The main material of the study is the sugar beets grown in the Ilgın district and the beet armyworm living on these plants. In the study, the sex pheromone traps (1.5 mg E.E-8.10-dodecadien-1-ol) have been used.

2.2 Method

2.2.1 Determination of trial fields

In the study, a total of nine sampling areas were chosen. There were chosen three fields for each region in the center of Ilgın, in Düger and Karaköy.

2.2.2 Determination of adult population development of Spodoptera exigua

This study was carried out in nine different fields for two years in 2017 and 2018 in order to determine *Spodoptera exigua*'s adult population development in three sugar beet fields (three fields in one region, total nine fields) located in central, Düger and Karaköy districts of Ilgın district center of Konya province. In order to determine the adult population development of *Spodoptera exigua*, sexual attractive Delta type traps were set in the second week of May (15 May) in the first year of the study and in the last week of April (25 April) in the second year of the study. One trap was placed in each field in a way to represent the field and a 1.5 m high board was placed in the field. Trap controls were performed twice a week until the first adult was captured, and once a week after the first adult was captured, the number of captured moths was recorded. Pheromone capsules were replaced with new ones every six weeks. Adhesive trays under the trap were changed when necessary by considering the adhesive properties.

2.2.3 Determination of infestation rate of Spodoptera exigua in sugar beet

The determination of the infestation rate of beet armyworm in sugar beet was started from the moment when larvae and / or damage were observed in the plants in sugar beet fields.25 plants were checked in all fields in the nine locations where the trials were carried out in such a way that will represent the field each week. When eggs, larva and / or larval damage were observed on the controlled plants, these plants were accepted as infested and the percentage of infestation of the fields was calculated.

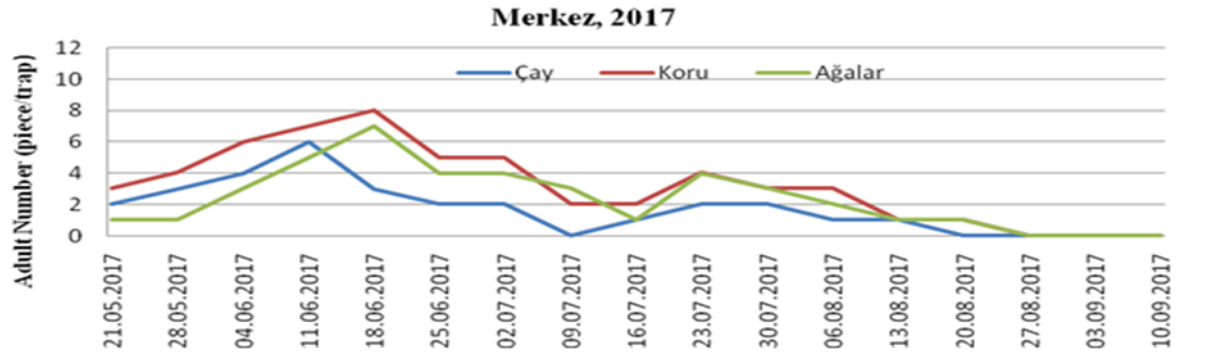
3. Results and Discussion

As a result of the study conducted in order to determine the population development of the beet armyworm and the rate of infestation, it has been determined that the pest population is low in Ilgın and causes little damage.

3.1. Determination of Adult Population Development of Spodoptera exigua

Traps were set on May 15th in 2017 and in April 25 in 2018 to determine the population development of beet armyworm in Sugar Beets. It was determined that the moths were caught on May 17 in the traps which were set on May 15 in order to determine the population development of sugar beet armyworms. In 2018, it was determined that the adult was caught on 13 May.

The population development of *Spodoptera exigua* in the centrum in 2017 and 2018 is given in Figure 1.



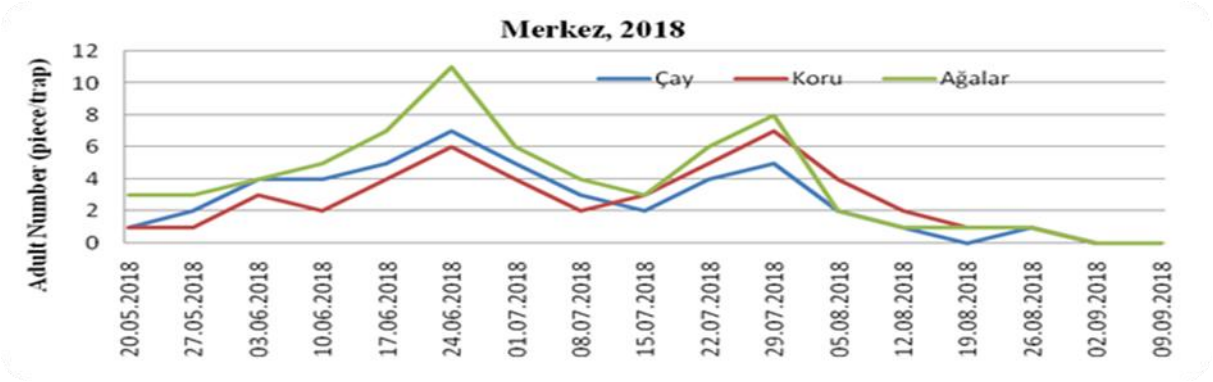


Figure 1
Population development of beet armyworm in sugar beet in the center of Ilgın in 2017-2018

In 2017, the beet armyworm adults in the sugar beet field in Çay, Koru and Agalar locations were first caught in pheromone traps on 17 May. The number of adults in the pheromone traps throughout the year was peaked twice in the second week of June and in the last week of July in each of the fields. Then, the population continued decreasingly. *Spodoptera exigua* was caught 8 times per week in Koru. The last date when adults were caught in the traps was determined as August 20.

In 2018, the beet armyworm adults in the sugar beet field locations were first caught in pheromone traps on 13 May in Agalar. The number of pest year was peaked twice on June 24 and on July 29 in each of the three fields. Then, the population continued decreasingly. The maximum number of *Spodoptera exigua* caught per week was 11 in Agalar location. The last date when adults were caught in the traps was determined as August 26 in Koru and Agalar (Figure 1).

Figure 2 shows the population development of *Spodoptera exigua* in 2017 and 2018 in Düger location.

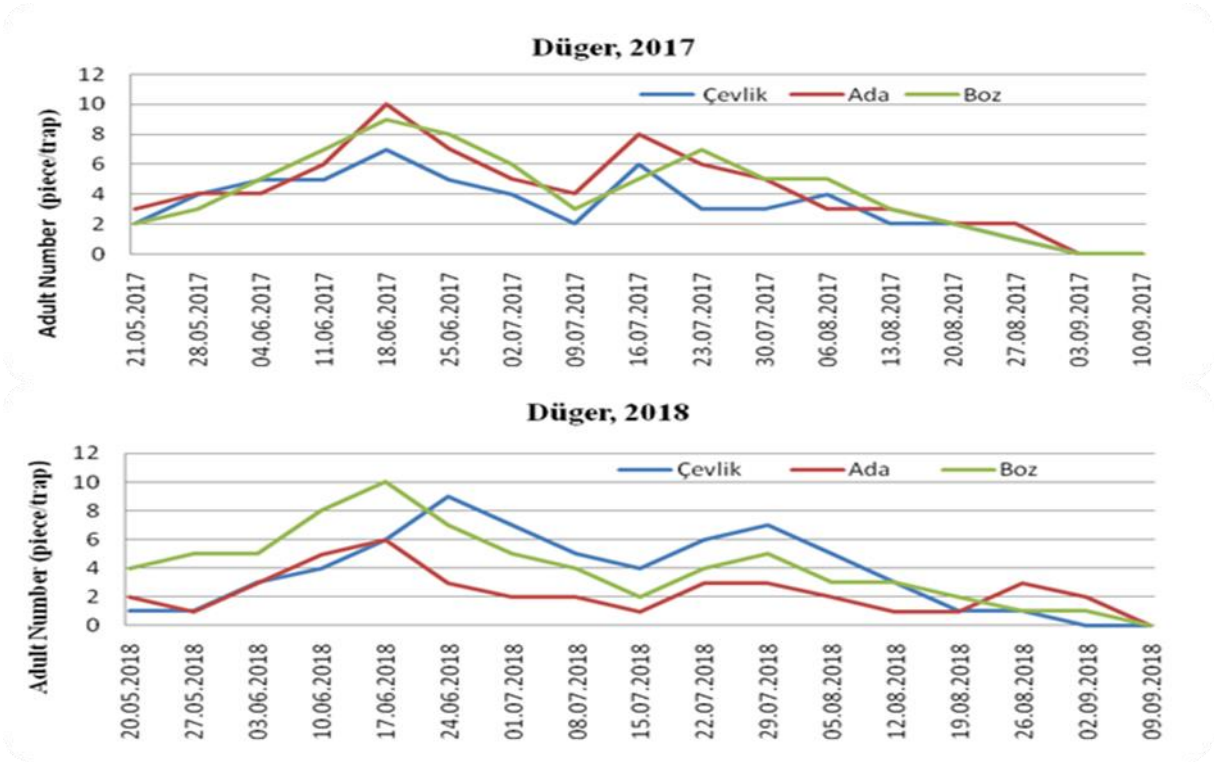


Figure 2
Population development of *Spodoptera exigua* in 2017 and 2018 in sugar beet in the location of Düger

In 2017, the beet armyworm adults in the sugar beet field locations were first caught in pheromone traps on May 17 in Düger. The number of pest year was peaked twice on June18 and in the second half of July in each of the three fields. Then, the population continued decreasingly. The maximum number of *Spodoptera exigua* caught per week was 10 in Ada location. The last date when adults were caught in the traps was determined as August 27.

In 2018, the beet armyworm adults in the sugar beet field locations were first caught in pheromone traps on May 16 in Ada location. The number of adults in the pheromone traps throughout the year was peaked twice in the second half of June and in the last week of July

in each of the fields. Then, the population continued decreasingly. The maximum number of *Spodoptera exigua* caught per week was 10 in Boz location. The last date when adults were caught in the traps was determined as September 2 in Ada and Boz (Figure 2).

Figure 3 shows the population development of *Spodoptera exigua* in 2017 and 2018 in Karaköy location.

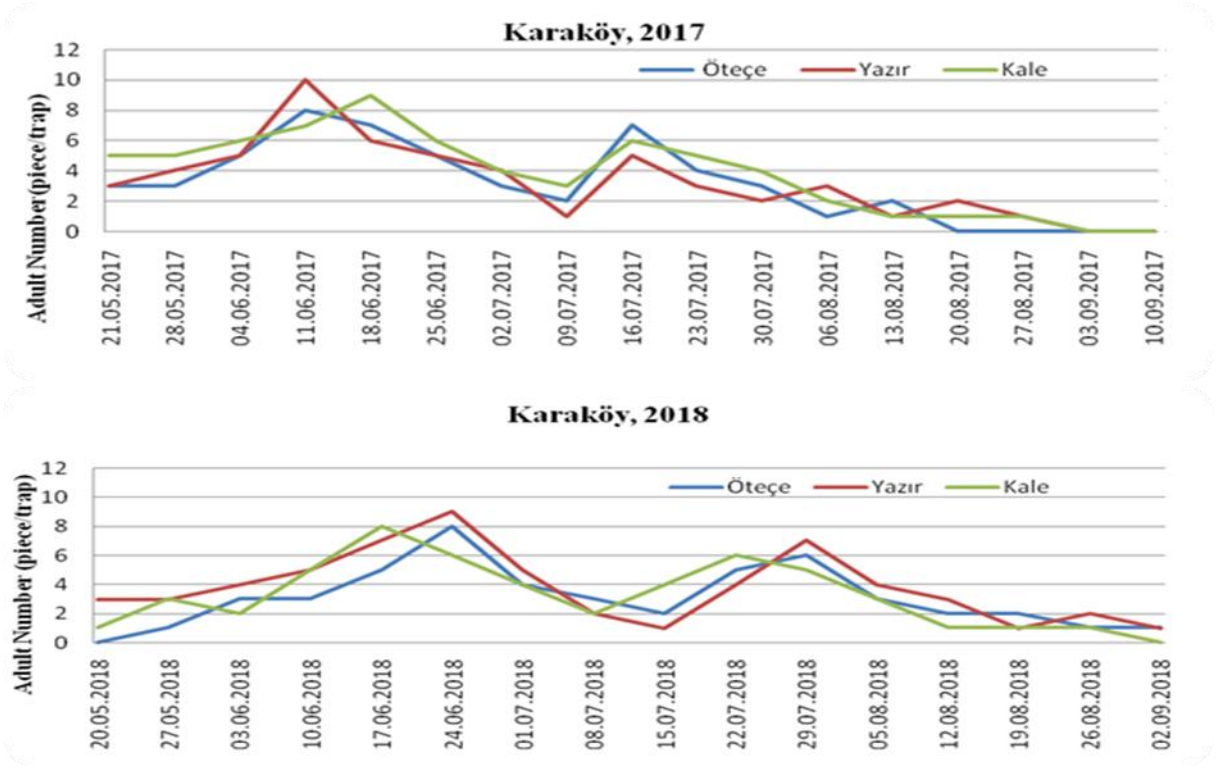


Figure 3
Population development of Spodoptera exigua in 2017 and 2018 in sugar beet in the location of Karaköy

In 2017, the beet armyworm adults in the sugar beet field locations were first caught in pheromone traps on May 17 in Karaköy. The number of pest year was peaked twice on June 11 and on July 16 in each of the three fields. Then, the population continued decreasingly. The maximum number of *Spodoptera exigua* caught per week was 10 in Yazır location. The last date when adults were caught in the traps was determined as August 27.

In 2018, the beet armyworm adults in the sugar beet field locations were first caught in pheromone traps on May 16 in Yazır location. The number of adults in the pheromone traps throughout the year was peaked twice in the second half of June and in the last week of July in each of the fields. Then, the population continued decreasingly. The maximum number of *Spodoptera exigua* caught per week was 9 in Yazır location. The last date when adults were caught in the traps was determined as September 2 in Öteçe and Yazır locations (Figure 3).

In the Centrum, Düger and Karaköy, where the study was conducted, it was determined that the first flight of the beet armyworm was seen in the first half of May in 2018 and it parallel the year 2017. The pests who peaked twice in each of the three sampling areas in 2017-2018 started to decrease in the first half of July. It then peaked second time, lower than the first. In this study, it was determined that the beet armyworm population in 2018 decreased in Düger and Karaköy compared to 2017 and increased in the Centrum. Due to the increase in sunflower cultivation areas, the other host of the pest in the centrum in 2018, it is thought to be effective in increasing the population level in 2018. In Düger and Karaköy, population levels decreased compared to the previous year. The reason for this is that 2018 may be rainy compared to 2017.

In the study, it was determined that the first adults were caught by sexual attractive traps in the first half of May. Indeed, Atlıhan et al. (2003) reported that the first adult flight of beet armyworm in Erciş and Muradiye was observed in June in a study conducted in potato fields, and similarly, a study conducted in a cotton field in Bismil District of Diyarbakır Province reported that *S. exigua* moths began to appear in sexual attractive traps on June 11 (Göven & Gümüş, 1998). According to the technical instruction of agricultural control, it was reported that the mature adults spending the winter in the maize plant began to be seen towards the end of April (Anonim 2008).

In 2017-2018, when the study was carried out, the time when the adult population was the most intense was determined as the middle of June and the end of July. It was reported that *S.exigua*, which caused significant damages in potato fields in Van province in 1998-1999, caused epidemic in 1998 and reached the highest population density in the season in late June and early July (Atlıhan et al 2003). In a study conducted on soybean in 1981-1982 in Çukurova, while soybean plants had 3-4 leaves, *S. exigua*'s population increased (Özdemir& Uzunali 1981).

When it was decided to work in the fields in locations in 2017, the first year of the study, in interviews with producers, the producers stated that they did not encounter any significant damage of sugar beet armyworm. As a matter of fact, it was determined in our study, as well. In a study conducted in 1981-1982 in Çukurova, since there was no significant increase in pest population in soybean plants, it was seen as an insignificant pest in soybean, however, if we consider the fact that the increase in the population of *S. exigua* in Çukurova coincides with the emergence of the soybean and that there is increase in the population of cotton from time to time in the past years, it is possible that the there will be a significant pest in soybean plant (Turhan et al. 1983).In another study, *S. exigua* has been reported to be harmful, important lepidoptera species in maize-grown fields (Özdemir & Uzunali 1981).

3.2 Determination of pest infestation rate

The amount of infestation seen in the gardens mainly shows the material loss caused by the beet armyworm for the producer. The infestation rate of *S. exigua* in 2017-2018, when the study was conducted, is given in Table 1.

Table1
Spodoptera exigua infestation rate in Ilgın between years of 2017 and 2018 (%).

	Centrum (±SE)			Düger (±SE)			Karaköy (±SE)		
Years	Çay	Koru	Ağalar	Çevlik	Ada	Boz	Öteçe	Yazır	Kale
2017	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.4±0.016	0.0±0.0	0.4±0.016	0.4±0.016	0.0±0.0
2018	0.0±0.0	0.0±0.0	0.4±0.016	0.0±0.0	0.0±0.0	0.4±0.016	0.4±0.016	0.4±0.016	0.0±0.0

In the Center, it was started from the period when the sugar beet had 8-10 leaves and during the weekly controls it was found that there was no infestation in the Çay and Koru locations in 2017-2018. While any infestation was not observed in Agalar in 2017, the average infestation rate in 2018 was 0.4%.

In Düger, no infestation was seen in the sugar beet leaves in Çevlik location in 2017-2018. In Ada location, infestation was observed in the first week of August in 2017 and the average infestation was found to be 0.4%. In 2018, no infestation was seen. In Boz location, no infestation was seen in 2017 and infestation rate was determined as 0.4% in 2018.

In the weekly controls in Karaköy, Öteçe and Yazır locations, infestation rate was determined as 0.4% on 30.07.2017 and in the first week of August 2018. The average infestation was seen in 2017 in both locations and was found to be 0.4% in 2018. In Kale location, no infestation was observed in both years of the study.

In 2017-2018 when the study was conducted, infestation was seen in the Center on 12.08.2018, it was seen in Düger in both years in the first week of August, it was seen in Karaköy at the end of July and in the first week of August, and the average infestation was determined as 0.4. In a study carried out in maize fields in Çukurova, it was reported that the densest developmental stages of *S. exigua* larvae were the stages when they were with 2-4, 4-6 leaves (Güllü 2000). *S. exigua* larvae were found in the two-leaved stage of maize in Çanakkale and there was density in early seedling and middle rifling periods (Tiftikci& Kornoşor 2015). Beet armyworm larvae were densely observed in the cotton field in Bismil District of Diyarbakır Province on June 18 and 22 (Göven & Gümüş, 1998). In a study on pest lepidoptera larvae in maize in Southeastern Anatolia, *S.exigua* larvae were found in the fields from July to September in 2003 and from the end of July to mid-September in 2004. During the study, it was observed that *S. exigua* larvae caused damage to the second crop maize which was sown late (Gözüaçık & Mart, 2009). In a study conducted on potato fields in Van province, *S.exigua* larvae were found on June 17 in Erciş and Muradiye (Atlıhan et al 2003).

4. Conclusions

When the results of the population development of *S.exigua* conducted in the fields of Ilgın district center and locations in 2017-2018 are evaluated, the first adult flight was seen in the first half of May and the last adult flight was seen in the last week of August and the first week of September. The adult population peaked twice in June (11 units / week) and July (8 units / week) during the year. In the light of this information, it is concluded that beet armyworm can give two offspring because the first offspring are seen as from June. In this study, it was determined that adults of *S.exigua* remained active for approximately 4 months from mid-May to the first week of September.

Considering the population and infestation rates of the pests, there was no significant increase of beet armyworms in the fields during the years of the research and it was found below the recommended economic thresholds and the sugar beet armyworm was considered as an insignificant pest for Ilgın district. In both years of the study, no spraying was recommended as there was not enough infestation to control with pesticide in Ilgın district.

This pest is known as "Caradrina" among people because it causes serious damages in sugar beet by eating the leaves during the early seedling period. In the control, it is recommended to apply pesticide when there are 2 larvae/plants on average in 25 plants (Anonim, 2008). However, it is known that some pesticides are ineffective and pests gain resistance against some pesticides. For this reason, farmers are advised to use pesticides after consulting with experts. If spraying is performed correctly against first-stage generations, the reproduction and emergence of subsequent generations will be prevented. This is why first spraying is very important. It is necessary to follow these warnings to avoid damage to subsequent products. Since there was no significant increase in the population of pests in sugar beet plants in 2017-2018 when the research was carried out, it was not seen as an economic pest in sugar beet, but given the increase in the population of pests in sugar beet from time to time as in 2014, it is likely that there is a significant probability of pests in sugar beet. It is therefore a pest that needs to be constantly monitored

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Forecasting of Rice Self-Sufficiency in the Benin Republic Using ARIMA Model

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ABSTRACT

Rice is one of the staple foods in the Benin Republic. Annual rice consumption is increasing faster than annual rice production. That is why Benin is not yet self-sufficient in rice production. To meet the local demand, huge quantities of rice are imported. For country planning, forecasting is the main tool for predicting rice variables. This paper describes an empirical study that used a time series modeling approach (Box-Jenkins' ARIMA model) to forecast rice production, rice consumption, rice importation, rice exportation and finally rice self-sufficiency in Benin. Based on ARIMA model, the rice self-sufficiency rate in Benin is forecasted to be 47%, 56%, 58%, 59% and 68% respectively in 2019, 2020, 2021, 2022 and 2023. The forecasts would be helpful for the policy makers to foresee ahead of time the future requirements of rice production, adopt appropriate measures to develop rice sector for effective rice self-sufficiency and to reduce rice importation.

1. Introduction

In most African countries, the agricultural sector occupies an essential place in the national economy. In Africa, every 1% increase in agricultural productivity reduces poverty by 0.6%, and a 1% increase in production reduces the number of people living with less than one dollar a day by 6 million (Thirtle et al. 2003). Two out of five people in Africa still live in extreme poverty (Beegle et al. 2016) and increasing agricultural productivity is crucial for reducing poverty (Christiaensen et al. 2011). Agriculture is the primary production activity of rural livelihoods in sub-Saharan Africa, and on average 92% of rural households is engaged in farming (Davis et al. 2017). Rural

Households also derive about two-thirds of their income from on-farm agriculture, compared with one-third (on average) in other developing countries (Christiaensen, 2017).

As a result, the economic "take-off" of Sub-Saharan African countries in general and of Benin, in particular, is closely linked to agriculture (Aho and Kossou, 1997). The agricultural sector contributes 38% to Gross Domestic Product (GDP) in Benin (PNUD-IDH, 2011). Crop production is the primary production activity in the agricultural sector and on average contributes 23% to GDP (FAO, 2012a).

In the crop production sub-sector, cereal products hold the prominent place, and among cereals, corn, sorghum, and rice are the most important ones. Local rice production provides 1% contribution to GDP (MAEP, 2007). In order to satisfy domestic consumption and re-exportation, Benin imports huge quantities of rice. West Africa is experiencing rapid growth in rice consumption due to population growth, urbanization and increasing purchasing power (Fofana et al. 2014). At the same time, rice is the most critical nutritional source and a highly strategic food commodity for the West African region (Seck et al. 2013). Rice is the staple food of more than 750 million people in sub-Saharan Africa (USDA, 2016). Average annual

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rice consumption in sub-Saharan Africa (4%) is increasing faster than rice production (3.3%) (LARES, 2008). Longtime considered as a luxury food consumed during feast days; rice became part of eating habits of the populations of Benin. In Benin, while rice consumption is increasing, only 7% of the rice production potential (land and water resources) is used (JACQUES, 2008). In the country, rice ranks third regarding cereal production after maize and sorghum (ABEL, 2009) and is the second most crucial cereal regarding consumption after maize. Despite the progress realized in local rice production in sub-Saharan Africa after the food crisis of 2007-2008, rice demand has never been met; rice importation dependence is still around 50% and local rice production represents only 60% of domestic consumption (Saito et al. 2015, USDA, 2016). The rapid increase in domestic rice production is a significant challenge for Sub-Saharan Africa (Secket al. 2012).

Given these situations and given that Benin has enormous potential for rice cultivation of which less than 8% is currently exploited, it is imperative to think of increasing the local supply of rice in order to satisfy local demand, reducing rice importation and increasing rice exportation.

This study aims to forecast rice production, rice consumption, rice importation, rice exportation and finally rice self-sufficiency over the next five years in Benin.

2. Material and method

2.1.Methods of data collection

The data used in this study were obtained from the official websites of the Ministry of Agriculture of Benin (MAEP) and Food and Agricultural Organization (FAO). For the time series data, we considered different periods: area, paddy rice and rice importation cover the period 1961-2016; rice exportation covers the period 1961-2015; milled rice and rice consumption cover the period 1961-2013. We took different periods for the time series because rice data of Benin are not available in the same period.

In this study, the self-sufficiency level is calculated by using the following formula. Self-sufficiency level= (Usable production/Domestic use) x 100(FAO, 2012b; Van Oort et al. 2015; Demirbaş et al. 2017).

2.2.Methods used in data analysis

Different models are used in data estimation. In agriculture domain, ARIMA model was used in many studies to forecast milled rice production (Suleman and Sarpong, 2012), to forecast rice area, production and productivity (Rahmanet al. 2016; Hemavathi and Prabakaran, 2018), to forecast the price of medium quality rice to anticipate price fluctuations (Ohyver and Pudjihastuti, 2018), to forecast maize production (Sharma et al., 2018). In this study, ARIMA model is also used for data estimation.

ARIMA model

Future estimation of a variable can be made only by using the variable itself without anyother variables. These estimates are not based on a theoretical model. The movement of the variable in the past can be used to predict future movement. A linear time series models introduced by Box and

Jenkins (1970), are now widely used and accepted. According to them, the ARIMA model is

denoted by ARIMA (p, d, q) where ‘p’ is the order of the autoregressive process (AR); ‘d’ is the order of homogeneity i.e. the number of difference to make the series stationary; and ‘q’ the order of the moving average process (MA) (Box and Jenkins, 1970; Awajan et al., 2017).

The general form of the ARIMA (p, d, q) is

$$Y_t = \varsigma + \beta_1 Y_{t-1} + \beta_1 Y_{t-2} + \ldots + \beta_1 Y_{t-p} + \varepsilon_t + \theta_1 \varepsilon_{t-1} + \theta_2 \varepsilon_{t-2} + \ldots + \theta_q \varepsilon_{t-q}$$ (Kennedy, 2006:351).

Here, Yt gives the time series, εt error term, β model estimator, ς time series average.

Before doing an analysis of time series, we plot the data by using standard plots and summary statistics to see the behavior of the data. The sample ACF and the PACF pattern were done to see whether given data is stationary in its level and variability. Apart from rice exportation and rice consumption variables, the other variables are non-stationary in level since they have not fluctuated around constant mean and variance. Then we took the first difference of the data values and we selected the stationary levels of the data (Table1). The selection criterion is the probability (5%). To determine the orders (p, q) we referred to ACF and the PACF pattern. We estimated the parameters and fixed the fitted ARIMA model. Therefore, the fitted ARIMA model is the one that has more significant coefficients, less volatile, a higher R-squared, a lower Akaike Criterion (AIC) and a Theil’sinequality coefficient less than 1 (Table2). The final step of the validity of the fitted model was based on the distribution of residuals and of residuals square to find out whether the residuals are a white noise or not and find out whether all the information contained in the series have been exploited or not.

Test of forecast accuracy of the Box Jenkins method.

Theil’s U statistic measures the forecast accuracy (Theil, 1958). In this study, Theil's inequality coefficient is used to measure the predictive accuracy of models.

Theil Inequality Coefficient

$$U = \frac{\sqrt{\frac{1}{n}\sum_{i=1}^{n}\left(\Delta\hat{Y}_i - Y_i\right)^2}}{\sqrt{\frac{1}{n}\sum_{i=0}^{n}(\Delta Y_i)^2}}$$

ΔY_i = actual change of variable

$\Delta\hat{Y}i$ = predicted change of variable

n = Number of observations

The coefficient U is bounded between 0 and 1 ($0 \leq U \leq 1$). Theil'sinequality coefficient shows the predictive accuracy of the model. This coefficient should be less than 1 (Vergil and Ozkan, 2007; Okur, 2009, Özer and İlkdoğan, 2013). The prediction of the model will not be accurate if the calculated value is greater than 1. In that case, the model is not the most appropriate one. In This study, Theil'sinequality coefficient is used to select the most appropriate model for the estimation (Table2).

3. Results and Discussion

3.1. Unit root test

Augmented Dickey-Fuller test was carried out for the stability test. After the stationary studies of the series, only consumption and exportation series are stationary in level. Import, white rice production, paddy production and area series are stationary in first difference (Table 1).

Table1
The results of ADF unit root test.

Variables	Test atlevel					First difference test				
	Lag	Model	ADF	Critic	Processus	Lag	Model	ADF	Critic	Processus
Cons_b	8	Trend et constante	-5.26	-5.34	I (0)					
Exp01	8	Trend et constante	-5.26	-5.34	I (0)					
Imp	7	Trend et constante	-4.43	-4.85	Non stationnaire	0	constante	-11.52	-4.85	I (1)
PROB_b	7	Constante	0.73	-4.44	Non stationnaire	0	Trend et constante	-7.25	-4.85	I (1)
Prod_p	5	Trend et constante	-2.62	-4.65	Non stationnaire	0	constante	-6.43	-4.44	I (1)
Sup	2	Trend et constante	-4.38	-4.85	Non stationnaire	7	Trend et constante	-5.94	-4.85	I (1)

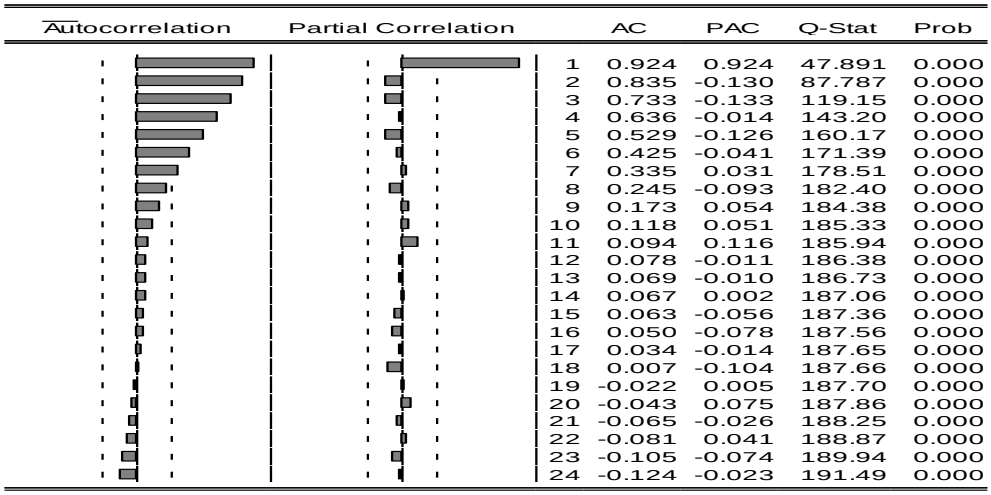
Tests are significant at 5%.

Table2
Summary of models

Variables	Order of integration	Model	Adjusted model	Theil'sinequality coefficient	Probability
Cons_b	I (0)	AR (1)	AR (1) AR (2) MA (7)	0.28	0.001
Exp01	I (0)	ARMA (1,1)		0.79	0.000018
Imp	I (1)	ARIMA (1,1,1)		0.52	0.00061
Prod_b	I (1)	ARIMA (3,1,3)		0.43	0.007
Prod_p	I (1)	ARIMA (5, 1, 3)		0.29	0.00015
Sup	I (1)	ARIMA(1,1, 12)		0.31	0.00016

The Theil's inequality coefficients for all the models are less than 1. So, the selected models are good for the prediction.

3.2.Estimates of rice consumption



	AC	PAC	Q-Stat	Prob
1	0.924	0.924	47.891	0.000
2	0.835	-0.130	87.787	0.000
3	0.733	-0.133	119.15	0.000
4	0.636	-0.014	143.20	0.000
5	0.529	-0.126	160.17	0.000
6	0.425	-0.041	171.39	0.000
7	0.335	0.031	178.51	0.000
8	0.245	-0.093	182.40	0.000
9	0.173	0.054	184.38	0.000
10	0.118	0.051	185.33	0.000
11	0.094	0.116	185.94	0.000
12	0.078	-0.011	186.38	0.000
13	0.069	-0.010	186.73	0.000
14	0.067	0.002	187.06	0.000
15	0.063	-0.056	187.36	0.000
16	0.050	-0.078	187.56	0.000
17	0.034	-0.014	187.65	0.000
18	0.007	-0.104	187.66	0.000
19	-0.022	0.005	187.70	0.000
20	-0.043	0.075	187.86	0.000
21	-0.065	-0.026	188.25	0.000
22	-0.081	0.041	188.87	0.000
23	-0.105	-0.074	189.94	0.000
24	-0.124	-0.023	191.49	0.000

Figure1
Rice consumption ACF and PACF for stationary series.

The rice consumption series is an I(0). By observing the Figure1, the model to be estimated is AR (1) and its values are shown in the table3.

Table3
The values of AR(1) model

Model	Coefficient	Std. Error	t-Statistic	Probability
AR(1)	0.995	0.027	36.609	0.000

The residuals correlogram shows that there is unused information in the model like MA (3) and AR (2). That's why we need to estimate the adjusted model and choose the most appropriate model.

Table4
The values of R(2), AR(1) and MA(3) models

	AR (2)	AR (1) and MA (3)
Significant coefficients	2	2
Sigma^2 (volatility)	$5.52*10^8$	$5.47*10^8$
R^2adjusted	0.98	0.98
AIC	23.21	23.22

The most appropriate model is the one that has more significant coefficients, less volatile, a higher R-squared, and a lower Akaike Criterion (AIC). This model is the model AR (2). To validate this model, we analyzed the correlogram of residuals and residuals squared.

When one still observes the correlogram of the residuals squared, one notices that there is serial autocorrelation. It must be corrected by integrating an AR (7) or MA (7). After estimation, it is the MA (7) that corrects it (Table4).

The correlogram of the residuals on this adjusted model shows that all the information is integrated into the model and the correlogram of the residuals squared shows that there is no more serial correlation.

Forecast

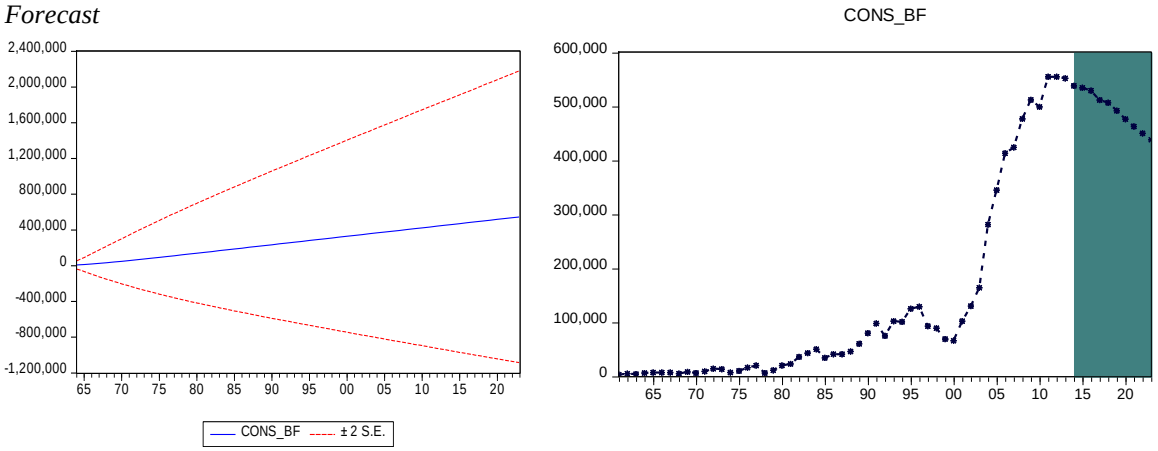


Figure2
Plot of rice consumption forecast.

Table4
Forecast values of rice consumption results

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Forecast (ton)	538003.5	534626.6	529279.5	511713.1	506690.0	491890.5	476481.4	462716.0	450114.1	438388.4

Rice consumption will decrease from 491890.5 tons in 2019 to 438388.4 tons in 2023 (Table5, Figure2).

3.3.Estimates of rice exportation

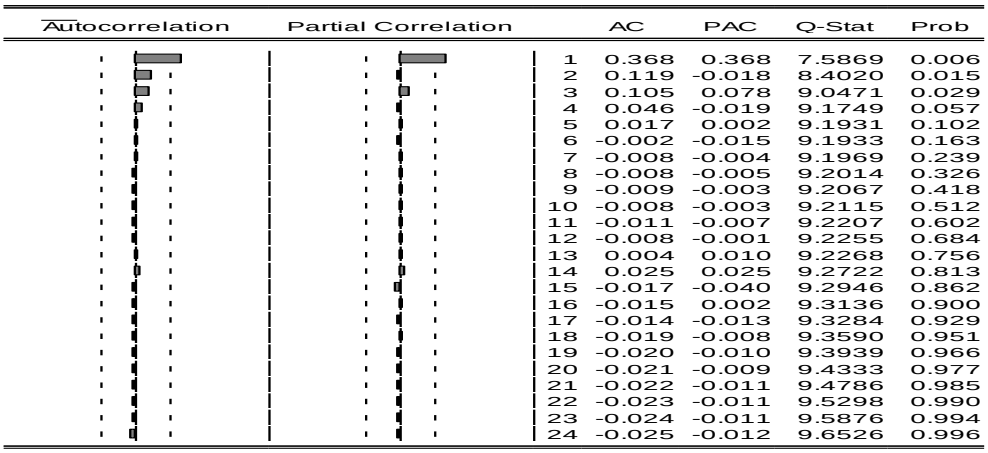


Figure3
Rice exportation ACF and PACF for stationary series.

The Rice exportation series is an I(0). By observing the Figure3, the model to be estimated is the ARMA model (1,1) and the its values are shown in the table5

Table5
The values of AR(1) and MA(1) models

Model	Coefficient	Std. Error	t-Statistic	Probability
AR(1)	0.292	0.801	0.365	0.016
MA(1)	0.081	0.907	0.089	0.029

Forecast

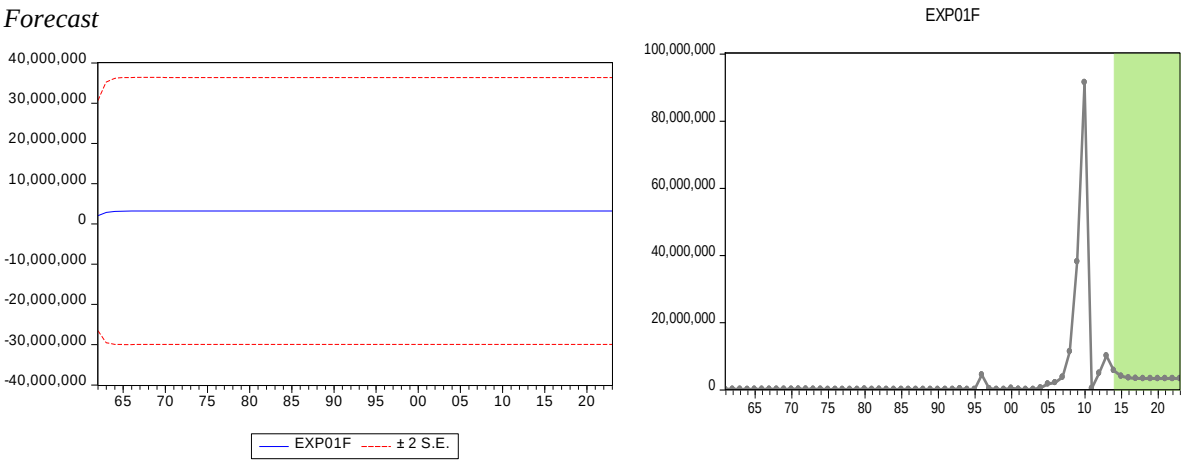


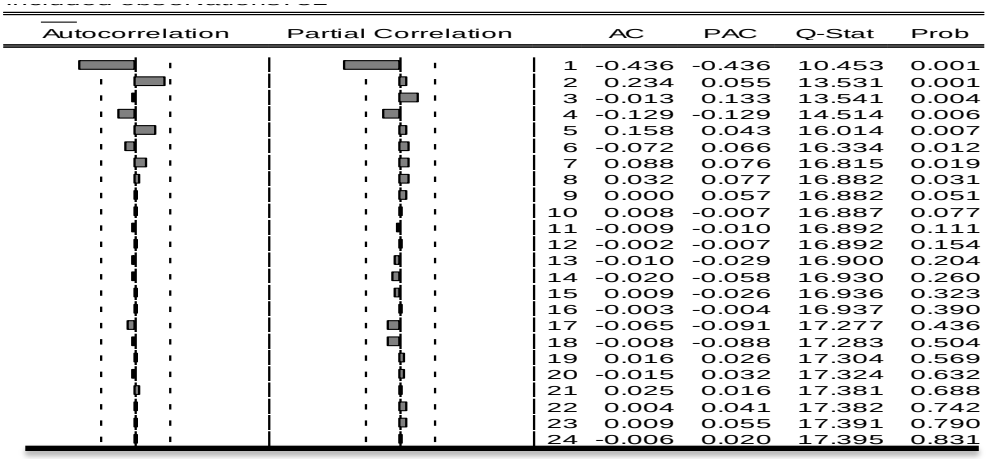
Figure4
Exportation forecast graphs

Table6
Forecast for rice exportation

Year	2016	2017	2018	2019	2020	2021	2022	2023
Forecast (ton)	3426473.63	3278216.33	3234802.85	3222090.29	3218367.73	3217277.67	3216958.47	3216865

Rice Exportations will decrease slightly from 3222090.29 tons in 2019 to 3216865 tons in 2023(Table6, Figure4).

3.4.Estimates of rice importation



	AC	PAC	Q-Stat	Prob
1	-0.436	-0.436	10.453	0.001
2	0.234	0.055	13.531	0.001
3	-0.013	0.133	13.541	0.004
4	-0.129	-0.129	14.514	0.006
5	0.158	0.043	16.014	0.007
6	-0.072	0.066	16.334	0.012
7	0.088	0.076	16.815	0.019
8	0.032	0.077	16.882	0.031
9	0.000	0.057	16.882	0.051
10	0.008	-0.007	16.887	0.077
11	-0.009	-0.010	16.892	0.111
12	-0.002	-0.007	16.892	0.154
13	-0.010	-0.029	16.900	0.204
14	-0.020	-0.058	16.930	0.260
15	0.009	-0.026	16.936	0.323
16	-0.003	-0.004	16.937	0.390
17	-0.065	-0.091	17.277	0.436
18	-0.008	-0.088	17.283	0.504
19	0.016	0.026	17.304	0.569
20	-0.015	0.032	17.324	0.632
21	0.025	0.016	17.381	0.688
22	0.004	0.041	17.382	0.742
23	0.009	0.055	17.391	0.790
24	-0.006	0.020	17.395	0.831

Figure5
Rice importation ACF and PACF for stationary series.

The series of import is an I(1). By observing the Figure5, the model to be estimate is ARIMA(1,1,1) and the its values are shown in the table7.

Table7
The values of AR(1) and MA(1) models

Model	Coefficient	Std. Error	t-Statistic	Probability
AR(1)	-0.749	0.225	-3.315	0.0018
MA(1)	0.251	0.494	0.507	0.0061

Forecast

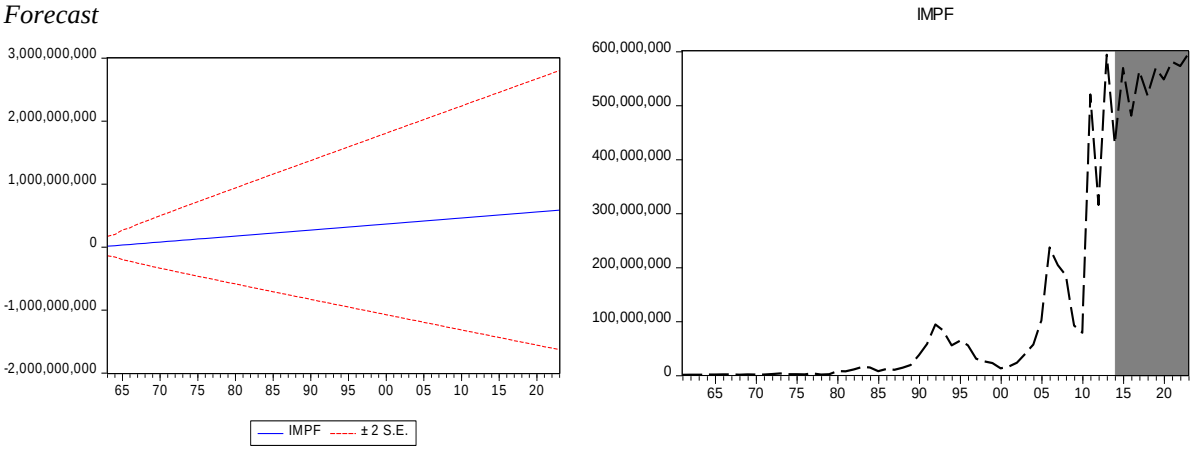


Figure6
Plots of importation forecast

Table8
Forecast for rice importation

Year	2017	2018	2019	2020	2021	2022	2023
Forecast(ton)	563000000	518000000	569000000	547000000	580000000	572000000	595000000

Imported rice will decrease from 569000000 tons in 2019 to 595000000 tons in 2023 (Table8, Figure6). These quantities of imported rice meet both domestic demand and re-exportations to neighboring countries.

3.5.Estimates of milled rice

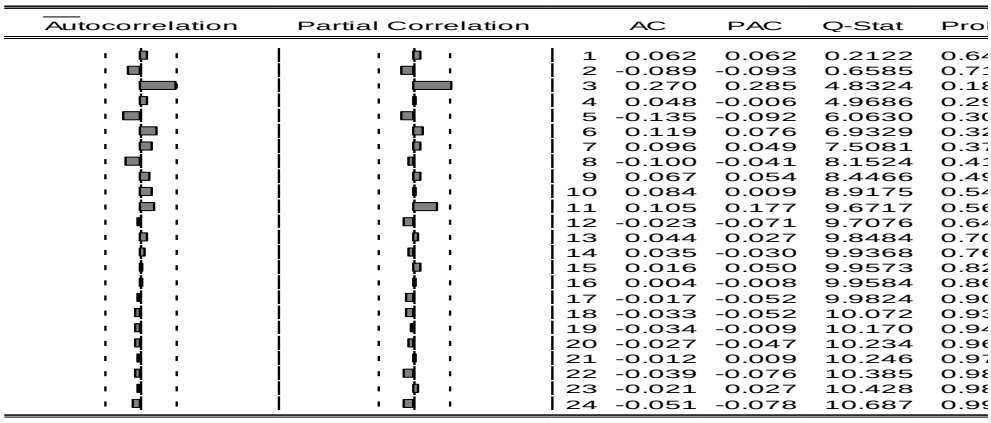


Figure7
Milled rice ACF and PACF for stationary series

The series of consumption is an I(1). By observing the Figure7 the model to be estimated is ARIMA(3,1,3) and the models values are shown in the table9.

Table9
The values of AR(3) and MA(3) models

Model	Coefficient	Std. Error	t-Statistic	Probability
AR(3)	0.811	0.316	2.564	0.013
MA(3)	0.066	0.501	0.132	0.0084

Forecast

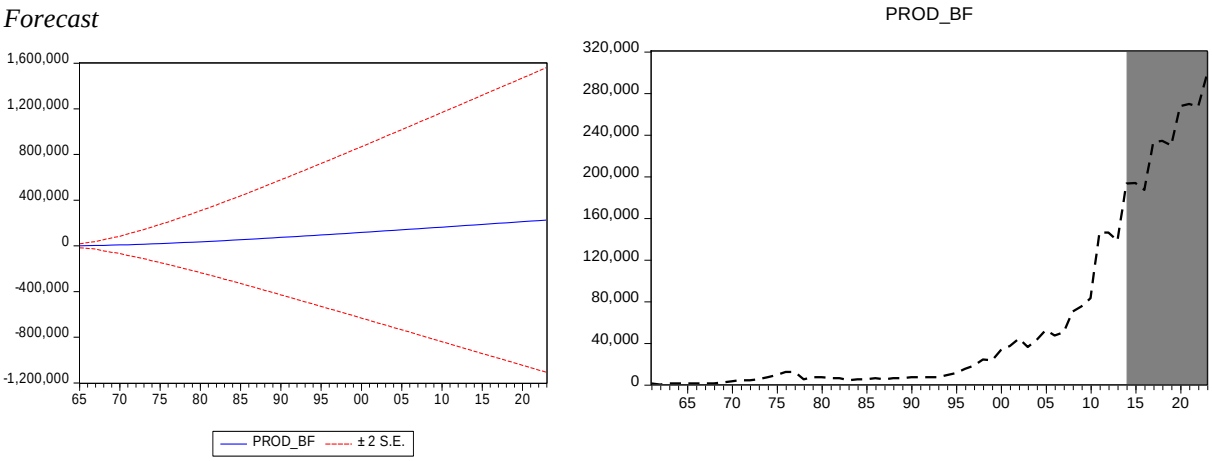


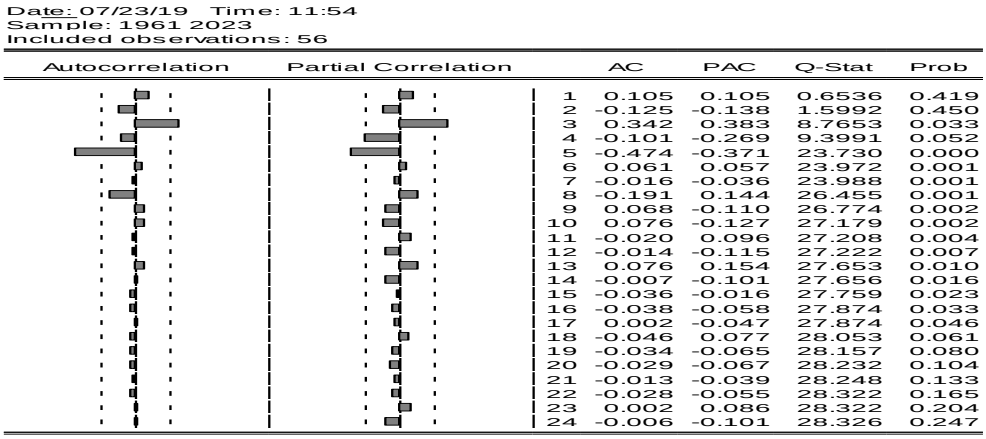
Figure8
Plot of milled rice forecast

Table10
Forecast for milled rice

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Forecast (ton)	193056.2	193612	186993.7	232599.9	233974.2	229526.1	267462.9	269501.5	266814.8	298527.1

Milled rice will increase from 229526.1 tons in 2019 to 298527.1 tons in 2023 (Table10, Figure8).

3.6.Estimates of paddy rice production



	AC	PAC	Q-Stat	Prob
1	0.105	0.105	0.6536	0.419
2	-0.125	-0.138	1.5992	0.450
3	0.342	0.383	8.7653	0.033
4	-0.101	-0.269	9.3991	0.052
5	-0.474	-0.371	23.730	0.000
6	0.061	0.057	23.972	0.001
7	-0.016	-0.036	23.988	0.001
8	-0.191	0.144	26.455	0.001
9	0.068	-0.110	26.774	0.002
10	0.076	-0.127	27.179	0.002
11	-0.020	0.096	27.208	0.004
12	-0.014	-0.115	27.222	0.007
13	0.076	0.154	27.653	0.010
14	-0.007	-0.101	27.656	0.016
15	-0.036	-0.016	27.759	0.023
16	-0.038	-0.058	27.874	0.033
17	0.002	-0.047	27.874	0.046
18	-0.046	0.077	28.053	0.061
19	-0.034	-0.065	28.157	0.080
20	-0.029	-0.067	28.232	0.104
21	-0.013	-0.039	28.248	0.133
22	-0.028	-0.055	28.322	0.165
23	0.002	0.086	28.322	0.204
24	-0.006	-0.101	28.326	0.247

Figure9
Paddy rice ACF and PACF for stationary series.

The series of paddy rice is an I(1). The analysis of the ACF and PACF functions allows us to retain the following competing models (3,1,5); ARIMA (5, 1, 3); ARIMA (3,1,3); ARIMA (5,1,5)

Table11
Comparison of different ARIMA models with model fit statistics for paddy rice

	ARIMA (3,1,5)	ARIMA (5, 1, 3)	ARIMA (3,1,3)	ARIMA (5,1,5)
Significant coefficients	2	2	0	0
Sigma^2 (volatility)	$1.74.10^8$	$1.65.10^8$	$2.58.10^8$	$2.03.10^8$
Adjusted R^2	0.4504	0.4791	0.1840	0.35
AIC	22.01	21.97	22.37	22.16

The most appropriate model is one that has more significant coefficients, less volatility, a higher R-squared, and a lower Akaike Criterion (AIC).). Based on the Table11, the model ARIMA (5,1,3). was selected as the most appropriateon.

Forecast

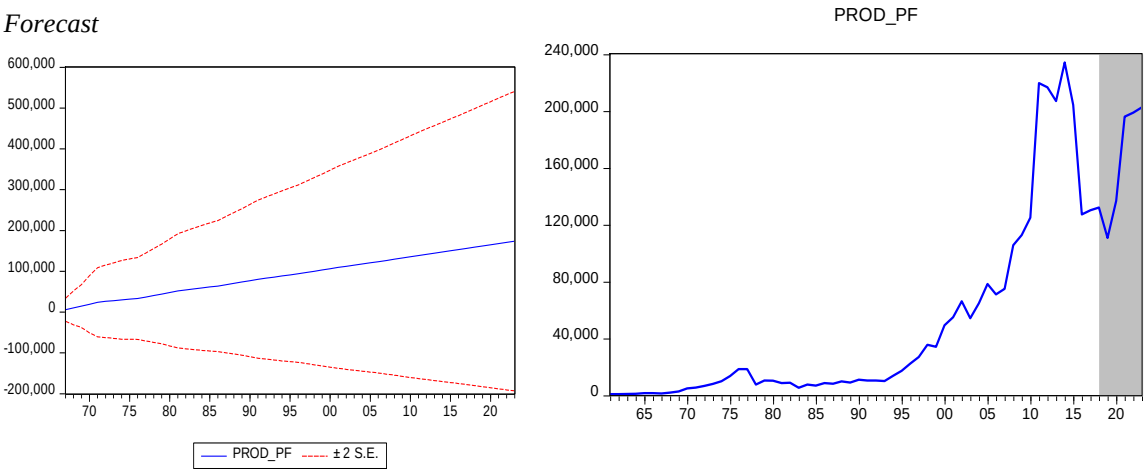


Figure10
Plots of paddy forecast

Table12
Forecast for paddy rice

Year	2017	2018	2019	2020	2021	2022	2023
Forecast (ton)	130189.8	132034.3	110682.8	136757.4	195994.9	198872.7	202584.1

Paddy rice will increase from 110682.8 tons in 2019 to and to 202584.1 tons in 2023 (Table12, Figure10).

3.7.Estimates of area of rice production

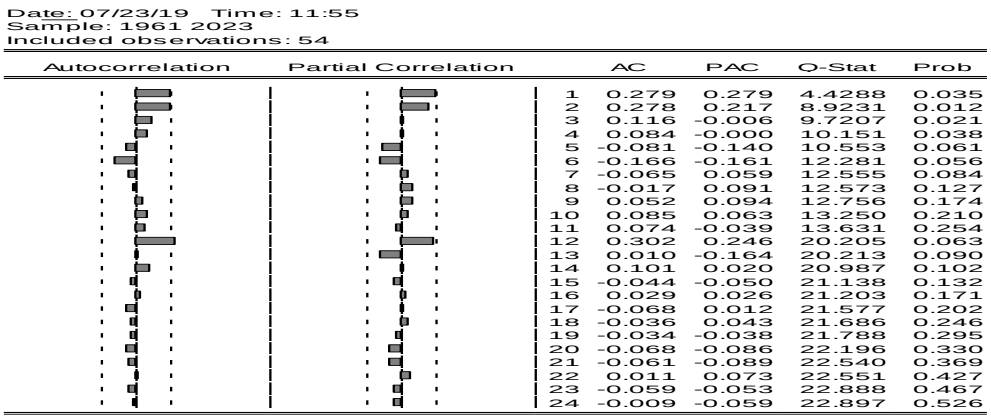


Figure11
Area ACF and PACF for stationary series

The series of area is an I(1). The analysis of the ACF and PACF functions allows us to retain the following competing models: ARIMA (1,1,12); ARIMA (12, 1, 1); ARIMA (12,1,12) ; ARIMA (1,1,1).

Table13
The values of ARIMA (1,1,12); ARIMA (12, 1, 1); ARIMA (12,1,12) ; ARIMA (1,1,1)

	ARIMA (1,1,12)	ARIMA (12, 1, 1)	ARIMA (12,1,12)	ARIMA (1,1,1)
Significant coefficients	1	2	1	1
Sigma2 (volatility)	4583815	6257622	4707474	8620418
Adjusted R2	0.5030	0.3215	0.48	0.06
AIC	18.70	18.75	18.77	18.95

The most appropriate model is one that has more significant coefficients, less volatility, a higher R-squared, and a lower Akaike Criterion (AIC). Based on the Table13, the ARIMA model (1, 1, 12) was selected as the most appropriate one.

Forecast

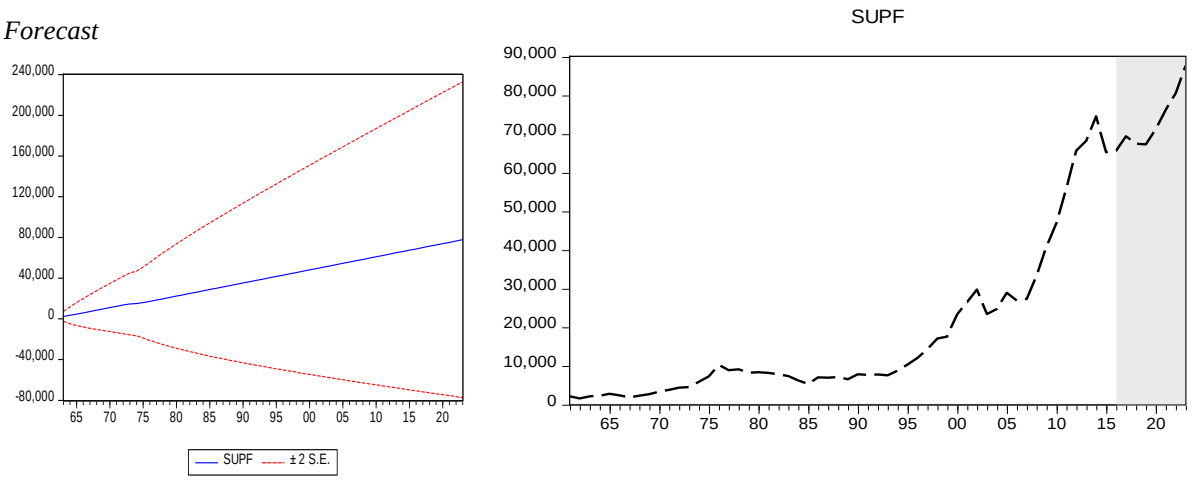


Figure12
Area forecast graphs

Table14
Forecast for area

Year	2017	2018	2019	2020	2021	2022	2023
Forecast (ha)	69394.72	67459.67	67317.95	71249.31	76254.26	80540.58	87708.02

The cultivated area will increase from 67317.95 ha in 2019 to 87708.02 ha in 2023 (Table14, Figure12).

Table15
Self-sufficiency rate (2019-2023)

Year	2019	2020	2021	2022	2023
Milled rice (ton)	229526.1	267462.9	269501.5	266814.8	298527.1
Rice consumption (ton)	491890.5	476481.4	462716	450114.1	438388.4
Self-sufficiency (%)	47	56	58	59	68

Based on Table15, one observes that the rate of self-sufficiency will increase and will reach its peak (68%) in 2023. It can be concluded that Benin will continue importing large quantities of rice to meet domestic demand and fill the gap of about 32% of the self-sufficiency rate remaining during the next five years.

According to estimates of theMinistry of Agriculture of Benin, Benin was expected to reach its self-sufficiency level in rice production since 2013 through domestic production (MAEP, 2010). However, this goal could not be achieved due to inadequate agricultural policies. Right now, the self-sufficiency level in rice production is around 60% and this, because of insufficient domestic production.

4. Conclusion and Suggestions

This study aims to give an overall idea of the rice sector in Benin and to forecast the variables of rice over the next five years by using the model. As a result, the self-sufficiency level will not be reached during the next five years. It will be about 68%. The fact is that annual rice consumption is increasing faster than annual rice production in Benin and in sub-Saharan Africa. Between 2010 and 2035, rice demand in sub-Saharan Africa is expected to increase by 130% (Secket al. 2012). Rice importations are likely to lose foreign exchange reserves and increase poverty and food insecurity. The rapid increase in local rice production is a significant challenge for sub-Saharan Africa (Catherine and Chapoto, 2017). To meet local consumption growth, rice production policies need to be redirected and revised. Because importation dependence can seriously affect food security and political stability, as demonstrated during the 2007-2008 food crisis (Berazneva and Lee, 2013). Sustainable food security cannot be based on importations, and it should be found on the development of domestic production for adequate protection against fluctuations in world prices (Larochea and Postolle, 2013).

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Determination of Fuel Properties of Some Alcohols (*Bioethanol, Butanol*), Biodiesel and Diesel Mixtures Obtained from Anchovy (*Engraulis encrasicolus*) Oil

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ABSTRACT

In this study, some alcohols (bioethanol, butanol) are mixed with different amounts in volume (D_{100}, B_{100}, $D_{75}B_{20}E_5$, $D_{70}B_{20}E_{10}$, $D_{65}B_{20}E_{15}$, $D_{75}B_{20}BU_5$, $D_{70}B_{20}BU_{10}$ and $D_{65}B_{20}BU_{15}$) some physical and chemical fuel properties of diesel, biodiesel and obtained alcohol + biodiesel + diesel blend fuels (Density, Kinematic viscosity, Flash point, Water content, Copper strip corrosion, Cloud point, Pour point, Cold filter plugging point (CFPP), The thermal value) was determined.According to the results of the research, it was observed that the physical and chemical fuel properties of biodiesel and blended fuels were within the standard fuel properties. The cetane number of $D_{65}B_{20}E_{15}$ fuels was 12% lower than the diesel standard (TS 3082 EN 590). In addition, when cold flow properties were examined, it was determined that ethanol and butanol added to fuels contributed positively.

1. Introduction

Energy is one of the major consumption elements of our age and is one of the basic elements of civilization. As the world population increases, industrialization activities and hence the demand for energy are increasing.In parallel with the development level of the countries, the energy use and the increasing demand for energy in order to meet the energy needed, the orientation to renewable energy sources has also gradually accelerated. In the future, this trend is expected to continue increasingly (Anonymous, 2012).

Bioenergy is an important place among renewable energy sources.Figure 1 shows the development of bioenergy installed capacity in the world between 2010 and 2018. As can be seen, the total bioenergy installed capacity in the world has increased steadily over the years.

The total installed capacity in 2010 was 66.926 MW while the total installed capacity in 2018 was 115.731 MW.Liquid biofuel installed capacity, which is one of the bioenergy types, increased from 1.856 MW in 2010 to 2.352 MW in 2018 with an increase of 26 percent (Anonymous, 2019).

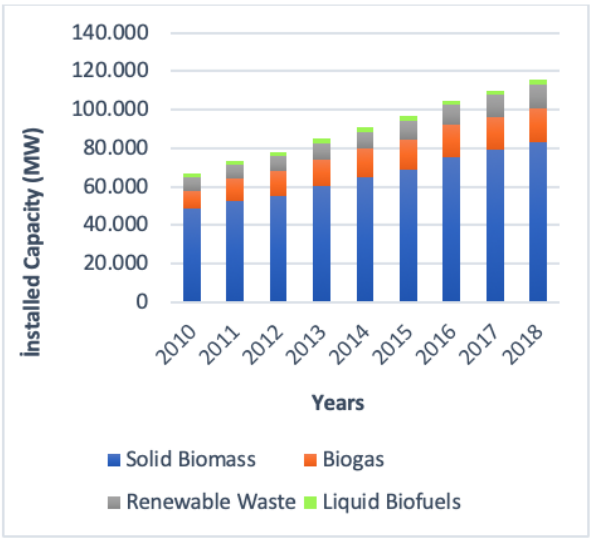

Figure 1
Energy capacity installed on earth

In internal combustion engines, alcohols, liquefied petroleum gas, compressed or liquefied natural gas, vegetable and animal oils and biodiesel derived from

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these oils can be used as alternative fuels (Sekmen and Şen, 2016). Biodiesel is a fuel that contains complex chemicals consisting of new or unnecessary vegetable oils and animal fats and that is made in the engine with mixing ratio ratio with diesel fuel (Eryilmaz, 2009).

Today, in biodiesel production, the usage of non-consumed waste oils, which are not consumed in other words, instead of vegetable and animal fats used as direct nutrients, constitutes an important alternative for countries such as our country, which obtain a portion of their edible oil needs through imports. In this context, considering the zero waste food policy, the part of the fish, seperated as waste throughout the world is considerable amount (Sekmen and Sen, 2016)

According to FAO (Food and Agriculture Organization) data, 90 million 923 thousand tons with fisheries and 80 million 70 thousand with aquaculture and total 170 million 995 thousand tons of fish was produced in the world in 2016, (Anonymous, 2018). In Turkey, 354 thousand fish by hunting, 276 thousand tons fish by aquaculture and total 630 thousand tons fish produced at 2017 (Tuik 2017, TOB 2019). It is reported that; approximately 50 % of processed fish become (gills, fin, internal organs and head) as waste. (Yayhaee et al., 2013)

Considering the cost of biodiesel production, 60 -75 % of the total cost, such as a large portion of the raw material used (oil and alcohol) costs constitute. For this reason, the use of non-consumed and waste oils in biodiesel production will contribute significantly to reduce production costs. Considering these and similar reasons, it is seen that studies on improving the production and quality of biodiesel from animal fats which are not consumed or used waste have been given importance recently (Guru et al.,2010; Sekmen and Sen, 2016).

In this study, fuel properties of some alcohols (*Bioethanol, Butanol*), biodiesel (*AOME*) and diesel mixtures were determined.

2. Materials and Methods

2.1 Material

In the study, anchovy oil obtained from Anchovy (*Engraulis encrasicolus)* fish, bioethanol and butanol were used as diesel and alcohol to be added to these fuels. Figures 2, 3 and 4, respectively, filtered oil of anchovy and mixtures with diesel, bioethanol and butanol.

Figure 2
Anchovy (Engraulis encrasicolus) fish

Figure 3
Filtered anchovy oil

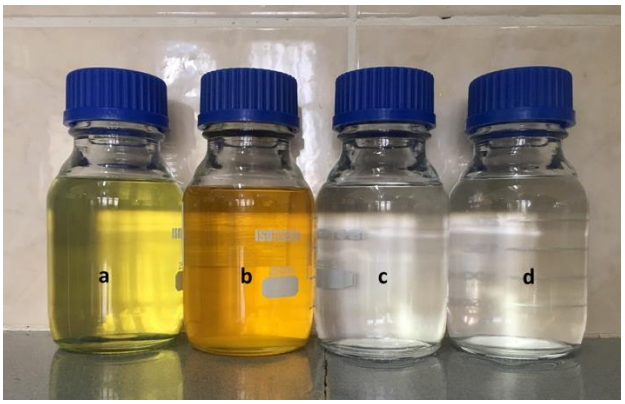

Figure 4
Diesel (a), Biodiesel (b), Bioethanol (c) Butanol (d)

2.2 Method

Anchovy oil was used as raw material in biodiesel production (Figure 3). In the production phase, one of the biodiesel production methods, transesterification method was used (Öğüt and Oğuz, 2006).

2.2.1 Obtaining Methyl Ester from Anchovy Oil

With the method of transesterification anchovy oil was produced after determining necessary alcohol and catalyst quantities for 1 litre raw oil. Accordingly, quantity of 20 % methyl alcohol (200 ml) and 4.7 gr

sodium hydroxide catalyst was determined (Sekmen ve Şen, 2016). Methyl alcohol and sodium hydroxide was blend in an appropriate cover till melted and methoxide was acquired. This mixture was added to raw oil which is heated at 60 °C in a heater with thermostat controlled and magnetic mixer and it was mixed homogenously.

Acquired mixture was kept for falling after mixing for two hour. At the end of the precipitation process, one of the two products, which had been deposited underneath, was taken.Biodiesel which is isolated from glycerol was rinsed with pure water. Rinsing process was performed with misting unit by using pure water at 50 °C with the quantity of 20 % of raw biodiesel (during rinsing biodiesel is 50 °C , water is 50 °C). Biodiesel was prepared as availlable after drying process. The AOME obtained at the end of the production process is shown in figure 5.

Figure 5
AOME produced as a result of transesterification reaction

2.2.2 Preparation of Anchovy Oil Methyl Ester, Alcohols (bioethanol and butanol) and Diesel Mixtures

Mixture fuels were prepared by volume in certain proportions, anchovy oil methyl ester produced by transesterification method was added to diesel fuel and then alcohol was added.

The obtained mixture was mixed with homogenizer for 10 minutes and a homogeneous mixture was obtained at the end of this period.Table 1 shows the amount of mixing ratios as a percentage and Figure 6 shows the mixture fuels prepared.

Table 1
Diesel, biodiesel and alcohol mixture rates

Mixture Name	Diesel (D) (%)	Biodiesel (B) (%)	Bioethanol(E) (%)	Butanol(BU) (%)
D_{100}	100	-	-	-
B_{100}	-	100	-	-
$D_{75}B_{20}E_5$	75	20	5	-
$D_{70}B_{20}E_{10}$	70	20	10	-
$D_{65}B_{20}E_{15}$	65	20	15	-
$D_{75}B_{20}BU_5$	75	20	-	5
$D_{70}B_{20}BU_{10}$	70	20	-	10
$D_{65}B_{20}BU_{15}$	65	20	-	15

1 D_{100}	2 $D_{75}B_{20}E_5$	3 $D_{70}B_{20}E_{10}$	4 $D_{70}B_{20}E_{15}$
5 $D_{75}B_{20}BU_5$	6 $D_{70}B_{20}BU_{10}$	7 $D_{70}B_{20}BU_{15}$	

Figure 6
Fuel and mixtures used in the research

2.2.3 Determination of Fuel Properties of Fuels and Their Mixtures

During the research, fuel analysis laboratory of Selçuk University, Faculty of Agriculture, Department of Agricultural Machinery and Technologies was used to determine the fuel properties*(Density, Kinematic viscosity, Flash point, Water content, Copper strip corrosion, Number of acids, Cloud point, Pour point, Cold filter plugging point (CFPP), Thermal value)* of fuels and mixtures.The results of the analysis were compared to standards TS EN 14214 for anchovy oil methyl ester and TS 3082 EN 590 standards for mixtures and diesel.

3. Results and Discussion

As a result of the analyzes, the fatty acid concentration values of the anchovy oil determined are given in Table 2 and the fuel properties of raw oil, diesel and mixture fuels are given in Table 3. In addition, TS EN 14214, TS EN 14213 and TS 3082 EN 590 standards are shown in Tables 4, 5 and 6 respectively.

Table 2
Anchovy oil fatty acids concentration

Fatty Acid		Anchovy Oil Concentration
Myristic acid	(C14:0)	6
Palmitic acid	(C16:0)	23.5
Stearic acid	(C18:0)	4.5
Oleic acid	(C18:1)	24.5
Linoleic acid	(C18:2)	3
Arachidic acid	(C20:0)	0.148485
Erucic acid	(C22:1)	0.79828

Sekmen and Sen, (2016), in their study, obtained similar results to the results given in Table 2.

3.1 Fuel Properties of Anchovy Oil, Anchovy Oil Methyl Esther, Diesel and Fuel Mixtures

As seen in Table 3, because of the viscosity of the crude oil is high (28.4 mm^2 /s) firstly the viscosity of the oil was reduced to standard value (TS EN 14214) by the transesterification method (4.55 mm^2 / s) and then the mixture of fuel by preparing the mixture fuel properties of fuels were determined. It is observed that; viscosity values decreased with increasing amount of diesel, bioethanol and butanol added to the produced anchovy oil methyl ester. This can be attributed to the

low viscosity of the used diesel and alcohols (bioethanol and butanol).

As it can be seen from Table 3, when the cetane number values of mixture fuels are examined, it is seen that the cetane number values of all fuels except $D_{65}B_{20}E_{15}$ fuel exceed the diesel standard (EN 590) value (at least 51.0). It is reported that ethanol has a negative effect on the ignition characteristics of diesel fuel in mixture ratios above 10% due to its very low cetane number and therefore cetane enhancers should be used (Yahuza and Dandakouta, 2015; Sezer, 2017). In general, cetane numbers of butanol mixtures are higher than ethanol mixtures. This can be attributed to the cetane number of butanol higher than ethanol.

The high consistency of anchovy oil decreased considerably after conversion to the methyl ester form and this fall continued in the mixture fuels. Consistency of anchovy oil, which was 922.2 kg / m^3, decreased to 895 kg / m^3 after conversion to methyl ester. As can be seen in the table, the density values of the fuels and their mixtures were found within the limits of the standard (TS EN 14214). When the consistency values of all mixture fuels are examined, it is seen that these values are between the standards (TS 3082 EN 590) values of diesel (minimum 820 kg / m^3, maximum 845 kg / m^3).

Table 3
D_{100}, B_{100}, $D_{75}B_{20}E_5$, $D_{70}B_{20}E_{10}$, $D_{75}B_{20}BU_5$, $D_{70}B_{20}BU_{10}$, $D_{65}B_{20}BU_{15}$, crude oil and diesel fuel properties

Fuel properties	D_{100}	B_{100}	$D_{75}B_{20}E_5$	$D_{70}B_{20}E_{10}$	$D_{65}B_{20}E_{15}$	$D_{75}B_{20}BU_5$	$D_{70}B_{20}BU_{10}$	$D_{65}B_{20}BU_{15}$	Crude Oil
Kinematic Viscosity (mm^2/s) (40 °C)	3.052	4.55	2.834	2.737	2.663	2.956	2.854	2.780	28.4
Density kg/m^3 (15 °C de)	835.0	895.1	838.8	837.3	835.3	838.4	837.3	835.8	922.2
Net Heat Combustion (MJ/kg)	46.335	39.720	42.688	41.989	41.202	44.576	43.597	43.216	-
Flash Point (°C)	57	147	-	-	-	-	-	-	-
Water Content (ppm)	17.887	183.13	246.27	392.58	441.06	86.066	106.321	123.172	651
Copper Strip Corrosion	1a	1a	1a	1a	1a	1a	1a	1a	-
Cloud Point	-4.5	8	-3	-3.8	-4.4	-3.1	-4.9	-6.5	-
CFPP	-16	7	-4	-6	-7	-5	-6	-7	-
Pour Point	-26	6	-7.1	-8.9	-9.9	-8.4	-9.5	-11.2	-
Cetane Number	53.717	-	52.344	51.877	44.149	53.249	53.682	53.359	-

According to the analysis results of fuels obtained from mixtures of bioethanol, butanol and diesel fuel with anchovy oil biodiesel, the water content values of mixture fuels ($D_{75}B_{20}E_5$, $D_{70}B_{20}E_{10}$, $D_{65}B_{20}E_{15}$) prepared only by adding bioethanol did not show compliance with diesel standard (TS 3082 EN 590) values. $D_{75}B_{20}E_5$, $D_{70}B_{20}E_{10}$, $D_{65}B_{20}E_{15}$) compared to the standard value (up to 200 ppm) 23%, 46% and 120% respectively. This can be explained by the high water content of bioethanol in the mixture fuels. Balcı (2017) found similar results in his study.

In addition, when the water content values of the mixture fuels were examined, it was observed that the water content values increased in parallel with the increase in the alcohol content in the mixture. For example, in blend fuels, these values were determined as 246.27 ppm (E_5), 392.58 ppm (E_{10}), and 441.06 ppm (E_{15}) in bioethanol mixtures, 86.066 ppm (BU_5), 106.321 ppm (BU_{10}) and 123.172 ppm (BU_{15}) in butanol mixtures. In addition, water content values of butanol in the high alcohol group were lower than the bioethanol in the low alcohol group. This can be attributed to the fact that butanol is more hydrophobic than bioethanol (Kumar and Saravanan, 2016).

When the thermal values of the mixture fuels are examined, it is seen that there is a slight decrease in the thermal values compared to the increased bioethanol and butanol ratios in the mixtures. In addition, a slight increase was observed in the thermal values of the mixture fuels obtained by the addition of butanol compared to the mixture fuels containing bioethanol. Kumar and Saravanan (2016) stated that butanol has a higher thermal value compared to bioethanol.

Flash point is an important value for storage and transportation of fuel. The anchovy oil biodiesel has a flash point of 147 ^{0}C and a diesel fuel of 57 ^{0}C. The flash point value of anchovy oil biodiesel was higher than ASTM 6751 and EN 14214 standards.

Table 4
TS EN 14214 automotive fuels –fatty acid methyl esters (fame/biodiesel) - diesel engines - standarts

Properties	Unit	Limits		Test method
		Minimum	Maximum	
Ester content	% (m/m)	96.5	-	EN 14103
Density at 15 °C	kg/m^3	860	900	EN ISO 3675 EN ISO 12185
Viscosity at 40 °C	mm^2/s	3.5	5.0	EN ISO 3104
Flash point	°C	101	-	EN ISO 3679
Sulfur content	mg/kg	-	10.0	EN ISO 20846 EN ISO 20884
Carbon residue (%10 distillet residue)	% (m/m)	-	0.30	EN ISO 10370
Cetane number		51.0	-	EN ISO 5165
Sulfated ash content	% (m/m)	-	0.02	ISO 3987
Water content	mg/kg	-	500	EN ISO 12937
Total contamination	mg/kg	-	24	EN 12662
Copper strip corrosiveness (50°C'ta 3 hour)	degree		Class 1	EN ISO 2160
Oxidation stability 110 °C'de	h	6.0	-	EN 14112
Acid number	mg KOH/g	-	0.50	EN 14104
Iodine value	g iodine/100 g	-	120	EN 14111
Linolenic acid methyl ester	% (m/m)		12.0	EN 14103
Poly unsaturated (>=4 double bonds) methyl esters	% (m/m)	-	1	
Methanol content	% (m/m)	-	0.20	EN 14110
Monoglyceride content	% (m/m)	-	0.80	EN 14105
Diglyceride content	% (m/m)	-	0.20	EN 14105
Triglyceride content	% (m/m)	-	0.20	EN 14105
Free glycerol	% (m/m)	-	0.02	EN 14105 EN 14106
Total glycerol	% (m/m)		0.25	EN 14105
Grup I metaller (Na+K) Grup II metaller (Ca+Mg)	mg/kg mg/kg		5.0	EN 14108 EN 14109 prEN 14538
Phosphours content	mg/kg	-	10.0	EN 14107

Cold Filter Plug Point

Climate vary	Properties	Unit	Limits						Test method
			Tip A	Tip B	Tip C	Tip D	Tip E	Tip F	EN 116
Mild climates	CFPP	°C maxi-mum	+5	0	-5	-10	-15	-20	

Table 5
TS EN 14213 heating fuels – fatty acid methyl esters (fame) standards

Properties	Unit	Limits		Test method
		Minimum	Maximum	
Ester content	% (m/m)	96.5	-	EN 14103
Density at 15 °C	kg/m^3	860	900	EN ISO 3675 EN ISO 12185
Viscosity at 40 °C	mm^2/s	3.5	5.0	EN ISO 3104 ISO 3105
Flash point	°C	120	-	EN ISO 3679
Sulfur content	mg/kg	-	10.0	EN ISO 20846 EN ISO 20884
Carbon residue (%10 distillet residue)	% (m/m)	-	0.30	EN ISO 10370
Sulfated ash content	% (m/m)	-	0.02	ISO 3987
Water content	mg/kg	-	500	EN ISO 12937
Total contamination	mg/kg	-	24	EN 12662
Oxidation stability 110 °C'de	h	4.0	-	EN 14112
Acid number	mg KOH/g	-	0.50	EN 14104
Iodine value	g iodine/100 g	-	130	EN 14111
Poly unsaturated (>=4 double bonds) methyl esters	% (m/m)	-	1	
Monoglyceride content	% (m/m)	-	0.80	EN 14105
Diglyceride content	% (m/m)	-	0.20	EN 14105
Triglyceride content	% (m/m)	-	0.20	EN 14105
Free glycerol	% (m/m)	-	0.02	EN 14105 EN 14106
Cold Filter Plug Point (CFPP)	°C	-		EN 116
Pour point	°C	-	0	ISO 3016
Net Heat Combustion (counted)	MJ/kg	35	-	DIN 51900-1 DIN 51900-2 DIN 51900-3

Table 6
TS 3082 EN 590 automotive fuels – diesel(diesel fuel) Standard

Properties	Unit	Limits		Test method
		Minimum	Maximum	
Cetane number		5.0	-	EN ISO 5165
Cetane index		46.0	-	EN ISO 4264
Density at 15 °C	kg/m^3	820	845	EN ISO 3675 EN ISO 12185
Polysiclic aromatic hydrocarbons	% (m/m)		11	EN 12916
Sulfur	mg/kg	-	350 (for 31.12.2004 or 50.0	EN ISO 20846 EN ISO 20847 EN ISO 20884
			10.0	EN ISO 20846 EN ISO 20884
Flash point	°C	Over 55	-	EN 22719
Carbon residue g (%10 distillet residue)	% (m/m)		0.30	EN ISO 10370
Ash	% (m/m)	-	0.01	EN ISO 6245
Water	mg/kg	-	200	EN ISO 12937
Total contamination	mg/kg	-	24	EN 12662
Copper Strip Corrosion (3 h, 50 °C'da)	Derece		1	EN ISO 2160
Oxidation stability	g/m^3	-	25	EN ISO 12205
Property of oiling, scale of erosion print that is levelled (wsd 1,4), 60 °C'ta	µm	-	460	ENISO 12156-1
Viscosity , 40 °C'ta	mm^2/s	2.00	4.50	EN ISO 3104
Distillation 250 °C'ta obtained % (V/V) 350 °C'ta obtained %(V/V) %95'in (V/V) obtain tempature	% (V/V) % (V/V) °C	- 85	<65 - 360	EN ISO 3405
Fatty acid methyl ester (FAME)	% (V/V)	-	5	EN 14078

Note – Dark written statements are related to European Fuels Directive 98/70/EC including Amendmentl 2003/17/EC [2]

Cold Filter Plug Point

Climate vary	Properties	Unit	Limits						Test method
Mild climates	CFPP	°C maximum	Tip A	Tip B	Tip C	Tip D	Tip E	Tip F	EN 116
			+5	0	-5	-10	-15	-20	

Animal oils are more disadvantageous in terms of cold flow properties compared to vegetable oils. In order to use biodiesel produced from animal fats in cold winter conditions, it may be necessary to use cold flow improving additives (Altun and Öner, 2008). When the B_{100} fuel is examined, it is seen that the values of cold flow properties are very high. Diesel fuel and alcohol were added to the mixture fuels to eliminate these problems.

The results of the analysis were compared to standards TS EN 14214 for anchovy oil methyl ester and TS 3082 EN 590 standards for mixtures and diesel.

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Some Reproductive Characteristics of Honamlı Goats

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ABSTRACT

This study was carried out to investigate the some reproduction characteristics of Honamlı goat breed that are rearing commonly in Taurus Mountains in the Mediterranean region of Turkey. The materials of the study was formed with the five years records from 2011 to 2016 of 27 flocks (average 220 bucks and 4400 does) chosen from 36 flocks within the scope of National Public Small Ruminant Improvement Project, which was raised under extensive conditions in Beyşehir and Derebucak districts of Konya. At the end of the research; kidding rate, survival rate, twin birth rate, fecundity, litter size and the averages for birth weight, weaning weight and daily weight gains for the five consecutive years were found as 85%,87%,15%,0.94,1.10,3.64 kg,19.14 kg,0.180 kg, respectively. Effects of farm, birth type and gender on live weights and daily weight gains were found to be statistically significant (P<0.01).

1. Introduction

The plenty number of the goat are constituting by the Hair goat (more than 90%) in Turkey, and these are reared near the forested land. On the other hand, the Angora goats are composing 2.3% of the number of goats in Turkey, for the rests are constituting Norduz, Honamlı, Malta, Kilis, Saanen, and some types of Hair goats. The breeds raised for milk production are Malta, Kilis and a tiny amount of Saanen goats and its cross-breeds which are becoming prevalent in west Anatolia. On the other hand, there were a tiny amount of some goats' breeds and different genotypes which adapted well into the different places in Turkey. This difference is providing an advantage in the search for productivity and improvement of our indigenous breeds.

The Honamlı goat is the breed that only raised in Taurus Mountains among Antalya, Burdur, and Konya, and takes attention for having products such as milk, meat, and fecundity. The most important sign of pure-blooded Honamlı goats is 2 cm of distance between their horns. Their noses' frame is roman type (hooked). Dağ & Zulkadir (2005) reported the mature live weights for bucks and does, litter size, birth weight for single and twins, lactation period, milk yield and hair yield as 80-95 kg, 50-70kg, 1.8, 3-4 kg, 2.5-3 kg, 270 days, 135-216 L and 500-600 g respectively.

Honamlı goats are going to extinct like the other kind of goats because of some policies of the government that applied in the past such as; goats are destroying and giving harm to the forests. However, goats are both eating the greens that are not consumed by the other animals and they have transmuted them into meat and milk, then they are fertilizing the soil with their feces, and they prune the branches of the old trees which are close to the land by eating them. Furthermore, scrub is the land cover of the Taurus Mountains and that land cover has to be pruned, otherwise, it disappears and dries in 30 years. There are only some researches about these kinds of goats that are a very important local source of income for Turkey until today, pure breeding and the possibility of being distributed are going to down day by day because of hybridization with the other goats. Because of that reason, the breed characteristics should be determined by the researches for Honamlı goats which are more productive for meat and milk according to the other kinds of goats in our country, these qualities should protect and use in scientific fields. From this point of view with this study, some reproductive traits of Honamlı goats are examined and it is thought that the findings obtained

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from this study will contribute to the identification of this breed and the subsequent studies.

2. Materials and Method

This study was carried out for 5 years between 2012 and 2016 within the scope of the National Public Small Ruminant Improvement Project in districts of Beyşehir (10 flocks) and Derebucak (17 flocks) of Konya province. The distribution of data collected from the 27 flocks remaining in the project for five years with an average of 4620 head goats (220 bucks and 4400 does) were given in Table 1.

Table 1
The Number of the goats and kids through the years

Years	Breeding does	Bucks	Vivip-arous does	Weaned kids
2012	3200	200	2639	2124
2013	5000	230	4204	4325
2014	4650	225	3957	3736
2015	4400	220	3770	3875
2016	4750	225	4153	4091
Average	4400	220	3744	3360

The flocks of the study are grazing in open areas and forests from early morning until noon during the grazing season. Then the flocks are taken under any shadowy places at noon and rested in there because of decreasing grazing desire of goats due to the hot weather. In the afternoon, with the disappearance of the temperature stress factor, the grazing starts again in the mountainous forest areas and the flocks returns and is put into the shelters in the evening. In general, these regions vary in terms of pasture and forest quality and are available in high quality places where spruce, larch and oak trees are dense, as well as there are insufficient areas with the amount of pasture and quality of forest. Kids are nursed in the morning and in the evening and they are weaned at the age of 90 days. Young goats selected as breeder are put on to the forest land and non-breeder kids after weaning are sold until 120 days of age or they fatten up to the period of sacrifices festival to provide economic gain. For each year in this study; the records related to kid birth weight, gender, dam ear tag number, birth type, weaning weight (at 90 days) are kept and the averages such as kidding rate, survival rate, twin birth rate, fecundity, litter size, birth weight, weaning weight and daily weight gain were analyzed from these records by the years.

Determination of goat reproductive traits

Kidding rate (%) = Number of the viviparous does/Number of the breeding does

Twin birth rate (%) = Number of the does which gave birth to twins /Number of the viviparous does

Litter size = The number of the newborn kids/ Number of the viviparous does

Fecundity =The number of the newborn kids /Number of the breeding does

Survival rate (%) = The number of the living kids until the 90 days of age/the number of the live newborn kids

Weaning weight was determined at the day of 120.

In 2012, but the other years it was determined in the 90. day. After the 90th day some of the kids are sold, that's why they didn't use for determining their survival rate.

Determination of the kids' growth

The kids were weighed and enumerated in the first 24 hours after birth. The birth weight of the kids, type of birth, gender and their mother ear tag numbers were registered. There were little amount of oak trees and spruces leafy branches given to the kids as forage during the suckling period in some farms. The kids' live weights at the weaning were weighed with precision scales. Weaning weights at the 90 days of age were calculated from the daily live weight gains by using interpolation method.

Statistical Analyses

General Linear Model (GLM) was used to determine the effect of birth type, farm and gender on live weight and growth. The following mathematical model was used to analyze the factors affecting the birth weight of the kids.

$$Y_{ijklm}: \mu + a_i + b_j + c_k + d_l + e_{ijklm}$$

Symbols of the models;

Y_{ijklm} = i. type of birth, k. gender, j. the effect of farm, m. kids' birth weight.

μ =Population average,

a_i = the effect of the type of birth (i= single, twin;1,2),

b_j = the effect of gender (j= male, female; 1,2),

c_k = the effect of farm (k= 27 different flocks),

d_l = the effect of the year (1=2012,2013,2014,2015,2016),

e_{ijklm} = random error.

This model also was used for 90. days weight and daily live weight gain from birth to weaning by adding the regression of weaning weight according to birth weight;

$$Y_{ijklm} = \mu + a_i + b_j + c_k + d_l + b_1 (X_{ijklm} - \bar{x}) + e_{ijklm}$$

μ, a_i, b_j, c_k, d_l and e_{ijklm} are the same with the equation above,

b_1: regression coefficient (partial regression of weaning weight according to birth weight)

X_{ijklm}: i. type of birth, k. gender, j. the effect of farm, m. kids' birth weight, $\bar{x}$: Average birth weight

Minitab package program was used for calculation (MINITAB, 2010).

3. Results and Discussion

Some fertility traits examined in the research flocks are given in Table 2. Kidding rate, survival rate, twin

birth rate, fecundity, litter size, the birth weight, weaning weight and average daily weight gain were found as 85%, 87%, 15%, 0.94, 1.10, 3.64 kg,19.14 kg, 0.180 kg, respectively. The differences between the years for the survival rates are found important (P<0.01).

Table 2
Some reproductive traits by the years

Years	Kidding rate (%)	Survival rate (%)	Twin birth rate (%)	Fecundity	Litter size
2012	82%	74%	15%	0.89	1.08
2013	84%	94%	18%	0.92	1.10
2014	85%	90%	10%	0.89	1.05
2015	86%	87%	16%	1.02	1.19
2016	87%	90%	18%	0.96	1.10
Mean	85%	87%	15%	0.94	1.10

1: χ^2 P<0.01

Karadağ & Soysal (2018) have stated in their study on the determination of some reproductive, growth and morphological characteristics of Honamlı goats, birth, infertility, single and twin birth rates were determined as 87%, 13%, 71% and 28%, respectively. Litter size and fecundity were reported as 1.28 and 1.11. They have stated the survival rate as %80 from birth to weaning. It seemed that similar studies in the same breed goats have been found to have different fertility rates. The main reasons for the difference between twin birth rate, litter size and fecundity in the same breed may be explained the duration of the research (5 years), number of the materials, management, nutrition, flushing and the differences of regional climatic conditions.

Differences in the values of similar studies in goat breeds reveal breed differences and the birth rate compared to similar studies; Şengonca et al. (2003)'s Hair goats (79%), Abbasoğlu (1998)'s Damascus goats (84.5%), Ceyhan & Karadağ (2009)'s Saanen goats (81.7%) higher than their values, Karadağ & Soysal (2018)' Honamlı Goats' (%87), Keskin (1995)'s Hatay goats (%94.3), Özcan (1977)'s Kilis goat (%100) was found to be lower than the values were obtained.

The birth weight and weaning (90th day) live weights of kids were obtained by interpolation method and given in Table 3. Birth weight, weaning weight, and daily weight gain was 3.64 kg, 19.5 kg, and 0.180 kg, respectively, as the average of five years.

The differences in terms of farm, birth type and gender in mean live weights and average daily weight gains were found to be statistically significant (P <0.01).

Table 3
Birth and weaning weights and daily weight gains by the years

Years	Live born kids number	Average birth weight (kg)	Weaned kids number	Average weaning weight (kg)	Average daily weight gain (g)
2012	2855	3.52 ± 0.015^{C}	2124	17.24 ± 0.100^{D}	0.152 ± 0.0011^{E}
2013	4612	3.61 ± 0.011^{B}	4325	19.06 ± 0.070^{C}	0.212 ± 0.0008^{A}
2014	4157	3.73 ± 0.012^{A}	3736	18.90 ± 0.075^{C}	0.169 ± 0.0008^{D}
2015	4472	3.63 ± 0.012^{B}	3875	20.05 ± 0.074^{B}	0.182 ± 0.0008^{C}
2016	4561	3.71 ± 0.011^{A}	4091	20.43 ± 0.072^{A}	0.186 ± 0.0008^{B}
	20657	3.64 ± 0.005	3630	19.14 ± 0.035	0.180 ± 0.0004

A, B: P<0.01

As can be seen from Table 4, a total of 20.657 goats used in this study, single and twin born kids' birth weights are given as 3.32 kg and 3.70 kg, weaning weights were 18.45 and 19.49 kg and average daily live weight gains throughout suckling period were found 0.179 and 0.185 kg, respectively. In male and female kids' birth weights were 3.53 kg and 3.76 kg, weaning weights were 17.97 kg and 20.65 kg, and average daily live weight gains throughout suckling period were found to be 0.169 kg, and 0.197 kg respectively.

Table 4
Weaning weights through birth, sex, and birth type

Traits	*N*	*Birth weight (kg)*	*N*	*Weaning weight (kg)*	*N*	*ADLWG* (kg) (birth-90th day)*
Birth type		**		**		**
Twin	*3167*	3.330 ± 0.012^{B}	*2726*	18.45 ± 0.090^{B}	*2726*	0.179 ± 0.0009^{B}
Single	*17490*	3.706 ± 0.0059^{A}	*15425*	19.49 ± 0.038^{A}	*15425*	0.185 ± 0.0004^{A}
Sex		**		**		**
Female	*10165*	3.532 ± 0.0074^{B}	*8919*	17.97 ± 0.043^{B}	*8919*	0.169 ± 0.0004^{B}
Male	*10492*	3.762 ± 0.0078^{A}	*9232*	20.65 ± 0.052^{A}	*9232*	0.197 ± 0.0005^{A}
Regression coefficient (regression of weaning weight according to birth weight)					$1.81 \pm 0.043^{**}$	

*^{A,B,**} : P<0.01; *:Average daily live weight gain*

Karadağ & Soysal (2018) 's daily live weight gains in the period of sucking was 0.180 kg in twins and 0.205 kg in singles; birth weights 3.65 and 3.86 kg for male and female kids respectively. If the weaning weights of the present study adjusted for the 120th day, they were found to be lower than the values reported in the twins as 24.80 kg and 28.82 kg in the singles. The reason for this is that Karadağ & Soysal's flock is a conservation herd and the breeding capability is made up of better animals, furthermore, the number of materials for our study is high and it can be explained as variable management conditions of 27 different flocks in a different pasture and forest quality under variable climatic conditions for five years.

Differences in the values of similar studies performed in goat breeds reveal breed differences and the present study when compared with similar studies Şimşek et al. (2007) for the birth weight of Saanen X Hair goat F_1 and G_1 Hybrids 2.18 and 2.82 kg, respectively; and for the weaning weights 14.07, and 15.62 kg; 0.131 for daily live weights gains during the suckling period, and again; Şimşek & Bayraktar (2006) reported the average birth weights lower than this study as 2.77 kg and 2.95 kg for Hair Goat and Saanen X Hair Goat (F1) hybrids respectively.

Tuncel (1977) revealed the birth weights and weaning weights of Saanen X Kilis hybrids dairy goats (Akkeçi) as 3.1 kg and 15.8 kg, respectively and Cengiz et al. (1982) reported Saanen X Kilis hybrids' weights at birth and 3 months of age as 2.96 kg, 15.14 kg and they revealed the daily growth rate from birth to weaning as 138.2 g. In a similar study, Özcan & Güney (1983) reported the average birth weights of Damascus goats in single-born females, single-born males, twins born females, twins born males 4.0 kg, 3.45 kg, 3.90 kg, 3.75 kg and weaning weights with the same row were found as 13.6 kg,12.0 kg, 8.83 kg, 10.05 kg respectively. Although the values obtained for birth weight in Honamlı kids have been found to be lower than those of Damascus kids, weaning weights were found to be higher than the values reported above.

4. Result and Conclusion

In this study, some reproductive traits of Honamlı goats that is one of the local genetic resources were examined. Although the values of fertility are generally affected by factors such as; breed, age, management, nutrition and regional conditions, the results that obtained from findings of this study are important because of being limited studies on this breed.

When the data obtained from this study were evaluated; in the terms of productive performance and growth characteristics, the use of Honamlı goat breed, which have superior characteristics than other domestic goat breeds will contribute to the studies about meat and dairy goat breeding in our country. It can be said that genetic heritage should be protected due to its being.

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The Effect of Some Environmental Factors on Diurnial Distribution of Births in Anatolian Merino Sheep

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ABSTRACT

In this study, data on the daily distribution of births of Central Anatolian Merino sheep reared in Sheep Breeding Department of Bahri Dağdaş International Agricultural Research Institute was evaluated. In this study, the effects of dam age, sex of lamb and type of birth on the time of birth in sheep were investigated. A day (24 hours) was divided into four timeframes as 22: 01-04: 00, 04: 01-10: 00, 10: 01-16: 00 and 16: 01-22: 00 in order to determine the time period in which births take place. Chi-square ($\chi 2$) test was used to determine whether the age, sex, and type of birth were effective on the distribution of births to the time periods during the day. As a conclusion, it was sind out that, in 2016, 78.09% of births were single and 21.91% twins. The sex ratio was 48.24% male and 51.76% female. The most frequent birth times were 10: 01-16: 00 (26.95%) and 04: 01-10: 00 (25.57%), the earlier birth times were 16: 01-22: 00 (23.93%) and 22: 01- 04:00 (23.55%). The effect of dam age and lamb sex on delivery time was significant ($P<0.05$), but the effect of birth type was not significant.

1. Introduction

As in all animal reproduction areas, one of the most important issues in sheep breeding is fertility. Increasing fertility is possible by providing appropriate conditions as soon as possible after birth. The period up to several hours after the onset of travail is a period of intense stress for the mother and offspring and various complications. For this reason, it is important for the breeder to be aware of birth behaviors in terms of success in production, maintenance, and management related issues (Özçalık et al., 2012). Investigating animal behavior provides an understanding of the particular characteristics of an animal and how it reacts to the environment. Considering that the methods used in animal husbandry practices are developed depending on animal behavior, the importance of research on animal behavior is understood better. By having the animals adapt to the changes in the environmental conditions, their behavior can be directed accordingly. Therefore, in order to understand animal behavior, environmental factors affecting behavior and behavioral function should be known well (Demirören, 2002).

Although a few hours at delivery and after birth is one of the important processes that affect the productivity of the farm in animal production, adequate information has not yet been obtained on birth and birth behaviors. Taking full advantage of reproductive performance affects not only the birth but also the successful survival of the first hours of the offspring depending on the relations between the newborn and the mother (Konyalı et al., 2004).

It is reported that sheep births have increased at certain times of the day and they prefer silent hours of the day (Ünal & Akçapınar 1994; Tomar 1979; Alexander 1993). In similar studies, as an increased birth time of different sheep breeds, Karabacak et al. (2012) reported that births were occurred between 10: 01-16: 00 and 04: 01-10: 00 hours; ın others study were determined that births were occurred in 16: 00-22: 00 hours (Öztürk (2012)) ,) in 04: 00-10: 00 and in 16: 00-22: 00 hours (Özçalık (2010)), in 04: 00-08: 00 hours (Gonyou and Cobb (1986)) , in 03: 00-07: 00 hours (Hudgens et al, (1986)), in 13:00-19: 00 and 15: 00-18: 00 hours (Younis and El Gaboury (1978)) and in 01: 00-07: 00 hours (Holmes (1976)). Although a large num-

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ber of literature related to many types of research made on sheep behavior exist, the number of research on domestic races in Turkey is quite low.

However, it is known that animal behavior varies according to species and breeds. In particular, the lack of researches related to behaviors of Central Anatolian Merino breed, a substantial part of Turkey's sheep existence, is regarded as a significant shortcoming.

In this study, the effects of sex, type of birth and dam age on the distribution of birth times of Central Anatolian Merino sheep during the day reared at institute conditions were examined.

2. Material and Methods

The animal material of the study consisted of Central Anatolian Merino sheep which were raised in Sheep breeding unit of Bahri Dagdas International Agricultural Research Institute. In the study, the effects of dam age (2, 3, 4, 5, 6 and 7), birth type (singleton = 1, twin = 2), lamb sex (female = 1, male = 2) on distribution of births within a day were investigated of 707 animals raised in the farm. Sheep grazing in pasture and stubble started mating in the first week of July and births took place in December and January. Sheep showing signs of delivery (lying-up, bleating, searching for places, etc.) were taken to the previously prepared birth compartment in the barn. During the lambing period, the flock housed in the barn observed every hour during the day and every two hours during the night. Observations were followed until the end of the birth, and date of birth, birth type, lamb sex, and dam age values was recorded. In addition, during the lambing period, the sheep were fed with two meals, morning and evening. Sheep nutrition; high quality dried alfalfa grass as roughage was given and bruised barley wheat, corn grains, sunflower seeds, and soybean pulp as concentrate feed was given by mixing in the feed unit within the institute.

One day (24 hours) was divided into four time periods as 22: 01-04: 00, 04: 01-10: 00, 10: 01-16: 00 and 16: 01-22: 00 to determine at which time lambing occurs more often (Karabacak et al. 2011, Ozturk, 2012). In the statistical analysis of the data, $\chi 2$ analysis was performed by using Minitab (14) package program to determine whether dam age, lamb sex and birth type factor were effective on the distribution of lambing over time periods.

3. Results and Discussion

The data of 707 sheep in sheep breeding unit were examined and the data on the distribution of births to different times of the day, the lamb sex, birth type and dam age were evaluated and summarized in the Table1. Accordingly, the highest lamb birth rate (26.95%) took place in the third period, followed by 2 (25.57%), 4 (23.93%) and 1 (23.55%) time periods, respectively. In terms of sex distribution, female ratio was 51.76% and male ratio was 48.24%, respectively. The highest delivery rate was in 2-years-old mothers with 23.80% and followed by 4 (20.65%) and 3-years-old mothers (19.27%), and the lowest birth rate was of 11.34% with 6 and 7-years-old mothers. When the type of birth was examined, it was seen that 78.09% were a singleton and 21.91% were twins.

As can be seen in Table 2, 23.80% of the lambs were born from 2 aged, 20.65% from 4 aged, 19.27% from 3 aged , 13.60% from 5 aged, and 11.34% from 6 and 7 aged sheep. . It was found that 55.03% of the 2-years-old mothers delivered between 10:01 and 22:00 (daytime), 51.63% of the 3-years-old mothers 22:01 and 10:00 (night), 4-years-old of mothers 56:67% 04:01 and 16:00 (day). 53,71% of the 5-years-old mothers 22:01 and 10:00, 52.22% of the 6-years-old mothers 4:01 and 16:00 (daytime), 56.67% of the 7-years-old mothers gave birth between 04:01 and 16:00 (daytime). In this study conducted on Central Anatolian Merino sheep, births were found to increase in the morning and evening hours.

It has been reported that the distribution of births to certain time period of the day according to the results obtained in other countries where similar studies are performed have similar results to the results obtained from this study (Alexander 1993, Holmes 1976, Entes 1976, Tomar 1979, Karabacak et al. 2011, Özçalık 2010).

According to the $\chi 2$ test results on the distribution of lamb sex at different times in the study, the distribution of male and female lambs to different times of day was found to be significant $P < 0.05$. As shown in Table 3, 383 of the lambs were born male and 411 were female, and 213 males (55.61%) were born between 04:01 and 16:00, 221 females (53.77%) between 10:01 and 22:00 when the birth rate was high. It was observed that 170 (44.39%) of the males were born between 16:01 and 04:00 and 190 females (46.23%) between 22:01 and 10:00 when the birth rate was low. Karabacak et al. (2012) reported in their study on Akkaraman breed sheep that male and female lambs' distribution of births to different hours of the day was insignificant, and 58% of births occurred in time period between 04: 01-10: 00 and 10: 01-16: 00 coinciding with daytime hours. In this study, it was seen that the time period in which males had the highest birth rate was similar to the study of Karabacak et al. (2015) In Öztürk (2012)'s findings for Akkaraman sheep breed, it was reported that male and female lambs had similar values at the time of birth, but as a result of the analysis, lamb sex had no effect on the delivery time ($P>0.05$), and the distribution of male and female lambs to time period was homogeneous. Özçalık (2010) reported in a study conducted on Akkaraman sheep that 54.5% of males, 52.0% of females and 53.12% of all lambs were born between 16:01 and 04:00.

Table 1
Distribution of lamb births at different times of the day, sex, sheep age and lamb rate by birth type (%)

Birth Time	Number of sheep N	Twins at Birth %	Lambs N	%
1 (22:01-04:00)	168	11.31	187	23.55
2 (04:01-10:00)	178	14.04	203	25.57
3 (10:01-16:00)	193	10.88	214	26.95
4 (16:01-22:00)	168	13.10	190	23.93
Total	707		794	
Sex				
Male		383	48.24	
Female		411	51.76	
Total		794		
Dam Age				
2	172	9.88	189	23.80
3	144	6.25	153	19.27
4	142	15.49	164	20.65
5	95	13.68	108	13.60
6	75	20.00	90	11.34
7	79	13.92	90	11.34
Total	707		794	
Birth Type				
Single	620	0.00	620	78.09
Twin	87	100.00	174	21.91
Total	707		794	

Table 2
Distribution of birth time according to dam age

Time Period									
Dam Age	22:01-04:00		04:01-10:00		10:01-16:00		16:01-22:00		Total
	n	%	n	%	n	%	n	%	
2	43	22.75	42	22.22	57	30.16	47	24.87	189
3	48	31.37	31	20.26	39	25.49	35	22.88	153
4	27	16.46	48	29.27	53	32.32	36	21.95	164
5	30	27.78	28	25.93	21	19.44	29	26.85	108
6	19	21.11	26	28.89	21	23.33	24	26.67	90
7	20	22.22	28	31.11	23	25.56	19	21.11	90
Total	187		203		214		190		794

$\chi 2 = 20.234$; DF = 15; P-Value = 0.163

Table 3
Distribution of lamb sex according to time periods

Time Period									
Sex	22:01-04:00		04:01-10:00		10:01-16:00		16:01-22:00		Total
	n	%	n	%	n	%	n	%	
Male	96	25.07	104	27.15	109	28.46	74	19.32	383
Female	91	22.14	99	24.09	105	25.55	116	28.22	411
Total	187		203		214		190		794

$\chi 2 = 8.639$; DF = 3; P-Value = 0.034

According to the $\chi 2$ test results on the distribution of birth type according to different time periods, the distribution of single and twin births to different times of day was not significant at P>0.05 level. As seen in Table 4, although the birth of singles occurred more during the daylight hours which coincide with 04: 01-10: 00. 10: 01-16: 00, and the birth of twin lambs was higher between 04: 01-10: 00 and 16:01-22: 00 which coincide with night hours, it was found insignificant, although it was found to be concentrated in the corresponding. This result is similar to the results reported in similar studies. In a study by Aleksiev (2007), it was reported in the distribution of births to time periods in Danube sheep that birth type had no significant effect on lambing time distribution. In another study, Younis and El-Gaboury (1978) stated that lamb birth type in Awassi Sheep had no specific effect on the distribution of births. In another study, Romano and Piaggio (1999) reported that the number of kids born did not make a difference in the distribution of the kids to the time periods during the day. In another study, Özçalık (2010) reported that singleton and twin births were more during the time periods between 04: 01-10: 00 and 16: 01-22: 00, but this was relatively not significant (p>0,05).

Table 4
Distribution of birth type according to time periods

Time periods									
Birth Type	22:01-04:00		04:01-10:00		10:01-16:00		16:01-22:00		Total
	n	%	n	%	n	%	n	%	
Single	149	24.03	153	24.68	172	27.74	146	23.55	620
Twin	38	21.84	50	28.74	42	24.14	44	25.29	174
Total	187		203		214		190		794

$\chi 2$= 1.979; DF = 3; P-Value = 0.577

4. Result and Conclusion

As a result, it was found that the effects of the time of births by sheep and the values related to number and rates, the effects of sex on the distribution of birth time according to birth times were significant (P <0.05), and distribution of birth type according to time periods was insignificant (P>0.05). While 52.5% of births (04: 01-10: 00; 10: 01-16: 00) occurred in the daytime hours, 47.5% (16: 01-22: 00; 22: 01-04: 00) were in the evening and at night. As a result of births, it was determined that the rate of twins was 21.91%. 57% of male lambs and 50% of female lambs were born during the daytime. 44% of males and 50% of females were born at night. This finding may be useful as an important finding for the owners of Central Anatolian Merino breeding in terms of ease of herd management and increasing productivity. According to the results of this research, it was found that the births were most intense during the day hours, even though the helpless births in sheep changed at every hour of the day. Moreover, it is seen that night births are at a rate that cannot be underestimated. In addition to the precautions taken during daytime births, taking the same precautions for the night births will be important to minimize the lamb deaths that may occur during nighttime births. Monitoring of the animals approaching birth and bringing these animals to special compartments during the birth season will also ensure healthy births.

In this study carried out under the conditions of the research institute, important information in terms of animal behavior in which time period of the Central Anatolian Merino sheep gave birth during the birth season was obtained. During the time of birth when labor period is more intense, if the workers become more active with the sheep in that time period, intervene in difficult births if necessary, and help lambs get their first oral milk, which may prevent the lamb's deaths and provide positive results for the welfare of the enterprise, In this way, it is evident that lambs will increase their livelihood and contribute positively to the profitability of the enterprise. It is very important for the breeders to know the behaviors of the breeds they are raising in order to prevent problems that may occur during the birth season.

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The Effect of Some Environmental Factors on birth weight in Anatolian Merino Sheep

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ABSTRACT

In this study, the data of 1510 lambs born in a private sheep farm in Eregli district of Konya in 2018-2019 were evaluated. Birth type, birth times, birth weight and lamb sex were investigated in this study. 892 of the lambs were born in 2018 and 618 of them were born in 2019. A total of 1510 lambs were born. 699 of them were born as single, 761 of them as twins and 50 of them as triplets. The total number of sheep was 1096. 681 of the lambs were male and 829 were female. Of the environmental factors affecting birth weight, while the effect of the year was statistically insignificant ($p < 0.05$), the effect of season, type of birth and sex was significant ($p < 0.01$). Lambs born in spring have more live weight than those born in other seasons. The live weight of male lambs was higher than that of females, however the weight of single born lambs was higher than that of twins and triplets.

1. Introduction

Akkaraman breed is a sheep breed which is raised in Central Anatolia and nearby regions. It is the highest number among domestic sheep breeds. It has been adapted to bad weather, thirst, hunger and regional conditions. Meat yield and quality can be increased by improving feeding and maintenance conditions. Annual wool yields are 2.2 kg and annual milk yields are 50-60 kg. Their tails are large and weigh up to 4-6 kg. Twinning rates are around 20% (Anonymous 2009).

German mutton merino is one of the main race used for crossbreeding of native breeds in Turkey. The Turkish merino, Anatolian merino, Konya merino, and Malya breeds were obtained by crossbreeding the German mutton merino with Kıvırcık and Akkaraman.

The bodies of the Anatolian merino mated with Akkaraman sheep and German mutton merino are covered with white fleece. Anatolian merino sheep have approximately 75-80% of German Mutton Merino genotype with 20-25% of Akkaraman genotype. The body is large. Head length and width is medium, lips are thick, ears are horizontal and wide, the neck is short and thick, the body is large, deep and long, thighs are full and fleshy, legs are long and strong. Its fleece is thin and consists of homogene fiber. Males and females are usually hornless. It is superior to Akkaraman race in terms of wool quality, growth, and fertility. It has a lean, thin, long tail structure, and twin birth rate is between 30-40%. Live body weight is 50-55 kg in adult sheep, milk yield is 70 to 90 liters per sheep, lactation period is 120 days, greasy fleece yield is about 3.0-3.5 kg (Anonymous 2009)

Factors such as birth type, birth weight, sex and dam age, nutritional status of mothers during pregnancy and after birth are effective on the growth characteristics of lambs except for their breed features. Birth weight is an important criterion for the profitability of enterprises. It greatly affects the survival of lambs. Lamb deaths increase with birth weight decreases. The average birth weight of lambs varies between 3-5 kg. There are many factors affecting birth weight such as feeding, birth type, dam age and race (Yılmaz and Akmaz 2000, Odabaşıoğlu 1990, Yılmaz 2006, Karakuş and Aşkın 2007, Ceyhan et al. 2013, Sezenler, et al. 2013, Ürüşan and Emsen., 2010). If birth weight is above or below the race's average, it can cause different problems. In particular, it can be said that if the birth weight is below the average, it increases the mor-

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tality rate in lambs. In lambs with birth weight less than 1.7 kg, the death rate is about 94%. On the other hand, the mortality rate is 8.1% in those with an average birth weight of 3.4 kg (MAUD and DUFFELL, 1977). By increasing the birth weight, the viability can be improved to a certain limit. The likelihood of growing slowly in the first 4-6 weeks in lambs with low birth weight is very high. In other words, the effect of birth weight on lamb growth is very important until weaning. However, this effect may decrease after weaning. Another negative effect; carcass fat ratio of lambs slaughtered at a certain weight is higher in low birth weight lambs than high birth weight lambs. Lambs should be slaughtered at a lower weight if an excess fat deposition is not desired. The effect of sex, which is one of the environmental factors affecting birth weight, is higher in the mortality rate of male lambs than female lambs. Therefore, the ratio of females in reared lambs is 2-3% greater. The effect of the birth type; Because of the limited and undernourished mothers, the mortality rate of single lambs is lower than that of multiple lambs. Mortality is higher in multiple births due to low birth weight (Koyuncu and Duymaz, 2017).

The aim of this study is to investigate the effects of some environmental factors on the birth weight of Anatolian merino sheep.

2. Materials and Methods

The material of this study consists of 1510 Anatolian Merino lambs born in 2018-2019 in a private sheep farm in Eregli district of Konya. Live weights of lambs were weighed and recorded after birth. At the same time, the sex of the lambs, birth types (singles, twins), birth year and seasons were recorded. 892 of the lambs were born in 2018 and 618 of them were born in 2019. A total of 1510 lambs were born, 699 of them were born in singles, and 761 in twins and 50 in triplets. The total number of sheep is 1096. 681 of the lambs were male and 829 were female.

At birth, lambs were weighed with 5 g precision scales and birth weights were recorded. Lamb sex, birth type and birth seasons are the other factors that were recorded. The distribution of sex, singleton, twin and triplet rates, distribution of births by year and season, birth type and sex distributions by years and seasons were calculated. In addition, the amounts of the factors affecting the birth weight were also calculated.

In the study, variance analysis was performed according to the least squares method using JUMP 7 statistical package program. As a result of the analysis of variance, OEF test (LSD test) was used to compare the sub-groups of the factors that were statistically significant among the factors examined on the birth weight (Anonymous, 2002).

3. Results and Discussion

Information on the birth years, birth seasons, lamb sex and birth types of Anatolian merino lambs are given in Table 1. As it can be seen from the table, 59.1% of the total 1510 lambs were born in 2018 and 40.9% were born in 2019. The distribution of born lambs according to the seasons was in spring, summer, autumn and winter seasons 11.5%, 16.4%, 28.5%, and 43.6%, respectively. The highest birth rate was in winter.

42.8% of the births of male lambs took place in 2018 and 48.2% of the births in 2019. 61.4% of female lambs were born in 2018 and 38.6% of them were born in 2019. The distribution of sex according to the seasons was as follows. 5.7% of male lambs were born in spring, 18.4% in summer, 28.5% in autumn and 47.4% in winter. Likewise, the highest birth rates of male lambs occurred in winter. The distribution of female lambs to seasons was 16.3% in spring, 14.7% in summer, 28.5% in autumn and 40.5% in winter. Like male lambs, the highest birth rates of female lambs occurred in winter. In 2018, the birth rate of single births was 51.2% and 48.8% in 2019. 65.8% of twins were born in 2018 and 34.2% were born in 2019. The birth rate of triplet lambs was 66% in 2018 and the birth rate in 2019 was 34%. In the distribution of birth type in seasons, 11.2% of singles were born in spring, 14.3% in summer, 23.4% in autumn and 51.1% in winter. The single birth rate is highest in winter. 11.7% of the twins were born in spring, 19.3% in summer, 32% in autumn and 37% in winter. Twin birth rate was also highest in winter. While 14% of the triplets lambs were born in spring, 46% in autumn and 40% in winter, triplets birth did not occur in summer. The highest triplet rate occurred in the autumn season. Of the total 1510 lambs, 63.8% were born as singles, 34.7% as twins and 1.5% as triplets. The sex distribution of the lambs was 45.1% male and 54.9% female.

Table 1
Descriptive statistics of birth year, birth season, birth type and lamb sex in Anatolian merino sheep

	Birth Year				Birth Season							
	2018		2019		Spring		Summer		Autumn		Winter	
	N	%	N	%	N	%	N	%	N	%	N	%
Lambs born	892	59.1	618	40.9	174	11.5	247	16.4	430	28.5	659	43.6
Sex												
Male	383	56.2	298	43.8	39	5.7	125	18.4	194	28.5	323	47.4
Female	509	61.4	320	38.6	135	16.3	122	14.7	236	28.5	336	40.5
Birth Type												
Single	358	51.2	341	48.8	78	11.2	100	14.3	164	23.4	357	51.1
Twin	501	65.8	260	34.2	89	11.7	147	19.3	243	32	282	37
Triplet	33	66	17	34	7	14	-	-	23	46	20	40
	Birth Type						Sex					
	Single		Twin		Triplet		Male		Female			
	N	%	N	%	N	%	N	%	N	%		
Lambs born	699	63.8	380.5	34.7	16.6	1.5	681	45.1	829	54.9		

Karabacak et al. (2015) determined in their study on Anatolian merino sheep that the single birth rate was 64.41%, the twin birth rate was 35.59%, 51.03% of the lambs were female and 48.97% were male. While singleton and twin birth rates determined by Karabacak et al. (2015) are similar to this study, the rate of female lambs is lower and the proportion of male lambs is higher. Karabacak and Zülkadir (2014) found in their study on Anatolian merino sheep the twin birth rate as 19.78%, singleton birth rate as 80.22%, and the sex distributions of female lambs as 54.54% and male lambs as 45.46%. The rate of twins obtained in this study is higher than the rate of twins stated by Karabacak and Zülkadir (2014), whereas the sex ratio has similar values. Zülkadir and Karabacak (2013) stated the sex distribution of Akkaraman lambs as 57.50% male, 42.50% female, and the Awassi lambs sex distribution as 42.11% male and 57.89% female. The rate of males found by Zülkadir and Karabacak (2013) for Akkaraman is higher than that of this study and the proportion of females is lower. The rate of males determined for Awassi is lower than this study and the proportion of females is higher. Karakuş and Aşkın (2007) found the birth type in Anatolian merino as 56.14% singleton, 36.84% twin, and 7.02% triplets. The reported single birth rate is lower than the rate obtained in this study, and the twin rate is similar and the triplet rate is higher.

Table 2 shows the results of the variance analysis calculated according to the least squares mean method of birth weight, year, season, sex, and type of birth.

Table 2
The least squares variance analysis results of the examined effective factors on birth weight

	DF	SOS	MS	F
General	1509	691.98	---	
Years Between	1	0.42	0.42	1.14
Between the Sexes	1	6.26	6.26	16.92
Between Birth Types	2	120.54	60.27	162.89
Between the seasons	3	8.21	2.74	7.41
Error	1502	556.55	0.37	

The least square mean of the factors affecting birth weight are given in Table 3.While the effect of year factor was not statistically significant ($P>0.05$), the effects of sex, birth type and season factors were statistically significant ($P<0.01$). The mean birth weight of lambs born in 2018 was 4.59 kg and the mean birth weight of lambs born in 2019 was 4.49 kg. Mean birth weight of lambs born in spring, summer, autumn and winter season was 4.59 kg, 4.37 kg, 4.33 kg , and 4.40 kg, respectively. The birth weight was highest in the spring season. The mean birth weight of male lambs was 4.59 kg and the mean birth weight of female lambs was 4.46 kg. The effect of birth type on birth weight was also statistically significant ($P <0.01$). The mean birth weights of singles, twins, and triplets were 4.59 kg, 4.07 kg and 3.62 kg, respectively.

Table 3
The least squares mean (LSM) and standard error (SE) values of affecting factors birth weight

	Birth Weight	P-value
Year	$\overline{X} \pm S_{\overline{X}}$	
2018	4.59+0.055	0.287
2019	4.49+0.113	
Season		
Spring	$4.59+0.055^{A}$	0.001
Summer	$4.37+0.046^{B}$	
Autumn	$4.33+0.039^{B}$	
Winter	$4.40+0.098^{AB}$	
Sex		
Male	$4.59+0.055^{A}$	0.001
Female	$4.46+0.050^{B}$	
Birth Type		
Single	$4.59+0.055^{A}$	0.001
Twin	$4.07+0.055^{B}$	
Triplet	$3.62+0.109^{C}$	

Yılmaz and Akmaz (2000) stated in their study carried out to investigate the effect of the season on the growth characteristics of lambs that seasons had an effect on the growth of lambs in all periods except the birth, and the birth type and sex had a statistically significant effect on live weight in the first and second month. This report of Yılmaz and Akmaz is not similar to the results of current study. Odabaşıoğlu (1990) found in their study with the aim of investigating the effects of sex on the growth of Anatolian Merino lambs that the effect of sex on the 15th and 30th days was insignificant, but significant at P <0.05 level on the 45th day and P <0.01 in the other periods. In contrast to Odabaşıoğlu (1990)'s report, the effect of sex on birth weight is statistically significant in current study. Yilmaz (2006) determined that the effect of birth type, sex, and breed on the birth weights of Akkaraman breed and crossbred lambs was statistically significant. The results of current study are consistent with the declaration of Yılmaz. Ceyhan, et al. (2013) remarked that birth type and dam age were effective on the birth weight of lambs, but sex was not effective. While the effect of birth type found by Ceyhan et al. (2013) on birth weight was parallel to the results of current study, but the effect of sex on birth weight was not similar. Sezenler et al. (2013) expressed that the effect of sex, year and type of birth was important on the birth weight of Karacabey merino lambs. The results of Sezenler et al. (2013) reports are similar to current study except for the year factor. Ürüsan and Emsen (2010) stated that the effect of breed and season is significant on the birth weight of lambs in Tushin, Awassi, Morkaraman and their crossbreed with Romanov. In this study, the effect of the season on birth weight is similar to the results found by Ürüşan and Emsen (2010). Foster et al. (1988) stated that lamb birth weights may increase in spring and summer periods, during which the environmental temperature increases and environmental conditions of the birth improve. In this study, birth weight of lambs born in spring season is similar to that of Foster et al. (Year).

As a result, 59.1% of total 1510 lambs were born in 2018 and 40.9% of them in 2019. The highest birth rate was 43.6% in winter and the lowest birth rate was 11.5% in spring. While 42.8% of males were born in 2018, 48.2% were born in 2019, 61.4% of females were born in 2018 and 38.6% in 2019. The highest rate of male births was in winter with 47.4%, while the lowest birth rate was 5.7% in spring. The highest birth rates of females occurred in winter with 40.5% and the lowest rate was 14.7% in summer. 51.1% of singles, 37% of twins and 40% of triplets were born in winter. The rate of single births was 63.8%, twin births were 34.7% and triplet births were 1.5%. The distribution of sex in born lambs was 45.1% male and 54.9% female. While the effect of the year on the birth weight of the lambs was statistically insignificant, the effect of season, birth type and sex were statistically significant (P <0.01). The birth weight of lambs born in spring season is higher than those born in other seasons, the birth weight of male lambs is higher than that of females, and the birth weight of singles is higher than that of twins and triplets.

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The Effect of Colostrum Quality and Immunoglobulin Amount on Development up to Weaning Period in Holstein Friesian Calves

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ABSTRACT

This study was conducted to determine the quality of given colostrum to calves born in three different dairy farms in Eregli district of Konya and to investigate the development of calves up to 60th day. A total of 71 calves were used in the study. 32 of them were male and 39 of them were female. The effect of sex, enterprises, number of birth and birth month were examined on the colostrum characteristics. Birth weight, 60th day weight, colostrum dry matter, colostrum specific gravity, serum IgG, IgM, IgA at birth and IgG, IgM and IgA values at 60th day averages were determined as 41.78 ± 4.30 kg, 79.57 ± 10.17, kg, 28.60 ± 2.33, 1067.40 ± 9.85 g / L, 0.03638 ± 0.005, 0.0801 ± 0.0041 and 0.0391 ± 0.0045; 0.0342 ± 0.0050, 0.0364 ± 0.0041 and 0.0181 ± 0.0045 mg / L, respectively. The effect of sex on birth weight was statistically significant at P<0.01 level, and the effect of the number of births and enterprises on birth weight was statistically significant at P<0.05 level. The effect of any factor on sixty-day weight was not statistically significant. The effect of birth number on colostrum DM was statistically significant at P<0.01 level. The effect of period factor was very important (P<0.01) for IgM and IgA, but it was insignificant for IgG.

1. Introduction

Healthy breeding of calves is one of the most important issues in terms of economic sustainability of meat and dairy farming. In dairy cattle breeding enterprises, it has vital that calves be grown in a healthy way for the replacement of new breeding instead of animals in the herd. Possible diseases in calves cause low yield in the future. Newborn calves are at risk for many threats because their immunity is not fully developed. Most calf diseases and deaths after birth are caused by low immunoglobulin density (Goyena et al., 1997).

Newborn calves face significant challenges until they adapt to environmental conditions. The first weeks of their lives can be challenging. The calves getting over this period have a high chance of survival. In addition, calf losses in the first three months period can increase up to 20% according to running conditions (Bardakçıoğlu, 2001).

Calves should receive sufficient and quality colostrum to avoid endangering their lives. Because the immune substances (immunoglobulins, antigens, and antibodies) in the colostrum provide passive immunity by protecting calves from the disease. For this reason, colostrum should be provided with sufficient amount of immune agents. Immunoglobulins are the most important immunological agents, especially IgG, IgM, and IgA.

Pakkanen and Aalto (1997) reported that cow colostrum contains mostly IgG and a small amount of IgA, IgD, IgE, and IgM. The major immunoglobulins that act as antibodies are IgG, IgA, and IgM.

Koç (2013) stated that IgG, which constitutes 85-90% of the immune proteins in the colostrum, is effective in systemic 3 immunities, IgM is effective in the early immunity and protection from and septicemia, and IgA is not fully known for its duty, and all these three immune proteins should be found for an effective immunity.

Islam et al. (2005) reported that 35.2% of calf deaths occurred in the first month after birth. According to the researchers, the major cause of these deaths is the lack of adequate development of passive immunity, which means that the required level of quality colostrum is not taken.

In Turkey, it has been reported that the proportion of neonatal calves lost is 1-8% in the professional ani-

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mal raising enterprises, and this percentage is even higher in public enterprises (Çelik, 2013).

Genç (2015) stated that the amount of immunoglobulin in the blood serum of the calf should be determined within 24–48 hours after birth so that it can be determined whether passive immunity has developed or not. He also reported that IgG detection is a widely used indicator to evaluate immunoglobulin status in calf blood and colostrum. He remarked that in order to ensure adequate passive immunity in calves, the IgG concentration in the blood should be at least 10 g /l by the end of the 48th hour after the birth, and that the calves with a serum IgG value of 10 grams or higher are less likely to catch the disease than the calves that have not caught this rate.

As a result of studies on immunity in calves, it is emphasized that more than 50 grams of IgG should be present in one liter of colostrum to provide adequate passive immunity (Arthington, 2001).

The aim of this study was to determine the quality of colostrum given to Black Holstein calves reared in three different farms in Eregli district of Konya, and to investigate the effect of colostrum in the development of calves up to 60th day.

2. Materials and Methods

The animal materials to be used in the study consist of the calves born in three different dairy farms in Konya Ereğli district. A total of 71 calves were used in the study. 32 of them were male and 39 of them were female. The effect of sex, enterprises, number of birth and birth month were examined on the colostrum characteristics.

Colostrum quality was determined by establishing the relationship between colostrum gamma globulin content and colostrum density with colostrometers. The colostrometer give results basing on the relationship between the amount of Ig in the colostrum and the specific weight. The colostrum obtained from each cow after delivery was cooled to 20° C within the first 24 hours and filled into a beaker and the specific weight was measured with colostrometer. Colostrum classification is based on specific weights (Anonymous, 2006).

Accordingly, colostrum with a specific weight of >1.045 g / ml is classified as good quality, colostrum of 1.035-1.045 g / ml is classified as medium quality and colostrum of <1.035 g / ml is classified as low quality.

Blood samples were taken from vena jugularis to vacuum tubes in the experimental and control group calves on the 3rd day after birth, with venosafe plastic vacuum blood collection tubes and apparatus under necessary hygiene measures. Blood samples were sent to the laboratory for determination of IgM, IgG and IgA antibody levels. After 30 minutes at room temperature, the samples were centrifuged at 3500 rpm for 10 minutes to obtain serum samples and IgG, IgA and IgM antibody levels were determined from blood serum.

Only one calf died in the examined farms. Therefore, survival data were not evaluated.

In this study, the effects of factors such as parity, enterprise, season and age, which were thought to be effective on colostrum quality, were evaluated. Duncan multiple comparison test was applied to compare the sub-groups of the factors whose effects were found to be significant from the investigated factors, and statistical significance was checked and lettered (Duncan, 1955).

LSMLMW Least-Squares and Maximum Likelihood General Purpose Program developed by Harvey (1987) was used to determine the effect of yield characteristics approached according to mathematical models, least squares mean and variance analysis.

The mathematical model used in the analysis of the factors affecting colostrum quality;

$$Y_{ijklm} = \mu + a_i + b_j + c_k + d_l + e_{ijklm}$$

It is in the form of the terms contained in these models

Y_{ijklm}= Colostrum dry matter of animal give birth in the i. month, j. enterprise, k. calf sex, l. parity,

μ = the expected average of the population,

a_i = i. the effect of birth month (February = 1, March = 2)

b_j = j. the effect of the enterprises (1, 2, 3),

c_k = k. the effect of calf sex (Female = 1, Male = 2),

d_l = 1. the effect of parity (1,2,3 ..),

e_{ijklm} = represents normal, independent, chance-dependent error.

3. Results and Discussion

Birth and sixtieth day weights

The LSM and SE values of the birth and sixtieth day weights of the animals examined were determined as 41.78 ± 4.30 and 79.57 ± 10.17 kg, respectively. While gender was effective on the birth and sixtieth day weight at P<0.01 level, and the number of births and enterprise was effective at P<0.05 level, the month of birth had no effect. The effect of any factor on the sixtieth day weight was not significant.

In the study, LSM and SE values of the factors that had effects on birth and sixty-day weight are presented in Table 1.

Table 1
The LSM and SE values of the factors that have effects on birth and sixtieth-day weight

Factors		N	Birth Weight	Sixtieth-day Weight.
Gender**	Female	39	39.46±0.79^{b}	79.75± 2.06
	Male	32	42.45±0.89^{a}	81.62± 2.24
Enterprise*	1	50	42.87±0.61^{A}	79.22± 1.59
	2	10	40.34±1.36^{AB}	79.72± 3.53
	3	11	39.65±1.31^{B}	83.11± 3.35
Number of Birth*	Single births	39	39.83±0.81^{B}	80.88± 2.17
	Multiple Births	32	42.08±0.87^{A}	80.49± 2.42
Month of Birth	February	40	41.13±0.80	78.69± 2.41
	March	31	40.78±0.88	82.68± 2.24

$^{A, B}$: P <0.05, $^{a, b}$: P <0.01: Differences between the means indicated by different letters in the same column are important

In the examined enterprises, the birth weight of males was approximately 3 kg higher than females. This is an expected case. The average birth weight of 41.78 ± 4.30 kg is very close to the general average reported for the Holstein breed. However, in the studies conducted on the subject; Ayaşan et al. (2016) determined the mean birth weight for Holstein Friesian breed as 42.24 kg, while Doğan (2014) determined the mean birth weight in calves born in winter and spring as 43.99 ± 0.89 kg and 40.90 ± 0.91 kg, respectively. These results reported by the researchers are slightly higher than the value obtained in the present study.

On the basis of enterprises, the highest average was obtained from the number one enterprise and the lowest average was obtained from number three enterprise. The differences between enterprises in terms of birth weight were found to be statistically significant (P<0.05). As well as the share of the father line in birth weight, the size of the mother, whether the mother gave first or more births, differences in the feeding and care applied to the animals may have caused birth weights to be different. Moreover, the mean birth weight of the mothers who had multiple births was 2.25 kg heavier than the birth weight of the mothers that had their first birth, and this difference caused a statistically significant difference (P<0.05).

There was no difference in the weights of the sixtieth day in the investigated farms, and it was observed that the animals with low birth weight compensated for these differences until the sixtieth day.

Colostrum dry matter and specific gravity

The LSM and SE values of dry matter (DM) and specific gravity (SG) values of colostrum obtained from the animals examined in the study were found to be 28.60 ± 2.33% and 1067.40 ± 9.85 g/L, respectively. Out of the factors such as calf gender, enterprise, the number of births and month of birth which were thought to have an effect on colostrum DM and SG, only the number of births had an effect on DM at the level of P<0.01, but the effects of other factors were insignificant.

The LSM and SE values of the factors thought to have an effect on dry matter and specific gravity values of the colostrum samples obtained from the study are presented in Table 2.

Table 2
The LSM and SE values of the factors that have effects on colostrum DM and SG values

Factors		N	DM (%)	SG (g/L)
Gender	Female	39	28.81±0.45	1067.58±1.93
	Male	32	28.86±0.48	1066.38±2.06
Enterprise	1	50	28.50±0.34	1067.86±1.43
	2	10	28.83±0.74	1068.52±3.15
	3	11	29.16±0.73	1064.56±3.08
Number of Births*	Single Births	39	27.87±0.47^{B}	1065.31±2.04
	Multiple Births	32	29.80±0.49^{A}	1068.64±2.17
Month of Births	February	40	29.24±0.44	1067.53±1.89
	March	31	28.43±0.48	1066.42±2.06

*: P <0.05, A, B :Differences between the means indicated by different letters in the same column are important

The specific gravity or relative density of the colostrum can be measured as an objective indicator of its quality. The device that measures the specific gravity of the colostrum is called a colostrometer. It has been reported that good quality colostrum should have a specific gravity greater than 1.056 g / L, whereas the specific gravity of normal milk is 1.032 (Wattiaux, 2008).

Kaygısız and Köse (2007) measured colostral density in the colostrum and divided the colostrum into three classes as good quality, medium quality, and bad quality. They have stated that the density of good-quality colostrum is higher than 1045 mg/ml, this value ranges from 1035 to 1045 mg/ml in medium quality colostrum and is less than 1035 mg/ml in low-quality colostrum.

Zinc sulfate test (ZST) can also be used to measure Ig levels in blood serum. In this method, serum IgG concentration less than 5 mg/ml is indicative of a failure in passive transfer immunity. Calves with this level are likely to have a high mortality rate. A value of 10-20 mg/ml indicates a moderate level of immunity (Rice and Rogers, 2003).

In the study of Göncü et al. (2013), the quality of colostrum and serum immunoglobulin levels in calves were compared in Holstein cows and heifers. The average density of colostrum samples collected in the study was determined as 1063.90 ± 1.67 g / L.

Blood immunoglobulin levels (mg / L)

The LSM and SE values of the immunoglobulin levels in the blood of calves reared in the farms subject to the study on the day of birth and on the sixtieth day for IgG, IgM and IgA were determined as 0.03638 ± 0.005, 0.0801 ± 0.0041 and 0.0391 ± 0.0045; 0.0342 ± 0.0050, 0.0364 ± 0.0041 and 0.0181 ± 0.0045 mg/L, respectively.

The effect of the period factor on the amounts of immunoglobulin was very significant (P <0.01) for IgM and IgA, but was not significant for IgG. LSM and SE values of the factors studied on immunoglobulin levels are given in Table 3.

Table 3
The LSM and SE value (mg/L) of the factors that have effects on the amount of immunoglobulin

Factors		N	IgG	IgM	IgA
Period	At Birth	71	0.0363 ± 0.005	0.0801 ± 0.0041[a]	0.0391 ± 0.0045[a]
	On the Sixtieth Day	71	0.0342 ± 0.0050	0.0364 ± 0.0041[b]	0.0181 ± 0.0045[b]

[a, b:] P <0.01, Differences between the means indicated by different letters in the same column are important

There was not much difference in IgG at birth and on the sixtieth day, but significant decrease in IgM and IgA occurred. The amount of IgM decreased to approximately 1/3 of that at birth on day sixtieth and the amount of IgA decreased to about half. IgG is the most common type of antibody in the body. It is found in all body fluids. It constitutes 75-80% of the antibodies. Therefore, there was not much reduction.

Genç (2015) determined the plasma IgG amount at 52.7 mg/ml in the sixth hour and reported that this value decreased to 4.8 mg/ml at 48th hour.

Conneely et al. (2014) in their study of the amount of serum immunoglobulin in dairy breed cattle have determined serum IgG concentration as 1.03 g / L at the zero hours. They remarked that after 24 h the serum IgG concentration increased to 39.1 g / L.

The birth and sixtieth day weights of the calves examined in the study were 41.78 ± 4.30 and 79.57 ± 10.17 kg, respectively. Although the difference between birth weights was significant, this difference disappeared at the sixtieth day. The survival rate of the calves was 98.60%. In other words, only one of the 71 calves that were the subjects of the study died. According to the colostrum quality classification, the average specific gravity value measured by colostrometer was found as 1067.40 ± 9.85 g / L. So colostrum qualities were found very high. The relationship between this result and the survival of calves is very high.

The mean DM of colostrum was found as 28.60 ± 2.33% and it was higher than the colostrum dry matter values reported in the literature. When the specific gravity and DM values are considered together, colostrum quality seems quite high.

The averages obtained for immunoglobulin amounts for IgG, IgM and IgA at birth and on the sixtieth day were 0.03638 ± 0.005, 0.0801 ± 0.0041 and 0.0391 ± 0.0045; 0.0342 ± 0.0050, 0.0364 ± 0.0041 and 0.0181 ± 0.0045 mg / L. According to these results, Ig was provided above the limits determined by the sources indicating that at least 10 g/L immunoglobulin should be given to newborn calves. This result was also reflected in the survival of calves.

In conclusion, it can be said that colostrum management was very well performed in the three farms investigated and therefore the calf losses were very low. These enterprises should work meticulously in this way to set an example for other enterprises. Businesses who have successfully survived the first four weeks of calf loss are more likely to minimize calf losses in the later periods by carefully observing the maintenance and feeding programs. As a result, the enterprises investigated have been found quite successful in terms of colostrum management.

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Artificial Neural Network Model for Predicting Specific Draft Force and Fuel Consumption Requirement of a Mouldboard Plough

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ABSTRACT

A 2-(5-8)-2 artificial neural network (ANN) model, with a back propagation learning algorithm, was developed to predict specific draft force and fuel consumption requirements of mouldboard plough in a clay loam soil under varying operating conditions. The input parameters of the network were tillage depth and forward speed of operation. The output from the network were the specific draft force and fuel consumption requirement of the mouldboard plough. The developed model predicted the specific draft force and fuel consumption requirement of mouldboard plough with an error <1 % when compared to the measured draft force and fuel consumption values. Such encouraging results indicate that the developed ANN model for specific draft force and fuel consumption requirement prediction could be considered as an alternative and practical tool for predicting draft force and fuel consumption requirement of tillage implements under the selected experimental conditions in clay loam soils. Further work is required to demonstrate the generalised value of this ANN in other soil conditions.

1. Introduction

Tractors are recognized as main source of power supply for agricultural machinery. For conventional tillage, most of the farmers in Turkey utilise their available tillage implements with a range of tractor powers, consequently there is often improper matching of the tractor and its implement resulting in under loading of tractor and hence, poor efficiency.

To increase efficiency of agricultural production; it is necessary to increase machine working efficiency. Taylor (1980) estimated that in the U.S. for each 1 % improvement in traction efficiency, 284–303 million litres of fuel could be saved annually. Due to increasing world population and limited non-renewable resources, especially fossil fuels, it is necessary to reduce and manage fuel consumption in various agricultural activities (Karparvarfard and Rahmanian-Koushkaki, 2015).

Tillage plays a critical role in the technological development in the evolution of agriculture. The objectives of soil tillage are seedbed preparation, water and soil conservation, and weed control (Opara-Nadi 2008).

Determination of forces which are applied on tools during tillage operation is worthwhile and necessary for designing tillage equipments that are in direct contact with soil particles. The draft force of tillage equipments is one of the most important forces that has been used for measuring and evaluation of energy requirement for tillage equipments. This force is a function of following parameters (Godwin et al., 2007; Roul et al., 2009):

1. Soil conditions such as its moisture content and texture.

2. Tools' parameters such as depth of cutting, cutting angle, sharpness of the cutting edge.

3. Operational parameters including forward speed of tools.

Tillage is one of the major energy consumers in agricultural production; its efficiency is measured by the power consumption. Plowing as a part of tillage also

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accounts for more traction energy than any other field operation and often determines the size of the suitable tractor. It consumes from 29 % to 59 % of all diesel fuel required for the complete technology. One of the major factors that affect fuel consumption is tillage depth. Increasing tillage depth also means more work which needs more fuel, therefore the issue of reducing the fuel consumption of the tractor during tillage have been investigated and reported by many researchers (Bentaher et al., 2013; Mamkagh, 2019).

Many studies have been done in order to investigation and prediction of this force that the majority of these models are for symmetrical tools and have been developed based on the soil-implement related models. These models calculate the draft force and the forces which are applied vertically on soil particles, also, in some cases these models are predictable for some tillage implements such as disks and mould board ploughs with lateral force (Godwin and O'Dogherty, 2007).

A mathematical model which predicted the draft force applied on bottom of mould board plough has developed by Godwin et al. (2007). One of the important aspects of this model is the calculation of draft force using geometric parameters including the body of bottom, ploughing speed and physical properties of soil. A program had developed to perform complex calculations. In order to evaluating the total draft force, Empirical work had been conducted to give credit to this model by using two types of bottom materials in sandy soils. The comparison of measured and predicted forces showed that the values of predicted forces were 2.8 % lower than measured ones.

A number of empirical polynomial/multi-linear regression models have been developed in the past by several researchers for the prediction of draught of tillage implements (Upadhyaya et al., 1984; Kheiralla et al., 2004; Sahu and Raheman, 2006). However, most of these models are often subjected to multi-colinearity problems and their application is limited to those soils and implements conditions for which they were developed. Most recently, Godwin et al. (2007) reported the following relationship between the draft, speed and depth of operation for mouldboard plough:

$$H_t = (Ad^2 + Bd)v^2 + (Cd^2 + \mathrm{Dt})$$

where, H_t is the total draft force (kN), d is depth of operation (m), v is forward speed (ms^{-1}). The values of the constants A, B, C and D determined from this analysis were specific for the particular soil and plough body geometry.

Many studies have been conducted to measure draft force and fuel consumption of tillage implements (Al-Janobi et. al 2001, Sahu and Raheman, 2006). Predicting tractor fuel consumption can lead to more appropriate decisions on tractor management. Khalilian et al., (1984) presented the fuel equations corresponding to different diesel engine air intake types. Results showed that fuel efficiency equations more nearly reflect actual data than ASAE equations where predictions were at least 20% higher than experimental data.

A few researchers have attempted to develop artificial neural network (ANN) models to predict the draught of tillage implements. Zhang and Kushwaha (1999) developed a radial basis function (RBF) neural network to predict draught of narrow blades using operating speed, tools and soil types as input parameters. The data for the development of the model were obtained by conducting tests in three field sites using 5 different narrow blades. They reported that the developed neural network model for the draft force prediction had good generalisation ability within the range of input parameters. Roul et al., (2009) developed an ANN model for predicting the draught requirement of tillage implements, such as mouldboard ploughs, cultivators and disc harrows for different soil physical conditions, namely, moisture content and bulk density. A 5–9–1 neural network was capable of predicting draught requirement of tillage implements in sandy clay loam soil under varying operating and soil conditions as indicated by high coefficient of determination (0.99), low mean squared error (0.0264) and low percentage error (6.4 %).

Rahman et al. (2011) developed an ANN model to predict energy requirement of a tillage tool from the laboratory data. The ANN model was trained and tested with soil moisture content, plowing depths, and operating speeds as input parameters. The measured energy requirement for a tillage tool in silty clay loam soil was used as output parameter. Their results showed that the variation of measured and predicted energy requirement was small.

The literature studies have shown that empirical models can be useful alternative and practical tool for predicting both draft force and fuel energy requirement of tillage implement under different operating conditions. Therefore, the objective of this study was to develop, evaluate and validate a new ANN model to predict specific draft force and fuel consumption requirements of a mouldboard plough. The different forward speeds and working depths of tillage tool in a clay loam soil were used as inputs; the ANN. Using these inputs, the ANN was both trained and validated with data from field experiments.

2. Materials and Methods

Field experiments were conducted at experiment field of Agricultural Faculty, the Universitiy of Selcuk (38° 1′ N 32° 30′ E). The soil texture at the experimental site was clay loam (clay: 43%, sand:29%, silt:28%) with previous wheat crop residue. The plot size was 10 m wide and 100 m long (1000 m^2). Some physical properties of soil were given in Table 1.

Table 1
Some physical properties of soil

	Tillage depth (cm)			
	0-15	0-20	0-25	0-30
Soil moisture content (d.b %)	9.90±3.5	9.90±3.1	10.30±3.5	10.40 ± 3.8
Bulk density (g cm-3)	1.84±0.3	1.95±0.2	2.00±0.3	2.10 ± 0.2
Penetration resistance (kPa)	2400±320	2650±420	2690±430	2840 ± 710

A front wheel assist, New Holland tractor (TD 65D) with a maximum engine power of 65 BG was used in field evaluation (Table 2). A mounted-type mouldboard plough (Şakalak, Konya) with 3 badies used in this study. Treatments consisted of four levels of real forward speeds (3, 4, 5 and 6 km h^{-1}), four levels of tillage depths (0.15, 0.20, 0.25 and 0.30 m), three replications, giving 4 speeds × 4 tillage depths = 16 experimental cases × 3 replications per case = 48 tests.

Table 2
Specifications of New Holland TD 65D tractor and mouldboard plough used.

Tractor	
Maximum tork (Nm) at 1400 rpm	261
Total weight (kN)	32.0
Weight on front axle (kN)	9.60
Weight on rear axle (kN)	22.40
Wheelbase (mm)	2300
Mouldboard Plough	
Total weight (kN)	2.92
Share cutting widht (cm)	320
Share cutting angle (°)	16
Sharp edge angle (°)	37

Rate of fuel consumption was measured with two turbine flow transducers (Aquametro) having a range of 1-400 L h^{-1}. One transducer was accommodated between the fuel filter and the injector pump of the tractor; another was used to measure the excess fuel returning from both injectors and injection pump to the fuel tank. In order to determine the pulling force requirements of the machines, the draw pin of 30,000 N has been attached to three-point link arms of the tractor. The data logger that collects 20 data per seconds was used. The actual forward speed was measured using a Dickey-John (DJCMS200) (Figure 1).

The experimental data was analyzed by MINITAB statistical packet programme. Analysis of variance and least significance difference (LSD) test were performed to identify results that were statistically significant.

Artificial Neural Networks (ANN) model was developed by using the Matlab NN Toolbox (The Mathworks Inc., Natick, MA, USA). In the model, 16 data in total were used. In the ANN model, km h^{-1} and m were used as input parameters; and kN m^{-1} and L da^{-1} as output parameters.

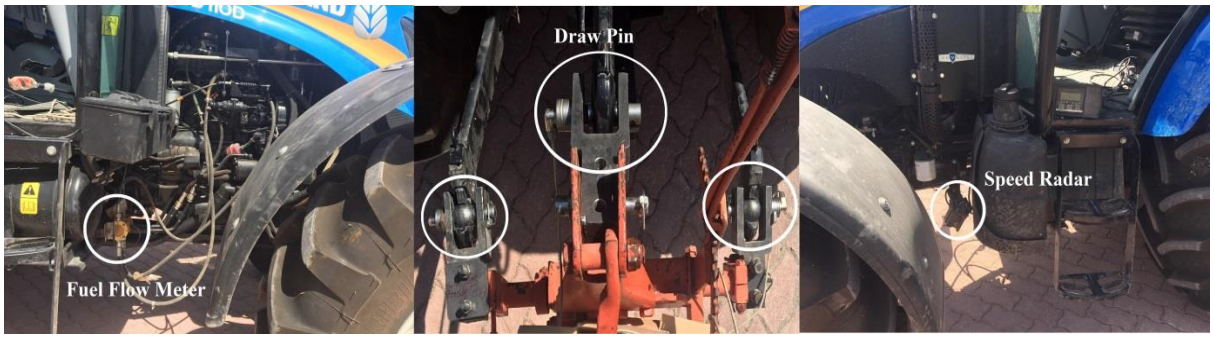

Figure 1
Connection points of the devices used in the study

While establishing the ANN model, all the data were normalized between 0 and 1 (Purushothaman and Srinivasa, 1994).

For normalization, the following equation was used:

$$y_{nor} = \frac{y - y_{min}}{y_{max} - y_{min}} \quad (1)$$

To obtain real values from the normalized values, "y" value was calculated using the same formula.

To develop the ANN model, normalized data were divided into two data sets of training and test. In the training set, 12 data were used, whereas 4 data in the test set. The numbers of the most fit neurons in the hidden layers were found to be in the range of 5-8 by the trial and error method. In the ANN model, to obtain the most fit epoch number, epoch numbers from 1 to 10,000 were tried. As a result of trials, the most fit epoch number for the model was determined.

In the ANN model, Feed Forward Back Propagation, Multilayer Perceptron network structure was used. The back-propagation algorithm in this network is the most popular and commonly used algorithm. It minimizes the total error by varying the weights in order to enhance the network performance (Jacobs, 1988; Minai and Williams, 1990). The training algorithm used is the Levenberg-Marquart algorithm techniques (Levenberg, 1944, Marquardt, 1963).

Training of the network was continued until the test error reaches the determined tolerance value. After

training of the network ended successfully, the network was tested by test data (Visen et al., 2002).

In order to determine the performances of the results, Root Mean Square Error (RMSE) and coefficient of determination (R^2) values that are considered to be principal accuracy measures and that are based on the concept of mean error and commonly used were calculated using the following formulas (Bechtler et al., 2001).

$$RMSE = \sqrt{\frac{1}{m}\sum_{i=1}^{m}(x_{1i} - x_i)} \quad 2$$

$$R^2 = 1 - \left(\sum_{i=1}^{m}(x_{1i} - x_i)^2\right) \Big/ \left(\sum_{i=1}^{m}(x_{1i})^2\right) \quad 3$$

Here, RMSE, Root Mean Square Error, R^2, coefficient of determination, m, number of data, x, measured value and, x_i, actual value.

The relative error between measured values and predicted ones was calculated by means of the following equation (Bağırkan, 1993).

$$\varepsilon = \frac{100}{m}\sum_{i=1}^{m}\left[\frac{(x_i - x_{1i})}{x_{1i}}\right] \quad 4$$

Here ε, relative error, m, data number, x, measured value and x_1, predicted value.

3. Results and Discussion

The specific draft force requirements of mouldboard plough in a clay loam soil under varying operating conditions were given in Figure 2.

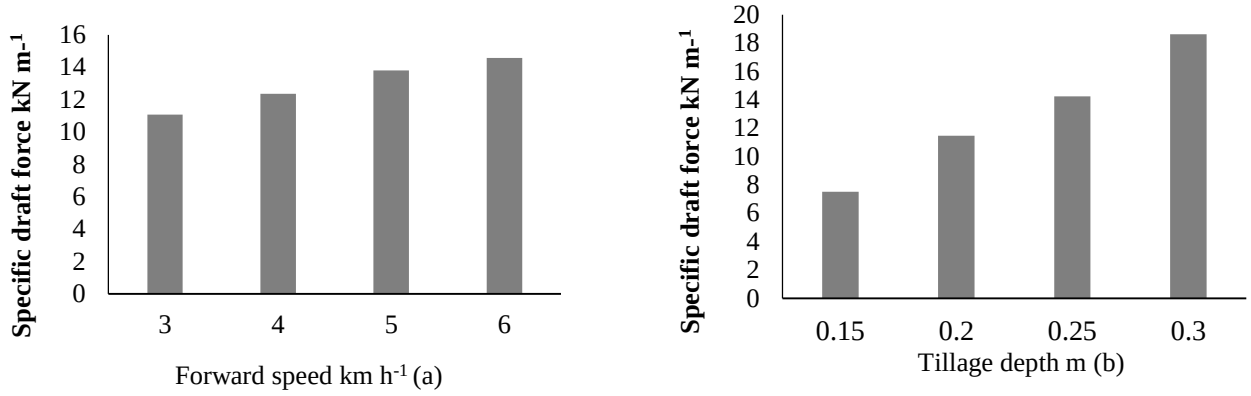

Figure 2
The specific draft force requirements of mouldboard plough based on forward speed (a) and on tillage depth (b)

The specific draft force was varied from 6.66 to 21.04 kN m^{-1} as depending on different forward speed and tillage depths. Averagely, the lowest value of draft force was obtained at speed of 3 km h^{-1} and tillage depth of 0.15 m, and the highest value was obtained at speed of 6 km h^{-1} and tillage depth of 0.3 m. Similar results were also obtained by Altinistik (2012). An increase of 100 % at forward speed resulted with increasing of 31.4 % in specific draft force, while the specific draft force was increased by 148% a increase of 100 % in tillage depth. The increase in tillage depth was more effective on the specific draft force compared to the increase in forward speed. Experimental data were analysed using the analysis of variance (ANOVA). The results showed a significant difference among the specific draft force values for the four different tillage depth and forward speed at 1% probability level.

The fuel consumption requirements of mouldboard plough in a clay loam soil under varying operating conditions were given in Figure 3.

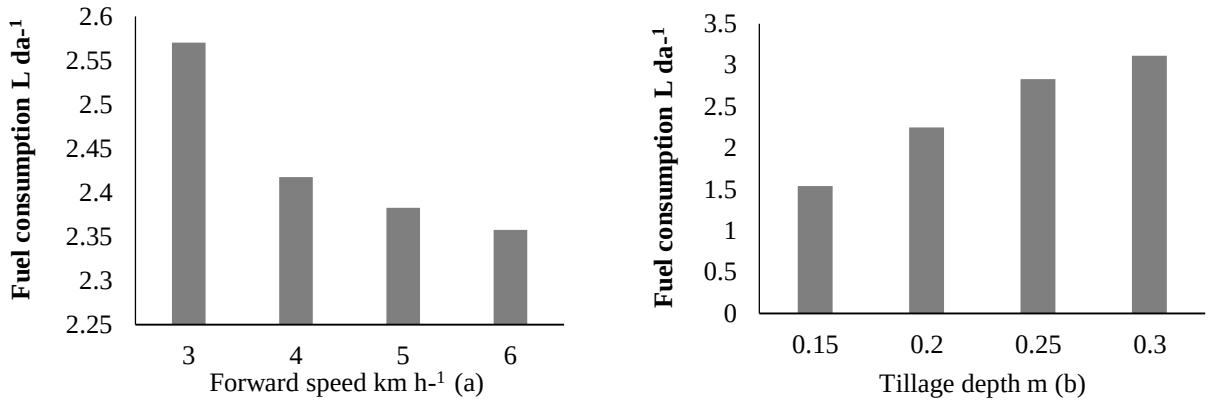

Figure 3
The fuel cosumption requirements of mouldboard plough based on forward speed (a) and on tillage depth (b)

The fuel consumption requirements were in the range 1.5-3.3 L da^{-1}. The greatest fuel consumption was found at tillage depth of 0.3 m and forward speed of 3 km h^{-1}. Approximately, to double the tillage depth resulted in a fuel consumption increase 101 %, whereas to double the forward speed caused a 8.26 % decrease of the fuel consumption. Altinişık (2012) found that specific fuel consumption decreased as a depending on increasing forward speed. Experimental data were analysed using the analysis of variance. The effects of tillage depth and forward speed on the fuel consumption were significant ($P<0.01$).

In the ANN model, the structure of the network was designed in the form of 2-(5-8)-2, consisting of 2 input, 2 hidden and 2 output layers (Figure 4). As training algorithm, the Levenberg-Marquart algorithm was used (Levenberg 1944, Marquardt 1963), as transfer function, linear function was used in the first hidden layer, tansig in the second hidden layer; and linear functions were used in the output layer. For the network, the lowest training error was obtained at the epoch number of 100.

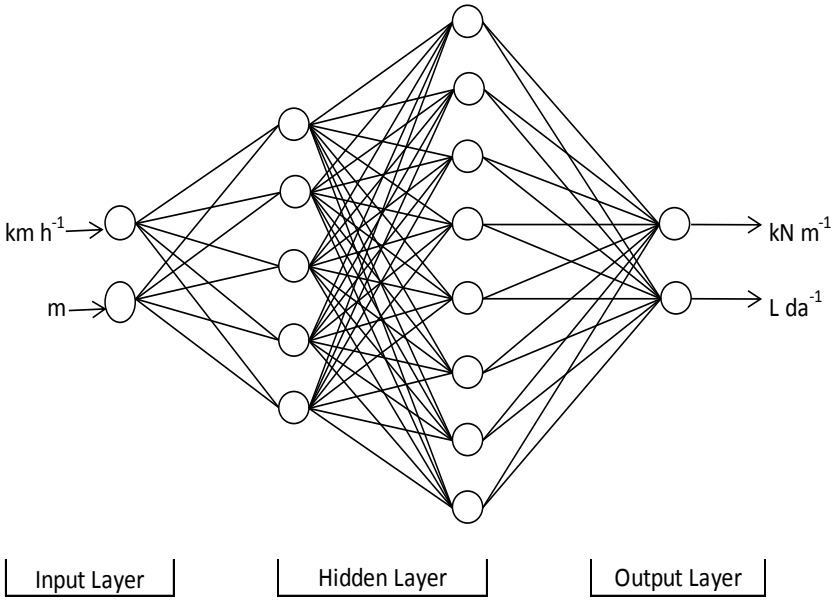

Figure 4
The network structure of the ANN model

Among the models obtained, the ANN model with the lowest RMSE and the highest R^2 value were determined to be the best fit. Whereas R^2 and RMSE values for kN m^{-1} in the training set were found to be 0.99 and 0.0921, respectively; in the test set, they were found to be 0.99 and 0.0629, respectively. While R^2 and RMSE values for L da^{-1} in the training set were found to be 0.99 and 0.0057, respectively; in the test set, they were found to be 0.99 and 0.0135 (Table 3).

Table 3
Performance of the ANN model

Output	Training Set		Test Set	
	RMSE	R^2	RMSE	R^2
kN m^{-1}	0.0921	0.99	0.0629	0.99
L da^{-1}	0.0057	0.99	0.0135	0.99

The coefficient of determination (R^2) between the experimental data and the predicted values obtained from the ANN model was found to be 99.96 % and 99.81% for kN m^{-1} and L da^{-1}, respectively (Figure 5).

The proposed neural network model by Al-Janobi et al (2001), by testing, indicated that there was a small variation of measured and predicted data with linear correlation coefficient equals to 0.987 and mean squared error between experimental and predicted specific draft equals to 0.1445. Roul et al (2009) found that good agreement between measured and predicted draught requirement of tillage implements values was found with a coefficient of determination of 0.99, indicating that the ANN model had successfully learnt from the training data set to enable correct interpolation.

ANN model was developed for the prediction of the performance parameters (draft, unit draft and required energy) of the disk plow by Al-Hamed et al (2013). Based on the results, the ANN model appears capable of providing accurate predictions of the disk plow's performance. Altinisik (2012) developed three different artificial neural network (ANN) models depending on the tractor working speed, equipment ploughing depth. An average accuracy rate for all generated three models were greater than 89%.

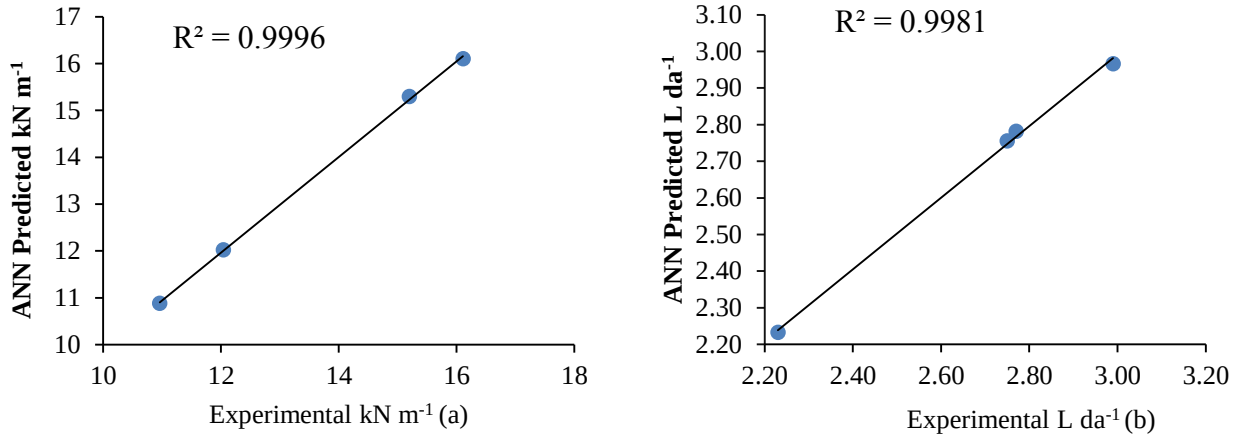

Figure 5
Regression graphics between ANN-predicted values and experimental data for kN m^{-1} (a) and for L da^{-1} (b)

Experimental data, predicted values calculated from the ANN model and the error values between them are given in Table 4. The mean error value for kNm^{-1} was found to be 0.38% and 0.45% for Lda^{-1}.

Table 4
Relative error values for the ANN model

Specific draft force (kN m^{-1})			Fuel consumption (L da^{-1})		
Experimental data	Predicted values	Error (%)	Experimental data	Predicted values	Error (%)
12.04	12.02	0.16	2.99	2.97	0.67
10.96	10.88	0.73	2.23	2.24	0.44
15.20	15.29	0.58	2.77	2.78	0.35
16.11	16.10	0.06	2.75	2.76	0.36
Mean error		0.38			0.45

4. Conclusions

The specific draft force and fuel consumption requirements increased due to increased tillage depth. At increasing forward speed, the specific draft force increased while fuel consumption requirement decreased. Tillage depth was the major contributory factor on the specific draft force and fuel consumption as compared to forward speed.

The specific draft force and fuel consumption requirements predicted by ANN were found to be quite close compared to the measured values. The validation for the specific draft force and fuel consumption models was acceptable. Consequently, the specific draft force and fuel consumption requirements magnitudes could be successfully predicted by the proposed model with good accuracy.

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The Effects of Addition to Different Levels of Mealworm (*Tenebrio molitor*) to Quail Diets on Performance and Carcass Traits

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ABSTRACT

Performance and carcass traits of quails fed by diets containing mealworms were investigated. A total of 200 mixed-sex one-day-old quail chicks were used in the study. The basal diets were supplemented with 0, 2, 4 and 6 % mealworm (*Tenebrio molitor*). Four levels of dietary mealworm were arranged in a completely randomized design and the treatments were replicated five times with 10 birds. The chicks were randomly assigned to among 20 cage pens. Feed and water were supplied ad-libitum. In the first week of the study, all quails were fed with the control diet. During the next four weeks, the quails were fed with 4 experimental diets. There were significant differences in body weight gain and feed conversion ratio between the treatment groups ($P<0.05$; $P<0.01$). The body weight gain of quails fed by diet containing 6 % dietary mealworm was lower than the quails fed by the diets containing 2 % mealworm. Feed conversion ratio increased by feeding with 4 and 6 % dietary mealworm level when compared to the control and 2 % dietary mealworm level group ($P<0.01$). Feed intake, carcass weight and carcass yield did not differ among the dietary treatments. The study suggested that performance parameters could be lower when dietary level of mealworm meal higher than 2 %.

1. Introduction

There is a need for diets that require higher amounts of protein to meet the amino acid requirements in order to increase the growth rate and egg production of poultry (Hossain and Blair, 2007). However, the amino acid composition of plant-based proteins for poultry is lower than that of animal-based proteins, particularly in terms of the content of substantially sulphur-containing amino acids such as methionine. Soybean meal is the most widely used source of vegetable protein in dietary formulations for poultry due to its high quality and quantity of protein and sufficient amino acid profile (Veldkamp et al., 2012). In order to solve this problem and make poultry production sustainable in the future, quality alternative protein sources are needed. Recently, high demand for fish meal has led to an increase in its price. In addition, increasing production pressure on aquaculture has led to an increase in the research for insect proteins for aquaculture and livestock production (FAO, 2013). Researching alternative and sustainable animal protein sources is an important issue that requires viable solutions in the short term and makes insects increasingly attractive. In recent years, the potential for the use of insect-derived protein sources in poultry diets has attracted much attention. Some insect species have been proposed as an alternative feed additive due to their high protein (30-70% KM) and fat content (30-40% KM). The yellow mealworm (Tenebrio molitor) is native to Europe and is a recognized pest of grain and cereal products (Ramos-Elorduy et al. 2002). The mealworm contains high amounts of crude protein (47-60%) and fat (31-43%). Fresh larvae of mealworm have a dry matter of 40% and a crude ash content of 1-4.5%.

Some authors suggest that insects may be important as an alternative source of protein for poultry nutrition (Ramos-Elorduy et al. 2002; Veldkamp et al. 2012; Makkar et al. 2014; Sánchez-muros et al. 2014; van Huis 2015). The effects of mealworm supplementation to the poultry diets on growth performance (Bovera et al., 2015; Bovera et al., 2016; Biasato et al., 2016) and carcass characteristics (Ballitoc and Sun, 2013; Bovera et al., 2016; Biasato et al., 2016) have been recently investigated. Biasato et al. (2016) confirmed that the inclusion of the yellow meal worm did not affect the performance of free-range chickens, so that mealworm could be used safely in poultry diets. In another study, these researchers (Biasato et al., 2018) suggested that increasing levels of dietary mealworm meal inclusion

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in broiler diets may improve body weight and feed intake. In addition, due to its high nutrient digestibility, mealworms were reported to be an alternative protein source for soybean meal and fish meal (Bovera et al. 2015).

The study aimed to evaluate growth performance and carcass traits of quail chicks fed diets including mealworm meal in order to determine optimum level.

2. Materials and Methods

A total of 200 mixed sex one-day-old quail chicks were randomly allotted to 4 dietary treatments, each consisting of 5 pens as replicates with 10 chicks per pen. During the first 3 weeks, the animals were heated by halogen lamps to maintain the suitable temperature according to standard breeding practices. Lighting schedule was 23 h light:1 h darkness during the experiment. The yellow mealworm larvae (*Tenebrio molitor*) was obtained from the company in commercial production (Mira Ltd. Şti., Aksu-Antalya). The larvae were submerged in a boiling water bath for 3 min, dried in an oven at 80°C temperature, then milled.

A diet based on corn and soybean meal was formulated and served as control, while 2, 4, and 6 % mealworm larvae meal inclusion as a partial replacement of soybean meal and soybean oil constituted the 3 experimental treatment groups (Table 1).

In the first week of the study, all quails were fed with control diet. During the next four weeks the quails were fed with 4 diets consisting of different levels of mealworm. The experimental diets were isonitrogenous and isoenergetic and were formulated. Diets met or exceeded requirements and were adjusted according to NRC (1994) Japanese quail nutrition specifications. Feed and water were provided ad libitum.

Body weight and feed intake of quails was determined at weekly during the experiment. Feed conversion ratio (FCR) was calculated as feed intake / body weight gain (FI/BWG). On the last day (35 days) of the experiment, 4 (two male and two female) quails from each replicate were randomly selected and slaughtered. These quails were weighed and cleaned, and then carcass weights were determined.

The data were analyzed by using the ANOVA in Minitab (2000). If the treatments were found to be significantly different, then Duncan's multiple range tests was used to determine the differences among treatments (MStat C, 1995).

Table 1
Composition of experimental diets (as fed)

Ingredients (%)	Dietary Mealworm Levels (%)			
	0	2	4	6
Corn	50.1	50.0	50.0	52.0
Soybean Meal (44 % CP)[1]	42.5	40.3	38.2	35.8
Mealworm Meal (51 % CP)[1]	---	2.0	4.0	6.0
Sand	---	1.1	2.0	1.8
Vegetable oil	3.4	2.9	2.4	2.5
Limestone	1.1	1.6	2.2	1.8
Dicalcium phosphate	2.2	1.4	0.5	---
Salt	0.3	0.3	0.3	0.3
Vitamin-Mineral Premix[2]	0.25	0.25	0.25	0.25
L-Lysine	0.15	0.15	0.15	0.15
TOTAL	100	100	100	100
Calculated Nutrients				
Crude Protein (%)	24.15	24.11	24.12	24.14
Metabolizable Energy (kcal/kg)	2905	2904	2905	2902
Calcium (%)	1.05	1.06	1.07	1.06
Available Phosphorus (%)	0.52	0.53	0.53	0.53
Lysine (%)	1.38	1.40	1.42	1.51
Methionine (%)	0.52	0.54	0.56	0.57
Cystine (%)	0.91	0.88	0.85	0.82

[1] Analysed value.
[2] Premix (provided per kg): 8.800 IU vitamin A, 2.200 IU vitamin D3, 11 mg vitamin E, 44 mg nicotinic acid, 8.8 mg Cal-D-Pan, 4.4 mg riboflavin, 2.5 mg tiamin, 6.6 mg vitamin B12, 1 mg folic acid, 0.11 mg D-biotin, 220 mg choline, 80 mg manganese, 60 mg iron, 5 mg copper, 60 mg zinc, 0.20 mg cobalt, 1 mg iodine, 0.15 mg selenium

3. Results

The differences among the groups fed with different levels of dietary mealworm meal in terms of final body weight and body weight gain were statistically significant ($P < 0.05$). The highest body weight and body weight gain was in the group fed with mealworm meal added to diets at the level of 2% (Table 2). Final body weight of quails fed with mealworm meal containing 4 and 6% diets was lower ($P < 0.05$) than the quails fed with diet containing 2% mealworm meal Feed intake were not differ ($P > 0.05$) among the groups. Feed conversion ratio of quails fed diet con-

taining 4% and 6% mealworm meal diets were higher than the quails fed diet control (0%) and 2% of the diets containing mealworm meal diets.

Table 2
The Effect of Dietary Different Levels of Mealworm on Performance of Quails

Dietary mealworm levels (%)	Initial Body Weight (g)	Final Body Weight (g)	Body Weight Gain (g)	Feed Intake (g)	Feed Conversion Ratio (Feed, g/Gain,g)
0	17.7 ± 0.20	171.3±3.78^{ab}	153.6±3.72^{ab}	480.4±12.5	3.13±0.04^{b}
2	17.1 ± 0.12	173.0±2.55^{a}	155.9±2.48^{a}	488.6±6.27	3.14±0.03^{b}
4	17.2 ± 0.12	163.8±2.28^{bc}	146.6±2.27^{bc}	488.9±4.13	3.34±0.06^{a}
6	17.9 ± 0.07	161.6±2.46^{c}	143.8±2.45^{c}	498.3±3.60	3.47±0.07^{a}

$^{a, b,c}$: Means with different minuscule in the same rows are significantly different at P<0.05.

At the end of the experiment, there was no significant difference between the treatment groups in terms of carcass weights and carcass yield of quails fed with diets containing different levels of mealworm meal (Table 3 and 4)

Table 3
The Effect of Dietary Different Levels of Mealworm on Carcass Weight of Quails

Dietary mealworm levels (%)	Carcass Weight (g/quail)		
	Male	Female	Mean
0	124.9±2.90	133.7±4.88	129.3±3.67
2	126.1±1.32	136.1±3.06	131.1±1.32
4	122.9±3.62	135.1±5.29	129.0±1.36
6	120.3±2.18	125.5±7.12	122.9±3.89

Table 4
The Effect of Dietary Different Levels of Mealworm on Carcass Yield of Quails

Dietary mealworm levels (%)	Carcass Yield (%)		
	Male	Female	Mean
0	78.4±0.66	77.2±0.36	77.8±0.40
2	75.8±1.10	74.8±0.86	76.0±0.85
4	77.8±0.42	75.6±1.52	76.7±0.73
6	77.1±0.70	74.7±1.00	76.2±0.97

4. Discussion

The present study evaluated the effects of dietary mealworm meal inclusion on growth performance and carcass traits of quails. The body weight, body weight gain and feed conversion ratio of the quails in the present study impaired when fed with diets containing more than 2% mealworm meal, but did not cause any change in feed intake. The previous study results regarding the mealworm meal utilization in poultry are limited and sometimes controversial. Ramos-Elorduy et al. (2002) reported that the addition of full fat mealworm at different levels between 5% and 10% in the diet of broilers fed with soybean meal-based diets did not cause any difference in growth performance. Similarly, Biasato et al. (2016) observed that the addition of 7.5% mealworm to the diet in free-range chickens fed with corn-soybean-based diets did not significantly affect performance. Bovera et al. (2015) reported that there was no difference in the body weight and body weight gain of the broilers between the group fed with mealworm meal containing rations and the control group. Biasato et al. (2018) suggested that the addition of 5, 10 and 15% mealworm to diet in male broiler may improve body weight and feed intake, but may adversely affect feed efficiency, so researchers suggested that low levels of mealworm addition to the diet may be more appropriate. The researchers also reported that there was no significant difference in carcass characteristics between the treatment group and the control group. Ballitoc and Sun (2013) reported that containing 0, 0.5, 1, 2 and 10% fed with mealworms of broilers may positively affect growth performance and carcass yield, and that 2% mealworm use in the broiler diets would be appropriate. Işık and Kırkpınar (2016) reported that body weight gain was higher in broilers fed with 6% mealworm diet than other groups (containing 0 and 2% of mealworm), but it was similar to containing 4% mealworm group. During the experiment, no significant difference was found between the groups in terms of feed conversion ratio of broilers. Researchers have suggested that mealworm can be used as a source of protein in broilers up to 6% without adversely affecting performance.

In conclusion, the use of mealworm meal in quail chicks diets up to 2% may be appropriate and above this level growth performance may be adversely affected.

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Review Article

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The Important of Beta Carotene on Poultry Nutrition

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ABSTRACT

Beta carotene, the primary source of vitamin A in poultry rations, is one of the most important carotenoids. Under the influence of enzymes, Beta carotene (BC) is converted to vitamin A. The BC molecule is a double retinal structure and theoretically gives 2 molecules retinal. Its biological activity is only half of retinal. Conversion of carotenoids to retinol is rarely 100%. Thus the vitamins of various foods are expressed in terms of the potential retinol equivalence (RE).

BC is absorbed from the duodenum and if there is oil in the intestinal tract, it is absorbed faster. Oxidatively converting BC into vitamin A is mainly carried out in the intestinal brush border membrane, organs such as the liver, kidney and lungs. BC egg yolk is transported to and stored in immune organs and similar tissues. The BC content of the egg of the poultry varies. BC contents of hen eggs are low, while BC contents of eggs of wild birds are between 25-30%. Despite depletion of BC in the liver it's transfer to the egg continues.

Since poultry can not synthesize BC, it must be taken from outside. Products such as yellow corn, marigold and alfalfa are very rich sources of beta-carotene. BC is abundant in egg yolks.

BC is effective in the pigmentation of skin and egg yolks of hens. Due to BC's antioxidant properties prevents deterioration of egg and meat. It has also been shown that BC has important effects on the immunity and endocrine system. BC, strengthens see function, reduces the risk of cardiovascular disease, prevents inflammation and some types of cancer. Studies have shown that BC enhances the immune system by raising antibody response in poultries and prevents acute respiratory tract infections.

In this review article, the introduction of BC, its functions, effects on poultry nutrition were investigated.

1. Introduction

It has been observed that the nutrient profile (fatty acids, minerals, vitamins, etc.) of the egg, which is considered to be a highly nutritious food among nutritional sources, can be significantly improved by diet manipulation. For this reason, intensive research is carried out on the passage of some nutrients that can affect human health positively to eggs (Bean and Leeson, 2003; Khan et al., 2012).

It is stated that the enrichment of egg in terms of carotenoids will be beneficial for human health (Skřivan et al., 2015). One of the carotenoids suitable for this purpose is BC (Stahl and Sies, 2005), a provitamin A (Olson, 1996). In recent years, due to the increase in demand for safe animal products, it has become more important to prefer natural resources for coloring the egg yolk (Calislar and Uygur, 2010). The nutrient profile of the eggs can be improved by diet manipulation. In the researches, it has been seen that some nutrient components that have important benefits for health can be transferred to the egg yolks via feed (Bean and Leeson, 2003; Khan et al., 2012).

Since poultry are exposed to stress conditions in a significant proportion of their lives, it is extremely important that their immune system is strong. One of the most suitable sources for this is the BC, which has a high antioxidant content. In the researches, it has been emphasized that BC enhances the survival of poultry by strengthening the immune system and positively affects the efficiency parameters.

BC is the primary source of vitamin A. Vitamin A is necessary for healthy development of bone, skin and mucosa, especially in eyesight (Thomas, 2006). Therefore, it is seen that BC has a combined effect in poultry. Particularly due to its antioxidant properties, it is thought that BC will contribute positively to the gen-

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eral immune system and performance of poultry which are exposed to diseases and effects of mycotoxins. It is also clear that as an egg component, it will have a positive impact on human health.

BC is used as a colorant and antioxidant agent in the food, cosmetics, pharmaceutical, animal feed industry (Martelli, et al., 1990; Astorg, 1997). BC gives color to products such as eggs and meat. However, it is known that most of the BC, which is used as colorant in various production industries, is synthetic. Recently, the use of natural BC has started to become widespread in line with consumer demands. By-products obtained from fruit juice production (carrot, grapefruit, apricot pulp, etc.) have low prices. Therefore, these products are used as natural BC source in chicken feeds (Sikder et. al., 1998; Mascarell et al., 2012). It has been reported that the recommended amount of BC in the feed of laying hens should be at the maximum feed rate of 30 mg / kg feed (EFSA, 2012).

It is considered that there is a small number of studies on poultry feed in relation to BC, which has important contributions to both poultry and human health, and it will be useful to focus on new research in this area.

2. Beta Carotene Resources

BC is a yellow-orange pigment. BC is found in the structure of fruits, grains, vegetables (carrots, green plants, pumpkin, spinach) and oils (Liu, 2013) with maize, green fodder, moss, marigold, stinging nettle and similar products (Table 1) (Kljak et al., 2012).

Plants such as sweet potatoes, carrots, cabbage, spinach, lettuce, fresh thyme, gourd, turnip, melon, green cabbage and broccoli are rich in BC (Groff et al., 1995). BC is more common in the leaves of plants and the amount decreases as the plant ages (Ballet et al., 2000). Egg yolks, milk, butter and liver are also animal sources containing BC. Because of its low amount and unstable structure, BC deficiency is sometimes observed in animals.

BC is also produced by algae (Dunaliella bardawil and Murielopsis sp) (Goodwin, 1992), fungi (Blakeslea trispora) (Mantzouridou and Tsimidou, 2008) and yeasts (*Rhodotorula glutinis*; Park et al., 2005). Among microbial sources, Rhodotorula glutinis, which is rich in protein, lipid and vitamins, has been reported to be suitable for producing BC (Bhosale and Gadre, 2001). In order to meet the BC needs of poultry, non-toxic Rhodotorula cells are used in rations (Kushwaha et al., 2014). The major carotenoid in the Western diet is BC (Stahl and Sies, 2005).

Table 1
Some sources of beta carotene and beta carotene contents

Source of BC	BC content	Literatur
Corn, yellow (mg/100g)	0.051	Yılmaz, 2010
Corn, sweet, yellow (mg/100g)	0.033	Lee et al., 1981
Daucus carrota (mg/100 g fresh weight)	3.2-6.1	Yılmaz, 2010
Carrots, raw (mg/100g)	4.65	Bushway, 1986
Red pepper, dry (mg/100g)	2.20	Yılmaz, 2010
Peppers, sweet, red, raw (mg/100g)	0.059	Philip and Chen, 1988
Alfa alfa, green (mg/kg crude matter)	97.5	Descalzo et al., 2012
Alfa alfa, dry (mg/kg crude matter)	5.5	Descalzo et al., 2012
Soybean meal, expeller (mg/kg crude matter)	0.30	Descalzo et al., 2012
Sunflower, expeller (mg/kg crude matter)	nd	Descalzo et al., 2012
Naturel meadow grass, green (mg/kg crude matter)	63.8	Kalac, 2012
Blakeslea trispora (mg/L)	173	Wang, et al., 2014
Rhodotorula glutinis (mg/L)	6.54	Kushwaha et al., 2014

Since vitamin A cannot be synthesized by poultry, it should be taken as BC or vitamin A with feeds (Theodosiou et al., 2010). Besides carotenoids from plants, some carotenoid derivatives in the European Union have also been approved for use as an additive. These; capsantin (C40 carotenoid), P-cryptoxanthine (C40), lutein (C40), zeaxanthin (C40), P-apo-8-carotenal (C30), P-apo-8'-carotenoic acid ethyl ester (C30), xanthaxanthin (C40) and sitranaxanthin (C33) (Nimalaratne et al., 2013). The bioavailability of BC (crystal form) found in carrot juice in the feeding of wild poppies was about 30% (White et al., 1993).

Carotenoids are tetraterpenoid (C40) pigments synthesized from eight isoprene units found only in plants (Wagner and Elmadfa, 2003). They are divided into two groups according to their chemical structure: carotenes (hydrocarbon class) and xanthophylls (oxygen class) (Shete and Quadro, 2013; Von Lintig, 2012). Carotenes consist of alpha, beta and gamma carotene. The most important of carotene is the BC, which is the source of vitamin A (Taylor, 1996). BC is a fat-soluble provitamin A (Valko et al., 2007).

The BC was first isolated by Wachenroder in 1831 (Davies, 1976). The name BC was taken from carrot (Daucus carota) (Deming and Erdman, 1999). BC is almost always associated with chlorophyll in plants (Merck Index, 2006). The 1-carotene absorption spectrum is between 400-500 nm and is green-blue (Isler and Solms, 1971). Therefore, the BC molecule absorbs green-blue light and gives red-yellow colors.

BC is insoluble in water, acids, alkalis, but soluble in carbon disulfide and chloroform. Insoluble in meth-

anol and ethanol BC, ether, hexane and oils (FCC, 2011) slightly soluble. The diluted solution was yellow. Absorbs oxygen, which leads to inactive, colorless oxidation products (Merck Index, 2006). Pure BC is a rather dark reddish-orange color, while oxidized or melted BC is slightly yellowish orange and gray. BC, like vitamin A does not dissolve in water, it is only soluble in fat (Tek et al., 2002).

BC melts between 176-182 °C. BC, which is in the cis- and trans-isomeric forms, has a melting point of 184.50 ^{0} C (Olson, 1996). The molecular weight is 536.87 g/mol (Merck Index, 2006; FCC, 2011).

Although many carotenoids commonly have asymmetric carbon atoms, BC does not contain asymmetric carbon atoms (Woollard, 2012). The BC in the non-polar hydro-carbon group has two ion rings and theoretically this retinal structure is converted into two molecules of retinol. The conversion of carotenoids to retinole is rarely 100%. Therefore, vitamin A power of various foods is expressed as retinol equivalence (RE). Accordingly, 1 RE; 1 mg of retinol is equal to 6 mg of BC and 12 mg with other provitamin A carotenoids (Maynard et al., 1979). Vitamin A requirement of poultry is expressed as international unit (IU). It has been reported that 1 IU vitamin A activity is equivalent to 0.6 microgram BC activity or 1 mg BC is equivalent to 1.667 IU vitamin A (Blair, 2018). 1 mg of BC is equivalent to 400 IU of retinole in broiler chicks (Johannsen et al., 1998), 1200 IU in old geese and only 60 IU in young geese (Jamroz et al., 2002).

There is no proven information that the carotenoids have been transformed into another carotenoid. However, β-apo-8'-carotenal and β-apo-8' carotenoic acid ethyl esters of the BC degradation products have been shown to have coloring potential in poultry (El-Boushy and Raterink, 1992; Erdman et al., 1993). BC gives yellow-orange color to egg yolk (Dufossé, 2009).

Feed carotenoids are present in the natural compounds in about 60 to 90% trans and 10 to 30% cis form. Trans form is a more effective pigment due to its red color tone and greater stability. Chickens have the ability to convert some of the trans form of BC into the cis form and this transformation takes place in egg yolk (Hencken, 1992).

Most commercialized beta carotenes are the chemical synthesis of β-ionone (Raja et al., 2007; Ribeiro et al., 2011). The β-ionone is originally synthesized from natural sources, such as lemon grass oil or pine turpentine. However, in recent years it has been produced from β-ionone, acetone or butadiene. BC is synthesized by saponification of vitamin A acetate. Fungal and microalgae are very promising sources for the industrial production of carotenoids (Echavarri-Erasun and Johnson, 2002). Some strains of Blakeslea trispora fungus, a host of tropical plants, are high BC producing sources (Dufossé, 2006).

3. Functions of Beta Carotene

Provitamin A and thus BC are required to perform visual functions (Von Lintig, 2012). BC has been shown to inhibit certain types of cancer with arthrosclerosis, cataract, and multiple sclerosis due to the antioxidant properties and provitaminase activity (Terao, 1989).

BC prevents oxidative damage to cellular lipids, proteins and DNA. BC, which shows anti-inflammatory properties, protects the skin against premature aging, photodermatitis and cancers against the harmful effects of UV light (Stahl and Sies, 2007; Cazzonelli, 2011). It has been reported that carotenoids have a significant effect on skin, egg and meat quality (Liufa et al., 1997). Carotenoids have a great effect on the color of the hens' skin and egg yolk, egg and meat quality (Sirri et al., 2007; Hien et al., 2013).

The annual total carotenoid production in nature is estimated to be around 100 thousand tons. Carotenoids play an important antioxidant function by activating singlet oxygen, an oxidant formed during photosynthesis in plants (Halliwell and Gutteridge, 1999). BC is an active molecule that has properties that inactivate some reactive oxygen species in relation to its antioxidant potency. Epidemiological findings have shown that BC can prevent cancers of various organs such as lung, stomach, cervix, pancreas, colon, rectum, breast, prostate and ovary due to its antioxidant activity (Jayappriyan et al., 2013).

Carotenoids with provitamin A and antioxidant effect have cellular differentiation, growth, reproduction, gene expression, immune function, and adipocyte functions (Tourniaire et al., 2009).

According to the BC free group, cock fed with BC containing rations, has been reported to produce higher antibody titer against newcastle disease (McWhinney et al., 1989). They reported that BC used in combination with vitamin E provided more protection against the infection of Escherichia coli in chickens (Tengerdy et al., 1990).

According to other organs, the concentration of BC in the corpus luteum was highest but no effect on reproduction was determined (Thomas, 2006).

4. Metabolism of Beta Carotene

Vitamin A is required for the survival of all vertebrate animals. BC is one of the important sources of vitamin A requirement. Absorption of BC from intestines, transformation into vitamin A, transport, accumulation and metabolism of tissues vary according to animal species.

The conversion of BC to vitamin A generally occurs in intestinal mucosa cells and liver (Coultate, 1996). Since the BC molecule consists of a pair of retinas, two molecules of retinal formation occur when this structure is separated from the middle. However, the biological activity of BC is only about half of the retinal. The enzyme responsible for the conversion of BC to retinale is known as BC-15, 15 monooxygenase

or 15.15 si dioxigenase (Wyss et al., 2000; Dela Seña et al., 2014). Retinol and retinoic acid are also produced from the retinal (Taylor, 1996; Arikan and Muğlalı, 1999).

Absorption of BC occurs in the duodenum of the small intestine. The absorption of BC can last for several days. Absorption is faster and more effective if there is an oil in the environment. Sometimes the BC is absorbed into the intestinal wall and is quickly converted to vitamin A in there. The rest of BC is transported in the blood as very low density lipoprotein cholesterol (Nnaji et al., 2013).

Approximately 40%-45% of total carotene content is found in egg yolk (Surai and Speake 1998; Surai et al., 1999). However, compared to other carotenoids, the amount of BC stored in the egg yolk is very low. Because BC is used as a provitamin A by poultry, it is very poor to accumulate in egg yolks or other tissues (Hammershoj et al., 2010).

Poultry predominantly accumulate oxycarotenoids in their body tissues or eggs (Goodwin 1986; Hencken 1992). The deposition rate of lutein and zeaxanthin in the egg yolk was 25%, while the accumulated amount of BC was only 0.5% (Jiang et al., 1994; Hammershoj et al., 2010).

The main storage site of BC in poultry is liver. Only 0.16% to 0.66% of the total carotenoids stored in the egg yolk of poultry cultivated under intense and semi-intensive conditions were reported as BC. It was found that the amount of BC accumulated in the duck egg yolk was 1.62% (Khan et al., 2017).

The total amount of carotenoid in the egg yolk of poultry has been reported to vary between 17.33% and 37.90%, while the amount of BC varies between 1.07% and 2.12% (Kotrbáček et al., 2013). Astaxanthin in egg yolk is stored at 14%, zeaxanthin 25% and canthaxanthin at 30-40% (Hencken, 1992).

The transfer of BC to egg yolk is 0.6% while the rate of conversion to vitamin A (5-6%) is relatively high. In a study in which chickens were given sweet potato and silage, the absorption rate of xanthophylline was 93-94% and the carotene was absorbed between 55-63% (Yamada et al., 1958). Poultry animals absorb carotenes less than xanthophylls (Surai et al., 2001). BC increase in egg yolk is only 2.1% of total carotenoids (Török et al., 2007).

The number of studies on the effects of egg yolk changes in BC content is insufficient. In previous some studies, it has been reported that the amount of BC in the egg yolk decreases due to increased storage time regardless of source (Rock et al., 1996; Thomas, 2006).

The amount of BC in the eggs of different poultry breeds varies. The amount of BC on the first day of storage white leghorn hens egg yolk has found to be 0.060 mg / g, in the first week 0.047 mg / g, in the second week 0.027 mg / g and in the third week 0.004 mg / g (Okonkwo, 2009).

5. Accumulation of Beta Carotene

Feed carotenoids can undergo numerous transformations in the metabolism of animals. Some of these compounds have vitamin A activity. Usually only monohydroxy and mono-cetocarotenoids are converted into vitamin A. Carotenoids, which have high vitamin A activity, generally have very low coloring properties (Hencken, 1992).

In a feeding study with a weight of 8000 IU vitamin A in laying hens, 80% of vitamin A was transferred to egg yolk (Squires et al., 1993). In another study, it was reported that only 85.11 micrograms of vitamin A in dietary 120 micrograms could be transferred to egg yolk (Surai et al., 1998).

The amount of BC stored in egg yolk was reported to be very low (1%) (Hammershoj et al., 2010; Xue et al., 2013). In a recent study, it was determined that 8.85% of the BC in different hybrid maize was deposited in the egg yolk of laying hens (Kristina et al., 2018).

Laying hens store vitamin A in egg yolks for incubation and embryo development during the first stages of life (Bardos, 1989). Most of the vitamin A stored in the egg yolk is retinol and a small portion is retinyl esters (Joshi et al., 1973).

Adding up to 70 g of carrots per day to the rations during the feeding of laying hens has been shown to increase the egg yolk color value, especially lutein, alpha carotene and BC content effectively (Hammershoj et al., 2010). Xanthophylls (lutein, zeaxanthin) have been found to be better absorbed than hydrocarbons carotenoids (alpha-carotene, BC) (Dumbrava et al., 2006).

The addition of lutein to the ration (100 mg / kg) increased the yolk color and redness value. Compared with the control group, lutein containing diets increased the amount of BC in egg yolks by 66%, lutein 97% and zeaxanthin by 94%. However, because it is expensive, lutein is not routinely added to rations (Englmaierová and Skininivan, 2013).

BC has an accumulation rate of less than 1% in egg yolk. It has been reported that there is a linear increase in the amount of egg yolk retinol due to the increase in the amount of BC in the diet (Jiang et al., 1994). In some previous studies, it has been reported that the amount of BC in egg yolk is 1.07-2.12 (µg / kg; Kotrbáček et al., 2013) and 0.16-1.62 (mg / kg-1; Khan et al., 2017).

Very few of the BC given with the ration passes to the yolk and the rest is converted to retinol and stored in the egg. Egg yolk color is mainly affected by fat-soluble carotenes, xanthophylls and BC. A decrease in the color of the egg yolk in line with the increase in vitamin A of the rations occurred. It has been stated that high vitamin A can cause absorption of fat-soluble pigments (Mendonça et al., 2002).

In bird species, carotenoids tend to accumulate in their immune organs. When carotenoids were included in the breeding diet, it was shown that there was a significant accumulation in the thymus and bursa fabricus of chickens. Furthermore, carotenoids from the chicken diet were still detected 4 weeks after hatching in carotenoid consuming diets fed from chickens (Koutsos et al., 2003).

Carotenoids can be exposed to oxidative effects due to storage time, room temperature and illumination (photochemical) due to the large number of double bonds in their structure. The enzymatic degradation of BC requires oxygen and the destruction at high temperatures is highest. Destruction stops after complete dehydration. Therefore, both enzymatic and photochemical effects which cause the destruction of BC during storage must be controlled (Geoffrey, 1998). Losses occur during storage of BC. It was reported that the loss in the waiting period of 25 ^{0} C for one month was 10% and the loss after three months was 29% of the initial value (EFSA, 2012).

6. Conclusion and Suggestion

Some nutrients in feeds can be transferred to eggs and functional eggs can be produced. It is thought that one of the nutrients that may contribute to functional production due to increasing the amount of egg that is passed to the egg and which is stored here may be BC. However, more information is needed about the transition of BC into eggs. It is thought that it is necessary to focus more intensely on BC, which is thought to have an important contribution to the realization of an organic and sustainable animal production suitable for human health in a century when organic egg and meat production is gaining momentum.

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Review Article

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Dust Transportatıon and Pastures

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ABSTRACT

Dust transport is important for ecosystems (land, marine ecosystems) and human activities in the World. The main causes of dust transportation are drought and desertification. Negative effects of transported dust on plants; when the dust particles that are deposited on the plants cover the surface of the leaves, they can prevent the vital functions of plants such as photosynthesis and transpiration. It is stated that it can be caused by the feeds/fodders that are affected by them and by the licking of the body hair that holds them rather than not direct effects of dust or air pollutants damage to the animals in natural pasture areas. Naturally, these causes' decreas in animal welfare and productivity. In addition, dusts make the administration of animals difficult.

1. Introduction

Dust is defined as solid particules which are suspended in the air in a specific time. Dust that dimensions are range from 1 and 100 micrometersare particules formed as a results of erosion, degredation, granulation and burning from the organic an inorganic materials. Existince of mineral dust is arouse from climatical conditions, plant vegatation, erosion, construction, agriculture, mining, industrial works, degragated pastures and deforested areas (Anonymous 2016). The amount of dust formation is mainly depended on 3 factors which are cohesion of material allows the particles to be held in mass, secondly dimension of particles related to transportation and third one is air current that is wind speed enables to dust movement and controls of decreasing of wind speed impede transportation. It is importand to take incremental measures for first 2 factors but reducing measures for third in factor in formation and transportation of dust. Any one or more of these three properties of the dust can be changed to minimize the amount of dust (Anonymous 2012).

Dust transport is important for ecosystems (land, marine ecosystems) and human activities in the World. The main causes of dust transportation are drought and desertification. Dust transportation has negative effects on climate, health and productivity. Dust rises to the upper layers of the atmosphere and travel long distances. Turkey, as it is close to the desert and existence of latitude value, is exposed to the dust storm by means of wind storm. In recent years, an average of 20 million tons of dust is deposited into our country as wet or dry. Studies carried out to date have shown that desert dusts are more effective especially in transition seasons. In the spring and autumn, it is considered as the period when desert dust increases its effect. The region most affected by dust storms is in Southeast Anatolia Region, especially our settlements close to Syria and Iraq border (Figure 6). According to the model study conducted by Tegenand Lacis in 1996, the atmospheric lifespan of the mineral dusts, defined as 0.1-10 μm grain size, are given as follows according to their dimensions. The particle size was measured in μm: 0.15, 0.25, 0.40, 0.80, 1.50, 2.5, 5.0, 8.0, and Atm. the duration of life as hour is 231, 229, 225, 219, 179, 126, 67, 28. Figure 1 shows the effect of wind erosion according to particle size (Figure 1) (Anonymous 2016).

In the Anatolian region of Turkey, the reason of dust mobility is often the results of wind erosion. Therefore, measures to prevent wind erosion in steppe areas dominated by the continental climate will also reduce dust transportation.

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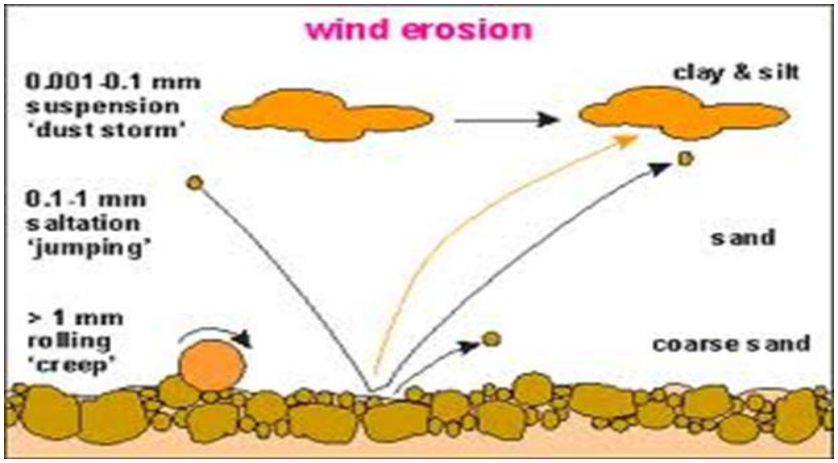

Figure 1
Effect of wind erosion on particle size (Anthoni 2000).

2. Causes, Effects and Solutions of Dust in Pasture Areas

The shortest way to reduce the dust transportation occurring in pasture conditions is to reduce dust formation and transportation, in other words, reducing wind erosion and sensible area to erosion. We can examine the dust transportation in the pastures in three ways as damage to plants and animals and the environment. We can also collect these in the following headings;

1- The damages to the plant: a) damages to plant development/growth and productivity b) damages to plant quality

2- Damage to grazing animals a) health hazards of animals b) damages related to their output c) damages related to their manegement and administration

3- Environmental hazards a) damages as pollutants b) damages due to accumulation c) damages in terms of living standards

In the semi-arid (step) regions of our country, the cultivation of large areas for field crop cultivation causes the impoverishment of the lands and the increase the erosion. The pasture grasses, which were resistant to harsh natural conditions, although they had low yields, kept the lands in place. With the removal of these weeds to make the field, the pasture land under heavy pressure of grazing has become sensible to fly away with vigorous and fierce winds. It is stated in the book, describing the history of the Karapinar district in which the most wind erosion calamity occure in Turkey (Gündüz 1980), Nomadic Turkmen conducted large scale of the animal husbandry in Karapınar-Hotamış plain and in the yearbook of Rumi dated 1300, it was mentioned and praised about animal breeding such as horses, sheep and goats in Karapinar-Hotamış plain, but in these breeding in 1953-59 and 1960-63 was a great blow with the distributions of land to the landless citizens. Because of this wrong applications the erosion was increased in pastures and cultivation areas by using inappropriate farming siystem. Historical realities justify us in this respecty. It is importand to use these places as a absolute pasture classified as absolute pasture areas. In such places, ensuring an appropriate transformation by reclamation will help to solve the problem from the beginning. Especially the priority can be applied in arid and inefficient production areas (Acar and Dursun 2010).

In addition to the dust damages caused by carrying strong wind, it is stated that strong wind causes evaporation of water in the soil, decreasing in retaining peculiarities of water to soil particles, drying of soil surface by warming, decreasing the growth rate of plants in insufficient water conditions and increasing the pests in arid land conditions (Avcı et al 2015).

As shown in Figure 2, whether the soil surface is covered with plants or not is related to the formation and efficiency of the wind erosion which causes the both water and dust transportation. In addition, the structure of the soil is also important in this regard. The soil structure with the most abrasion/structure characteristics was stated to be sandy sand> heavy clay> fine sandy loam> excess dust (Demiryürek et al 2007). The damage caused by wind erosion is inversely proportional to the amount of vegetation on the surface.

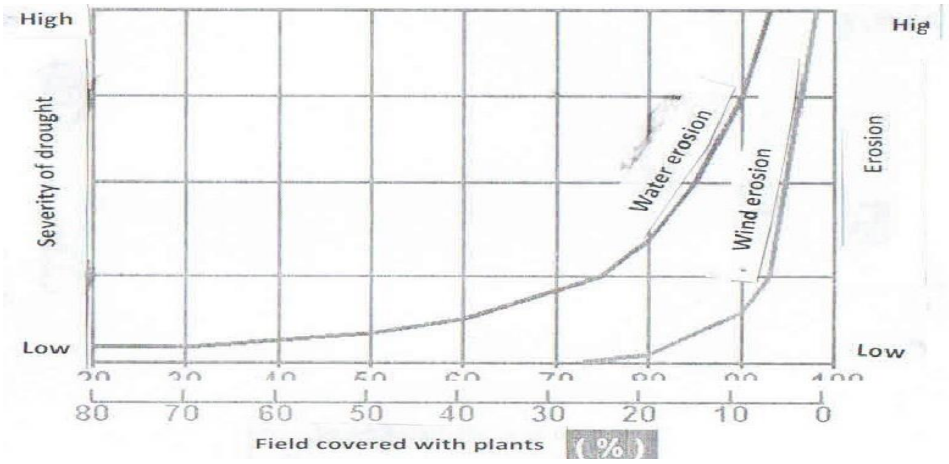

Figure 2
The relationship between plant and erosion in the pastures (Altın et al 2011).

Table 2
The amount of sediment in sediment-holding containers at different elevations in the Karapınar wind erosion site (between Ort.2000-2005) (Demiryürek et al 2007).

Areas	Depth cm	Sand %	Clay %	Silt %	Organic Matter %	<0.42mm Dry agr. %
Pasture	0-2.5	82.43	3.47	14.11	0.78	83.1
	2.5-5.0	90.49	3.47	6.04	0.81	80.0
	5.0-10.0	86.45	7.50	6.05	0.63	68.6
	10.0-25.0	86.43	9.53	4.04	0.75	48.8
	25.0-40.0	80.35	11.56	8.08	0.45	38.4
Field area	0-2.5	61.19	26.61	12.20	1.55	52.2
	2.5-5.0	59.10	26.64	14.26	1.41	43.7
	5.0-10.0	59.06	26.67	14.27	1.21	40.6
	10.0-25.0	56.98	28.83	14.28	1.21	30.8
	25.0-40.0	32.09	49.43	18.48	0.69	21.0

Table 3
The total amount of dust transported from pasture and cultivated area (Demiryürek et al 2007).

Altitute Cm	Pastures (17 İst. avr.)		Field areas (10 İst. avr.)	
	g	%	g	%
10	0.232	58.10	0.421	44.70
20	0.076	19.10	0.224	23.80
30	0.038	9.60	0.126	13.40
45	0.024	6.10	0.074	7.80
65	0.013	3.30	0.042	4.50
90	0.009	2.30	0.029	3.10
120	0.005	1.20	0.016	1.70
150	0.001	0.40	0.008	0.90
Total	0.398	100	0.940	100

As seen in Figure 2 and Table 2, it is clearly seen the relation of occuring of wind erosion or the amount of dust transportation when the land is covered with vegetation and ın Table 3, the total amount of dust transported from pasture areas (0.398 g) is much less than the amount of land in the cultivated area (0.940 g).

The Factors affecting wind erosion;

A- Natural factors: 1-Climate (precipitation, heat, humidity, wind) 2- Soil 3-Vegetation

B-Human factors (Abali et al 1986).

In Central Anatolia (annual average 300-350 mm rainfall), due to excessive evaporation in late June, it is stated that absorption by dry and hot air of whole humidity in the soil, unable to use water on the top layers of soil, especially dominating of wind in summer months were the main reason of distressing conditions of life (Birand 1968).

Pasture reclamation is one of the biggest problems of our country. Plants to be selected in pasture reclamation should be able to adapt to the region and use plants belonging to different families in the mixtures. If the herbaceous plants for the mixture for covering soil in the pasture reclamation to be selected, herbaceous plants should be large, if possible, the tall, rhizome and stolon forming should be considered more (Akalan and Dogan 1988).Especially, in pastures where wind erosion occurs, both live and artificial wind breakers which minimize the drying and carrier damages of winds should be applied in such a way that they do not obstruct grazing and that the existing pastureland protection. When selecting live wind breakers, firstly shrubs, semi-shrubs or wood species should be selected, which are fast growing and resistant to drought

plants that do not harm animals and that can also partially graze and extend the grazing period (Mücevher et al 2016). There should also have some facilitatives functions such as grazing, shading, etc. for grazing animals. In other words, it should be considered together with pasture improvement and erosion prevention in such places. Pastures formed with a balanced combination of fringe rooted species (grainy species), pile-rooted species (especially legumes), fodder plants and tree species can be defined as ideal pastures in arid and semi-arid climatic zones (Acar 2017). As a result of the destruction in a significant part of the pastures in our country shows that the stage of reclamation only with herbaceous plants has decreased in part. On the other hand, shrub plants act as a microclimate for the growth of other plants with the role they play in the ecological system, and serve as an important element in preventing erosion and protecting biodiversity (Figure 3).

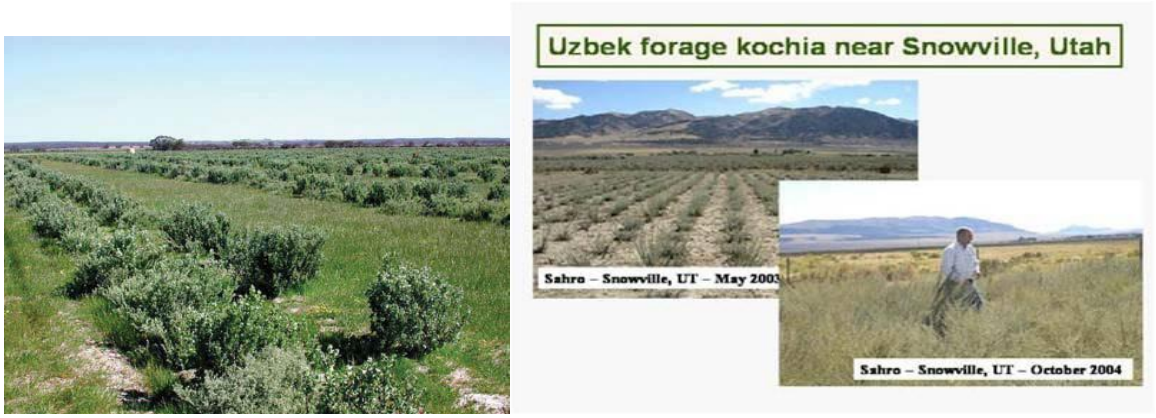

Figure 3
Shrub plants used in pasture breeding in different parts of the world.

Pastures should not be over-grazed, in accordance with grazing power, and generally take half and leave half principle should be followed. Plant residues not only protect the soil against wind and water erosion, but also making soil more humid and facilitates germination and extraction. The determined grazing season must be followed. In order to prevent erosion and to protect the vegetation, the alternately/rotated grazing system should be applied and to avoid the over grazing. With continuous grazing of the animals in the pastures, it is seen that the areas crushed by the animalsand places with no plants are increased. These places, which seem to be insignificant in the early stages, gradually grow and form gullies due to wind erosion,

On the other hand, it should be ensured that the seeds meet the soil in the pastures where it is needed for the renewal of the seeds of pasture plants in the summer season. The number of suitable animals may vary depending on appropriate climate and soil conditions. When these rules are followed, the weak and degraded pasture stage in Figure 4 is not come out and there is no erosion and dust transportation. In the destruction of the pasture, the decrease of invasive plants is the last stage of deterioration, after which the vegetation becomes sparse and cannot protect the soil. In this circuit, erosion has accelerated very rapidly. The soil is significantly lost. Another reason that increases the erosion in the pastures is that some grass and shrub plants with soil-retaining properties are removed and used as firewood (Akalan & Dogan 1988, Altin et al 2005).

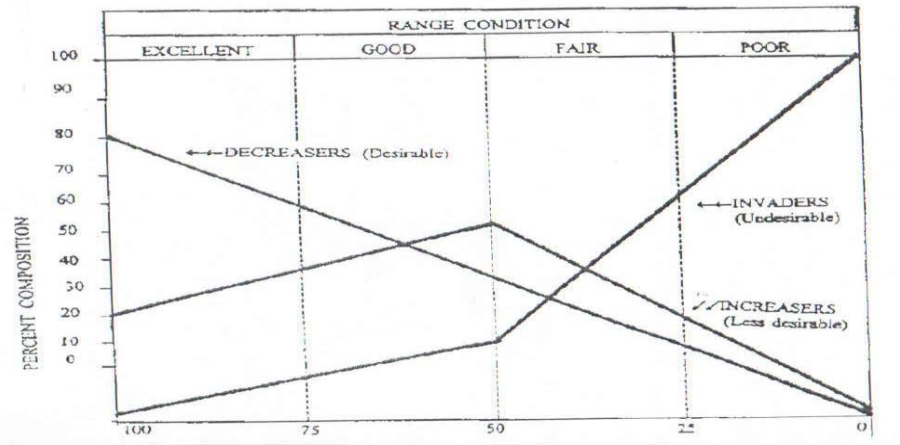

Figure 4
Changes in plant groups according to pasture conditions (Anonymous 2018).

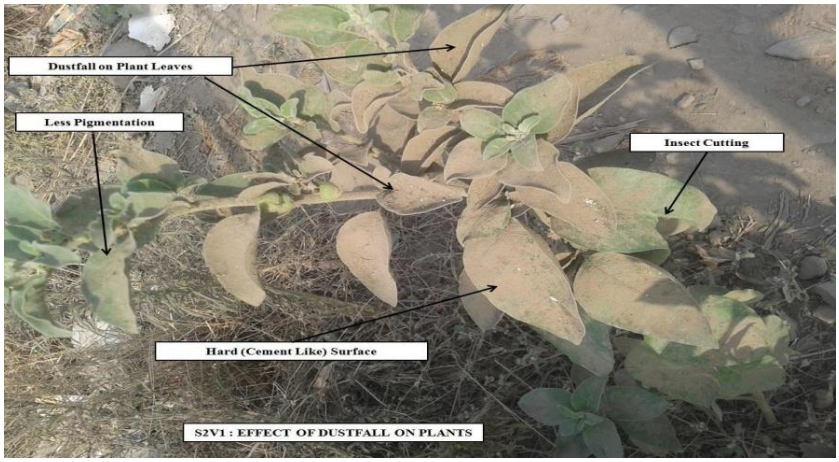

Figure 5
Effect of dust on plant (Supe & Gawande 2013).

Negative effects of transported dust on plants; when the dust particles that are deposited on the plants cover the surface of the leaves, they can prevent the vital functions of plants such as photosynthesis and transpiration. (Andıç 1984, Supe & Gawande, 2013). This effect is more severe if the size of the dust particles is small (Bağcı & Şengün 2012). It can affect the yield and quality negatively. The other harm to the plants of the dust is that it can be abrasive on the plant surfaces, which is related to the nature of the transported dust. In the dry areas, the dust may adversely affect the water transfer to the plant due to its moisture-absorbing feature (Figure 5).

3. Harm of Dust to Pasture Animals

Inorganic dust tend to accumulate in the lung. Dusts, which are at risk of forming fibrosis (hardening of the lung tissue), cause chronic lung diseases by creating a textural disorder. Inhalable dusts are the group of dust that enters the respiratory tract and reaches the alveoli for their size. These dusts are the biggest danger for the disease in the lungs.

Air currents can sweep the mineral particles in the soil and carries to very remote areas. The livings that breathe mineral dusts suspended in the air into the lungs for a certain time are at risk of becoming ill after a while. Research on the respiratory tract and allergic effects of the dusts on animals should be increased. The structures of the transported dusts are important for influencing the animals, and researches about the damages of the dusts type to animals and tolerance limits are needed. Unfortunately, there is very little research on the veterinary issues(on cattle and livestock) of the carried dusts (Lillıe 1972).

It is stated that it can be be caused by the feeds/fooders that are affected by them and by the licking of the body hair that holds them rather than not direct effcets of dust or air pollutants damage to the animals in natural pasture areas. Another reason for these types of dust and air pollutants caused low yield in animals is that low quality and taste differences in the herbs and feeds/fodder and also these fodder and herbs are consumed in small amounts by animals. Naturally, this causes decreases in animal welfare and productivity (Lillıe 1972).

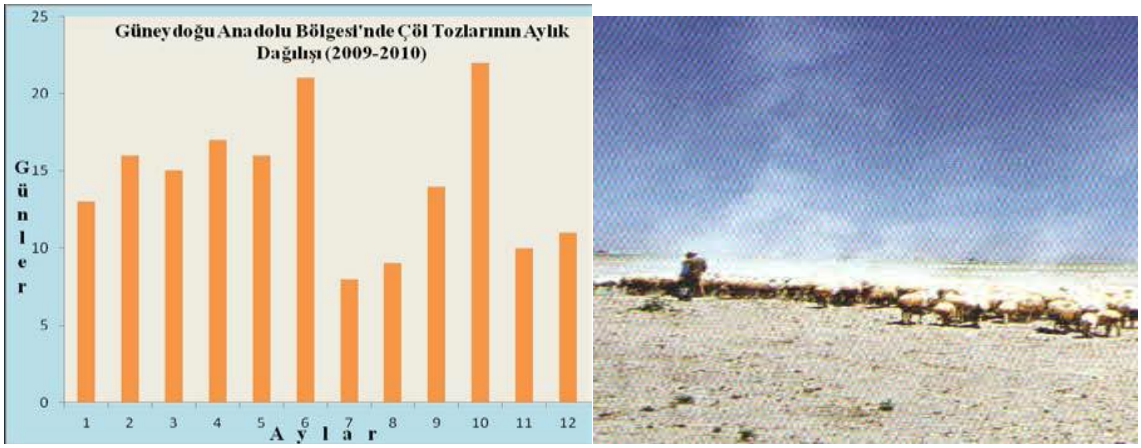

Figure 6
Annual distribution of desert dust in Eastern Anatolia (Şengün & Kıranşan 2013).

As seen in Figure 6, the times when most of the desert dusts are present are the times when animals are most in the pasture in terms of grazing season. As dust storms are physically damaging during dust storms and also microorganisms are transported from one region to another, or even from one continent to another. It is also among the results of the studies that desert dusts have spread some of the epidemic diseases in the world (Bağcı & Şengün 2012). In addition, dusts make the administration of animals difficult.

4. The Benefit of Desert Dust in Plant Production?

Some of the studies published on the desert dust in some regions and plants depending on the content of desert dusts, it can be useful for plant and nutritious plants such as agricultural fertilizers (Bagci & Sengün 2012). This can happen is usually where the soil is inefficient and the precipitation is abundant and regular. There is no dust on the plant for a long time, the dust will reach the soil with rain, the negativity of the dust is eliminated.

5. Conclusions and Recommendations

It is possible to protect people from dusty environment by providing personal dust masks for short-term dust protection, but this is not possible for farm animals fed in the open air under pasture conditions. It is therefore feasible that in these places where individual protection is not possible, collective protection of land or grazing animals is feasible. The most effective and lasting method is prevention at source. In other words, it is best to take necessary measures in the source of erosion or dust. If this cannot be performed for various reasons (due to physical or legal management and authority limits or material difficulties), measures should be taken to reduce the negative effects of the dust.

Due to the destruction in a significant part of the arid pastures where our country is insufficient rainfall, it is not now possible to reclaim the areas by vegetating or planting of herbacous plants. In pasture amelioration, shrub or semi-shrub plant formations which have a value of feed with wind screen and protect their herbaceous plants from adverse conditions, should/must be considered additionallyto prevent the erosion or minimize the damages of the dust that can be transported, increase the weed yield and grazing time, facilitate the grazing and management of the animals. Successful examples of these practices are seen with similar or more difficult ecological conditions in different parts of the world. It is necessary to prioritize the construction of wind break screen, which prevents the transportation of the seeds and soil to be planted and prevent the plants from being affected negatively from the wind and dust transportation after the emergence of the plants in reclamation areas where wind erosion is dominating. Particularly in the form of shrubs or semi-shrub formation can be planted in instead of seed as well, in order to partially prevent damage after sensitive output. There are successful examples in our country and in the world (Figure 7).

Figure 7
Semi-shrub Bozkır Otu grown in the greenhouse and planted to pasture (*Kochia prostrata*) (Org.).

Wind protected meadows positively affect the health and efficiency of animals. During the warmer times of the day. Animals which are resting under the trees and resting in the shade increase the milk yield. Unprotected pastures are affected by all kinds of climatic conditions (Altın et al 2005, Avcı et al 2015).The protection of grazing animals from wind and dust is also important in this respect.

In our country, similar or similar issues (such as erosion and pasture improvement) working together ensure more efficiently and quickly possibilityto achieve the goal. Moreover, the sustainability of the results of the studies depends on concious user and existence of legally regulated organizations.

6. Acknowledgements

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