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EURASIAN JOURNAL OF AGRICULTURAL RESEARCH

Observed Changes in Annual and Seasonal Temperatures in Nevşehir (Central Anatolia, Turkey) for Period 1960-2016

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Abstract

This study investigated changes and trends in mean annual and seasonal temperatures together with temperature anomalies in the province of Nevşehir, Turkey for the period 1960-2016. Nevşehir is within the Central Anatolia Region which is potentially sensitive to climate change due to its semi-arid climate. Trends in temperature series were analysed using Mann-Kendall and Gaussian statistical tests. Results show statistically significant increases in mean annual and summer temperatures at 0.05% level. A significant increasing trend in spring and autumn temperatures is weaker than summer temperatures. In other words, a slight warming trend in all these three seasons was detected. For winter temperatures, an increasing trend was also detected in this period. The trends, both annually and in summer, are evident from 1994, when the mean annual temperatures were above the long-term average. The warmest year was 2010 and the coldest year was 1992.

Keywords: Climate change, trend, temperature, Mann-Kendall, Nevşehir

INTRODUCTION

Climate scientists have reported a warming tendency in the global average surface temperature. Their studies have shown that in the last 150 years there has been an increase of 0.8°C in global mean temperatures and 1°C in Europe (IPCC, 2012). The study area of Nevşehir province is located in the vicinity of Cappadocia within the Middle Kızılırmak Sub-Region of the semi-arid Central Anatolia Region, which is sensitive to climate change. While the results of studies indicate that there is an overall upward trend here in extreme and average temperatures (Türkeş *et al*., 1996; Türkeş, 1999, Türkeş *et al*., 2009; Toros, 2012), there have also been positive trends in minimum temperatures and a statistically significant upward trend in summer temperatures, especially in Nevşehir (Kızılelma *et al*., 2015). According to (Türkeş, 2005), Nevşehir and its environs is the most continental part of Cappadocia with high inter-annual variability and low temperatures.

Nevşehir has an arid and sub-humid climate, first mesothermal, (excess of water is too little during the year) and the summer concentration of temperature activity is equal to the third mesothermal (Türkeş, 2005). In another study (Türkeş and Akgündüz, 2011), the Cappadocia region is subject to desertification due to both natural factors (drought, climate-process system, tuff separation, erosion, climate change) as well as human influence (land degradation, intensive tourism). In studies on the tourism of Nevşehir, it was noted that it is possible to stay outdoors all day owing to comfortable weather conditions in the summer (Türkoğlu and Çalışkan, 2011; Çalışkan and Matzarakis, 2012). Türkoğlu and Çalışkan (2011)'s study detected that for the PET (Physiologically Equivalent Temperature) values of all hours of the day, an increasing trend has been found in Nevşehir (urban meteorological station). In a study on the effects of temperature and rainfall changes on the soil and water

resources of Nevşehir, it was suggested that a serious additive trend was observed in the average, maximum and minimum long term temperature (Bağdatlı *et al*., 2015).

Studies on Turkey in recent years show the occurrence of extreme temperature events in the summer and an increase in annual changes in the second half of the 20st century (Türkeş *et al*., 2011; Erlat and Türkeş, 2013; Öztürk *et al*., 2014). Türkeş (1998) pointed out that Turkey is influenced by the hot and arid climate prevailing in the Middle East and North Africa. Increases in temperature and anomalies there bring problems such as drought and floods in the Central Anatolia Region, especially in the case of natural vegetation cover, variety of agricultural products and water resources. The purpose of this study is to determine the trends of Nevşehir province in the last 57 years using monthly, annual and seasonal temperature data.

GEOGRAPHIC SETTING and CLIMATE

Nevşehir province is situated between the coordinates 38° 12'-39° 20' north (latitude) and 34° 11'-35° 06' east (longitude) (UTM, ED 50, Zone 36 N) and in the southern part of the Kızılırmak River valley. The province, which belongs to the Middle Kızılırmak Sub-Region, has different topographical features and elevations varying between 910-3900 metres. Moreover, Nevşehir is located within the area known as Cappadocia, which is a popular tourist destination and covers a large plateau formed by accumulation of the ash and lava from extinct volcanoes such as Mt. Erciyes (3916 m), Mt. Melendiz (2963 m) and Mt. Hasan (3268 m). It is surrounded by these mountains to the south and east (Figure 1). Thus, geographically, while Cappadocia is centred on the city and province of Nevşehir, it also encompasses parts of Kayseri, Niğde, Kırşehir and Aksaray provinces.

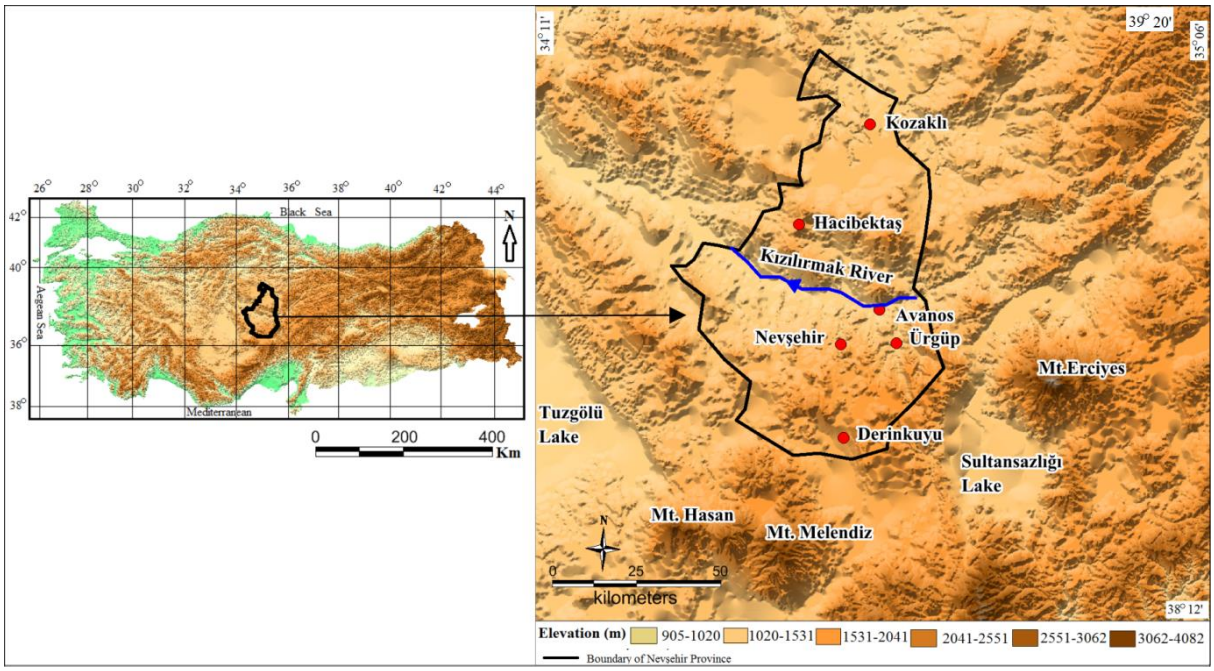


Figure 1. Location and DEM map of Nevşehir province.

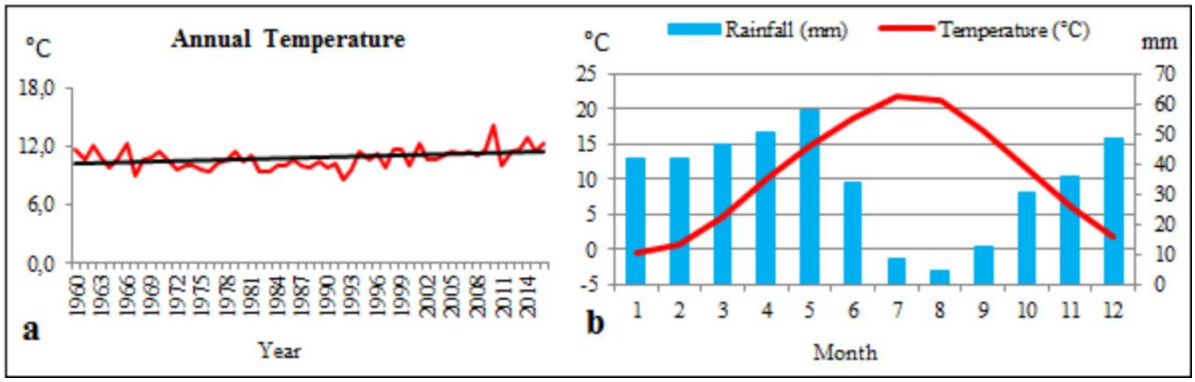


Figure 2. Variability in annual mean temperatures of Nevşehir province.

MATERIALS and METHOD

In this study, the changes and trends in the mean annual, seasonal temperature and anomaly series of Nevşehir using 57 years of data were examined. Gaussian Filter was used to examine the long-term fluctuations visually in the mean series. In this method of filtering, the weighting of successive terms of series varies symmetrically both backwards and forwards from a central weight (WMO, 1966; Türkeş *et al*., 1996). In addition, Mann-Kendall rank correlation coefficient was used to determine nonlinear trends in the time series. The u(t) curve obtained from this analysis shows the trend in the observation series.

The u(t) and u'(t) curves overlapping several times show that there is no significant trend in the series. Intersection of these curves shows the point where the trend begins (Sneyers, 1990).

RESULTS AND DISCUSSION

When the changes in annual temperature anomalies in Nevşehir from 1960 to 2016 are examined, periods occurred where decreasing and increasing trends can be distinguished, as well as the interannual variability (Figure 3).

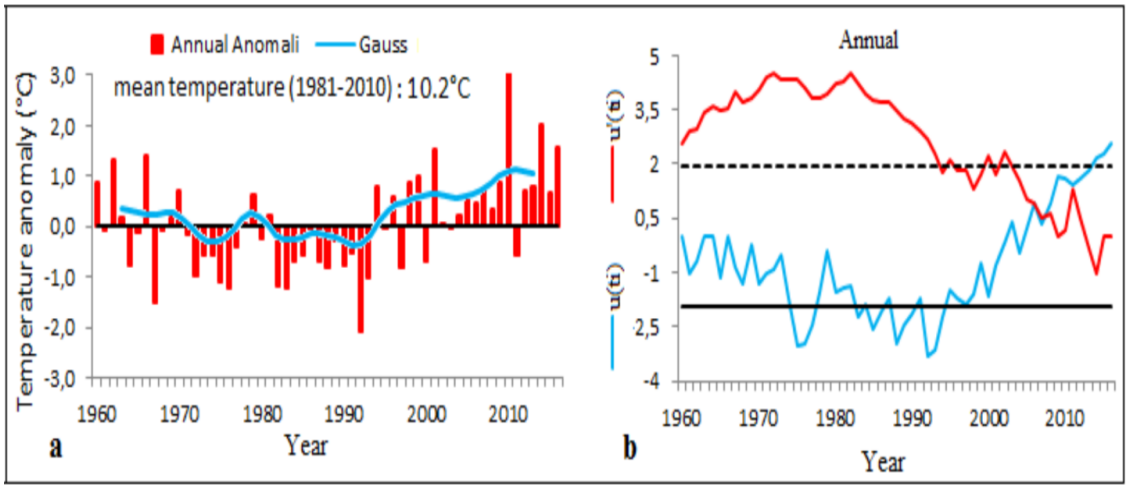


Figure 3. Changes and trends in mean annual temperatures of Nevşehir. (a) Red columns and blue curve show annual anomalies and 9-point Gaussian Filter, respectively. (b) Trend in annual temperature series according to u(t) and u'(t) obtained from Mann-Kendall test.

The Gaussian graph (Figure 3a) shows that a relatively warm period is observed between 1960 and 1966. This period was followed by a significantly cold period between 1971 and 1993. Following this period, a significant warming trend is observed despite the variable interannual during the period 1994-2001. Temperatures are above normal from 2014 to 2016. The year 2011 is distinctive in this period due to being below normal (Figure 3a). According to long-term annual anomalies, -3°C cooling is observed in1992. After this year, a warm period above the normal value occurred until 2016, except for the years 1994, 1997 and 2000. 2010 has the warmest maximum increase (+3°C). After this, there is no significant decrease, except for 2011.

These results based on Gaussian filter are also confirmed by results obtained from the Mann-Kendall test. As shown in Table 1, positive values indicate an increasing trend and a1 values (winter, spring, autumn) greater than 0.1 indicate that no significant increasing trend is observed. According to Mann-Kendall, a significant increasing trend is observed from 2006 (Figure 3b). The increasing trend in winter, spring and autumn temperatures is statistically not significant, while the increasing trend in annual temperatures is statistically significant at 0.05 level.

Table 1. Features of study area and analysis results (*: significant at 5%).

Meteorological Station	Period	Elevation (m)	Latitude and Longitude north	east	Mann-Kendall a1	u(t)	Gaussian t
Nevşehir	1960-2016	1150	37°59' and	34°42'	Annual: 0.0098	2.58*	2.64
					Winter: 0.337	0.096	
					Spring: 0.126	1.535	
					Summer: 0.0004	4.557	
					Autumn: 0.238	1.184	

As shown in Figure 4, the maximum cooling in winter temperatures occurred in the first half of the period, in 1972, with a decrease of -2°C. Generally, no significant increases were observed in this season; however, the most positive increase is observed in 2010 with an increase of 2.2°C. The maximum cooling occurred in 1992 with a decrease of 2.7°C (Figure 4a). The coldest spring with a negative anomaly of -2°C occurred in 1988 during the first period and the second highest negative anomaly occurred in 1997 with a decrease of -1.4°C. After this, a significant decrease is not observed. The highest positive anomaly is observed in 2008 with an increase of 2.1°C and 2014 with an increase of 1.9°C (Figure 4b).

The negative and positive anomalies in the summer temperatures follow each other between the years 1966 and 1979. The highest negative anomaly belonged to 1967 with a decrease of -1.85°C. After 1980, which has a significant positive anomaly (+1°C), the negative anomalies continue until 1986. Fluctuations are also observed from 1986 to 1997.

Interrupted positive anomalies are observed from 1998 to 2016. In other words, an increasing trend in summer temperatures continued over the last eighteen years. The positive anomalies range between +2.81°C (in 2010) and +0.54°C (in 2009). The highest positive anomaly is observed in 2010. As to autumn temperatures, positive and negative anomalies are observed from 1960 to 1975. This period is followed by fluctuations in temperature from 2000. Non-significant negative anomalies are observed between the years 2001 and 2016. In particular, a significant negative anomaly in temperature is remarkable in 2011, with a decrease of -2.18°C. The highest positive anomaly can be seen in 2010, with an increase of +3.83°C. The highest positive anomalies are observed in 2010 for all seasons in the period 1960-2016, except spring.

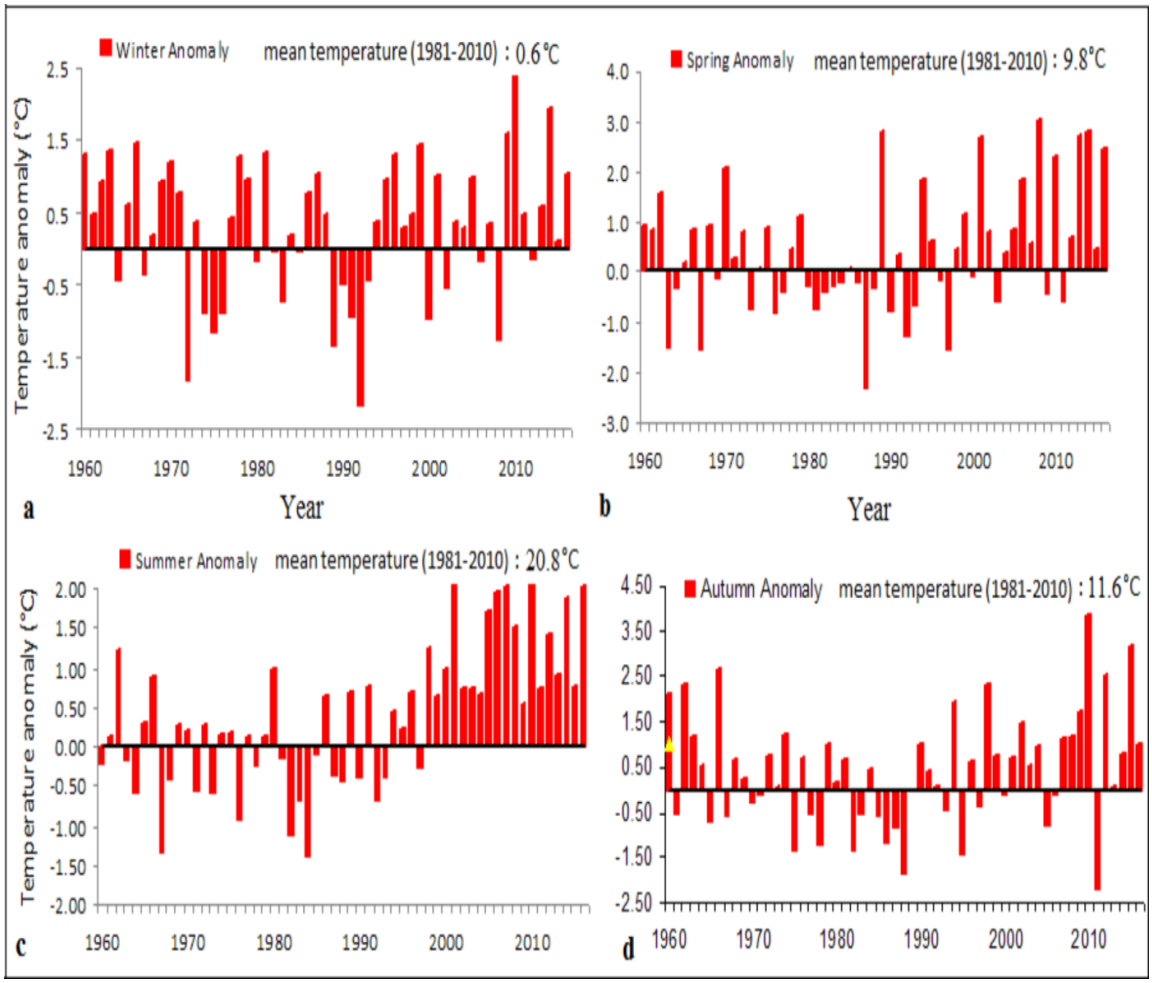
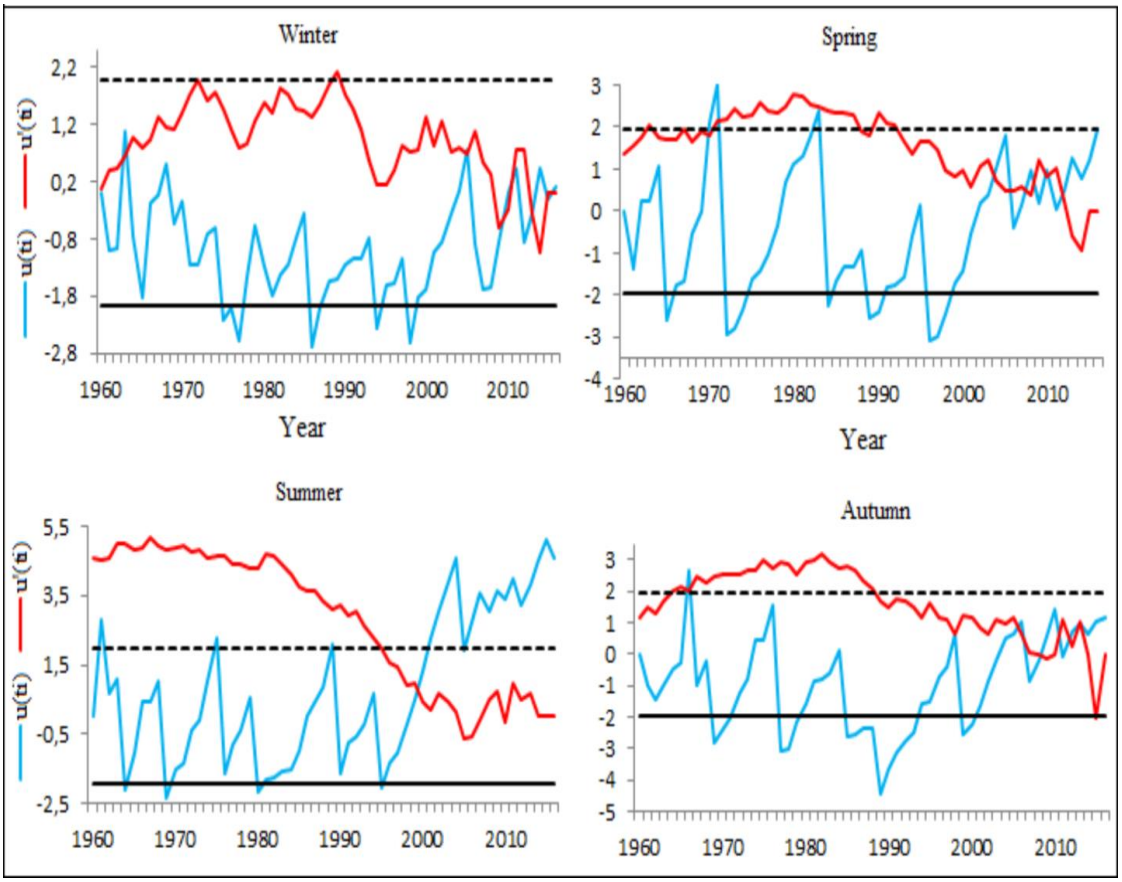


Figure 4. Seasonal anomaly values of Nevşehir province.

With respect to Mann-Kendall trend analysis, the increasing trend in summer temperatures is observed statistically significant at 0.05 level (see Table 1). For other seasons, no statistical significance is detected between 1960 and 2016 (Figure 5). The trends in summer temperatures are generally below the long-term average up to the beginning of the 1990s and show an increasing trend from this time onwards. A statistically significant increasing trend in summer temperatures is observed in Nevşehir from the year 2000. These results are consistent with those of previous studies (Türkeş *et al*., 2002; Türkeş, 2012; Kızılelma *et al*., 2015; Gökmen, 2016).

Figure 5. Trends in seasonal temperature series according to u(t) and u'(t) obtained from Mann-Kendall test.



CONCLUSION

It may be concluded that the warming trend in global mean air temperatures and warming trend in temperatures of Nevşehir province have increased significantly. In the annual temperature time series of Nevsehir from 1960 to 2016, three different periods were detected. These are: (1) Fluctuations in temperature and a slight warming trend until the beginning of the 1970s, (2) a general cooling trend from 1972 to 1993 ranging from -0.8°C to -2.3°C, and (3) a strong warming trend following 1993. Negative anomaly values are observed between the years 1972 and 1993, while positive anomaly values are observed from 1993. According to Mann-Kendall analysis, the increasing trend in annual and summer temperatures is statistically significant at 0.05 level. This shows that the increasing trend in summer temperatures plays an important role in amplifying the warming trend of annual temperatures. The highest warming is observed in 2010 for both annual and seasonal temperatures.

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REFERENCES

Bağdatlı M. C., Bellitürk K. and Jabbari A. 2015. Possible effects on soil and water resources observed in Nevşehir province in long annual temperature and rainfall changing. *Eurasian Journal of Forest Science*, 3 (2), 19-27.

Çalışkan O. and Matzarakis A. 2012. The Climate and Bioclimate of Nevşehir from the Perspective of Tourism. In: *Advances in Meteorology, Climatology and Atmospheric Physics*, C.G. Helmis and P.T. Nastos (eds),, Springer-Verlag Berlin Heidelberg DOI 10.1007/978-3-642-29172-2_56.

Erlat E. and Türkeş M. 2013. Observed changes and trends in numbers of summer and tropical days and the 2010 hot summer in Turkey. *International Journal of Climatology*, 33(8), 1898-1908.

Gökmen M. 2016. Spatio-temporal trends in the hydroclimate of Turkey for the last decades based on two reanalysis datasets. *Hydrol. Earth Syst. Sci*., 20, 3777– 3788.

IPCC, 2012. Summary for Policymakers. In: *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation.* Field, C.B., V. Barros, T.F. Stocker,

D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds), A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK, and New York, NY, USA, pp. 3-21.

Kızılelma Y., Çelik M. A. and Karabulut M. 2015. İç Anadolu Bölgesinde sıcaklık ve yağışların trend analizi. *Türk Coğrafya Dergisi*, 64, 1-10.

Özturk T., Türkeş M. and Kurnaz M. L. 2014. Analysing projected changes in future air temperature and precipitation climatology of Turkey by using RegCM4.3.5 climate simulations. *Aegean Geograph. J.*, 20, 17–27.

Sneyers R. 1990. On the statistical analysis of series of observations. World Meteorological Organization (WMO), Technical Note, No. 143, Geneva, 192 pp.

Toros H. 2012. Spatio-temporal variation of daily extreme temperatures over Turkey. *International Journal of Climatology*, 32(7), 1047-1055.

Türkeş M. 1998. Influence of geopotential heights, cyclone frequency and southern oscillation on rainfall variations in Turkey. *International Journal of Climatology*, 18, 649–680.

Türkeş M. 1999. Vulnerability of Turkey to desertification with respect to precipitation and aridity conditions. *Turkish Journal of Engineering and Environmental Sciences*, 23, 363-380.

Türkeş M. 2005. Orta Kızılırmak Bölümü güney kesiminin (Kapadokya yöresi) iklimi ve çölleşmeden etkilenebilirliği. *Ege Coğrafya Dergisi*, 14, 73-97.

Türkeş M. 2012. Turkiye'de gözlenen ve öngörülen iklim değisikliği, kuraklık ve çölleşme. *Ankara Universitesi Çevre Bilimleri Dergisi*, 4(2), 1-32.

Türkeş M., Utku M. S. and Kılıç G. 1996. Observed changes in maximum and minimum temperatures in Turkey. *International Journal of Climatology*, 16, 463-477.

Türkeş M., Sümer U.M. and Demir I. 2002. Re-evaluation of trends and changes in mean, maximum and minimum temperatures of Turkey for the period 1929– 1999. *International Journal of Climatology*, 22, 947–977.

Türkeş M., Koç T. and Sarış F. 2009. Spatiotemporal variability of precipitation total series over Turkey. *International Journal of Climatology*, 29, 1056-1074

Türkeş M. and Akgündüz A. S. 2011. Assessment of the desertification vulnerability of the Cappadocian district (Central Anatolia, Turkey) based on aridity and climate-process system. *International Journal of Human Sciences*, 8, 1234-1268.

Türkeş M., Kurnaz M.L, Öztürk T. and Altınsoy H. 2011. Climate changes versus 'security and peace' in the Mediterranean macroclimate region: are they correlated? In: Proceedings of International Human Security Conference: New Challenges, New Perspectives: 625-639. CPRS Turkey. 27-28 October, İstanbul.

Türkoğlu N. and Çalışkan O. 2011. Nevşehir ve Ürgüp'te şehirleşmenin biyoklimatik koşullar üzerine etkisi. *Ankara Üniversitesi Dil ve Tarih-Coğrafya Fakültesi Dergisi*, 51, 45-63.

WMO.1966. Climatic change. World Meteorological Organization (WMO), Technical Note, No. 79, 79 pp, Geneva.

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Molecular Identification, Virulens and Genetic Diversity of *Fusarium* species on Wheat

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Abstract

Surveys were conducted in Konya, Ankara, Eskisehir, Kayseri, Nevsehir, Aksaray, Yozgat, Kirsehir and Kirikkale province in 2011 and 2012 growing seasons and 1256 diseased wheat samples were collected from 2770 wheat fields. As a result of isolation from this samples 668 *Fusarium* isolates were obtained belonging to 18 different species. In consequence of DNA sequence analysis, obtained isolates were determined *Fusarium acuminatum, F. avenaceum, F. brachygibbosum, F. cerealis, F. chlamydosporum, F. culmorum, F. equiseti, F. graminearum, F. incarnatum, F. lacertarum, F. longipes, F. nivale (Microdochium nivale), F. oxysporum, F. proliferatum, F. redolens, F. solani, F. sporotrichioides, F. tricinctum*. Pathogenicity tests performed and it was determined that the most virulent group were respectively, 86,72-96%, 84,67-94% ve 80,67-94,67% with diseases severity *F. culmorum, F. tricinctum* and *F. nivale*. The most commonly isolated species was *F. nivale*. Using phylogenetic analyses based on the internal transcribed spacer sequence data, it was examined by genetic variations between species of *Fusarium.*

Keywords: *Fusarium* spp.,*Triticum aestivum*, molecular, pathogenicity

INTRODUCTION

Wheat is a major agricultural crop and the main cereal consumed by humans in Turkey. Total wheat production is forecast at 18 million tonnes in 2016 in Turkey. Central Anatolia Region is the most wheat producing region with 2.9 million hectares of wheat cultivation area. *Fusarium* is one of economically important and destructive fungal diseases of wheat in Central Anatolia (Tunali *et. al,* 2008). *Fusarium* spp. cause root and crown rot and head blight on wheat.

The most important reported *Fusarium* species are *F. graminearum* and *F. culmorum* while several others such as *F. acuminatum, F. avenaceum, F. nivale* and *F. crookwellense* have also been reported (Burgess *et al*. 2001, Fernandez & Chen 2005, Smiley & Patterson, 1996). *F. graminearum* predominates in North America and in Southern Europe, while *F. culmorum* and *M. nivale* predominate in cooler climates in Europe (Parry *et al.* 1995). The causal agents of *Fusarium* head blight are primarily *F. graminearum, F. culmorum* and *F. avenaceum* (Lemmens *et al.,* 2004; Stepien *et al.,* 2008) The *F. graminearum* species complex, which consists of at least 11 phylogenetically distinct species, is the predominant species causing *Fusarium* head blight worldwide (O'Donnell *et al.,* 2000). Apart from reducing the yield, head blight damages grain quality by contamination from toxic

secondary metabolites (mycotoxins), which cause a health risk to both humans and animals. The toxins produced by *Fusarium* spp. are Deoxynivalenol (DON); Diacetoxyscirpenol (DAS), Monoacetyl-deoxynivalenol; Nivalenol (NIV); Zearalenone (ZEN) and Fusarenone-X (Bottalico and Perrone, 2002). More frequently occurring species are *F. culmorum*, *F. pseudograminearum*, *F. acuminatum*, *F. solani*, *F. avenaceum* and *F. verticilloides* (Yıldırım *et al*., 1999 ;Tunali *et al*., 2008) in Central Anatolia Region. In these studies conducted especially Konya, Karaman, Niğde, Aksaray Ankara Provinces in Central Anatolia Region. In this study some province e.g. Kayseri, Kırşehir, Nevşehir and Yozgat were firstly investigated in terms of *Fusarium* species. Traditional diagnostic methods for detection and identification of *Fusarium* spp. in culture are based on micro and macro morphological features. This process is time consuming, requires training, and it can often be difficult to distinguish between similar species. Molecular methods, more sensitive and faster are also employed to the specific identification of *Fusarium* species. The majority of the diagnostic assays are random amplified polymorphic DNA (RAPD) analysis (Voight *et. al.*, 1995), specific diagnostic PCR primers (Nicholson *et. al*. 1998), or DNA sequencing (Appel & Gordon 1996, O'Donnell *et al.* 1998). Several studies have demonstrated that ITS primers are useful targets for identification of some species complexes of *Fusarium* (Tan & Niessen, 2003, Mishra *et al*. 2003, O'Donnell *et al.* 2008).

In the present investigation morphological and molecular techniques were used to identify some *Fusarium* species isolated from wheat fields in Central Anatolia Region, as well as evaluating the genetic diversity of the identified species using the CLC Main Workbench 7.7.3 program.

MATERIALS and METHOD

Sample Collection

Surveys were conducted in Konya, Ankara, Eskisehir, Kayseri, Nevsehir, Aksaray, Yozgat, Kirsehir and Kirikkale province in 2011 and 2012 growing seasons in Central Anatolia Region, Turkey (Figure 1). 1256 diseased wheat samples were collected from 2770 wheat fields.

Figure 1. Location of survey area in Central Anatolia Region

Isolation of *Fusarium* species

Segments of root and crown rot were surface sterilized for 1 min. in 1% sodium hypochlorite (NaOCl) solution, then washed thoroughly with sterile water and air dried in a laminar flow hood prior to place on potato dextrose agar (PDA, Merck, Germany) containing 50 mg/l streptomycin sulfate. Ten segments were placed on each plate and five petri dishes were used for each sample. Then dishes were incubated under a combination of long-wave ultraviolet and fluorescent light (12 h light: 12 h dark) for 7 days. Temperature was kept 23 ±2 ^{0}C under the light and dark conditions, respectively. After incubation, the cultures were transferred onto Synthetic Nutrient Agar (SNA). for species identification.

Pathogenicity Tests

Pathogenicity tests were performed with agar plate assay. Isolates were incubated on PDA at 23 ±2 ^{0}C for 2 days, mycelial discs (4mm) from an actively growing edge of the fungal culture were transferred to 2% WA and incubated at the same conditions for 2 days. Seeds of the susceptible wheat cultivar (cv. Sultan 95) were disinfected by dipping in 1% NaOCl for 5 min, rinsed with sterile distilled water and aseptically blotted then six seeds were placed onto adjacent to the growing edge of the isolates in each Petri plate. Five plates were used for each isolate. After incubation for 7–8 days at 23±2°C under photoperiod of 12 h, disease assessment was rated on a scale of 0-5, based on the relative size of a necrotic area on the hypocotyl as follows :0=no disease, 1= 1-10%, 2= 11-30%, 3=31-50%, 4=51-80 % and 5=the entire hypocotyl infected (Ichielevich-Auster *et al.,* 1985). These scale values were converted to disease severity values using the following formula (Karman 1971).

Disease Severity= [∑ (no. of plant in category x category value)] x 100 / Total no. of plants x max. category value).

Morphological Identification

For morphological identification, single spore isolates were grown for 10–15 days on PDA medium. Culture characteristics of each isolate were determined from 10 to 15 day old SNA cultures. Microscopic features of conidia, conidiophores and chlamydospores were also determined based on Leslie & Summerell (2006).

Molecular Identification

Approximately, 300 mg mycelium were harvested and ground with liquid nitrogen in a sterile mortar for DNA extraction from culture medium. Genomic DNA was extracted using a Qiagen DNeasy ® Plant Mini Kit, as specified by the manufacturer, and stored at -20 ^{0}C prior to use. PCR reaction mixtures and condition were modified from previous studies (Aroca & Raposo 2007; Cobos & Martin, 2008). The ITS regions of the isolates were amplified using the universal primers ITS-1 (5’ TCC GTA GGT GAA CCT GCGG 3’) and ITS-4 (5’ TCC TCC GCT TAT TGA TATGC 3’) as described by White *et al.* (1990). The reaction mixtures of PCR, a final volume of 50 µl, contained 5µl of 10X buffer [75 mM Tris HCl, pH 9.0, 50 mM KCl, 20 mM (NH4)2SO4], 2 µl of 5 µM each primers, 5 µl of 1.5mM MgCl2, 2 µl of 10 mM deoxynucleoside triphosphates (dNTPs), 1 U Taq polymerase (Fermentas), 5 µl of DNA template for each reaction and 5 µl of bovine serum albumin (BSA: 10 mg/ml). DNA amplifications were carried out in a Techne TC-5000 thermal cycler by the following program: 94 C for 2 min, followed by 34 cycles of (1) denaturation (94˚C for 30 s), (2) annealing (60˚C for 30 s) and (3) extention (72 ˚C for 30 s), and a final extension step 10 min at 72˚C. The PCR products were separated in 1.5 % agarose gels stained with ethidium bromide, and visualized

under UV light. They were sequenced by GENOKS (Gene Research and Biotechnology Company, Ankara, Turkey). The nucleotide sequences were subjected to Basic Alignment Search Tool (BLAST) analysis (http://www.ncbi.nlm.nih.gov) and compared to other sequences in GenBank. The phylogenetic neighbour joining trees were created using the CLC Main Workbench 7.7.3 Programme.

RESULTS and DISCUSSION

It was detected that 668 *Fusarium* isolates recovered from 1256 diseased wheat samples collected from Konya, Ankara, Eskisehir, Kayseri, Nevsehir, Aksaray, Yozgat, Kirsehir and Kirikkale province (Table 1). In consequence of morphologic identification and DNA sequence analysis, isolates obtained from infected plants were determined as *F. avenaceum, F. brachygibbosum, F. cerealis, F. chlamydosporum, F. culmorum, F. equiseti, F. graminearum, F. incarnatum, F. lacertarum, F. longipes, F. nivale (Microdochium nivale), F. oxysporum, F. proliferatum, F. redolens, F. solani, F. sporotrichioides, F. tricinctum* (Figure 2). The total size of the ITS1 and ITS4 regions, including the 5.8S rDNA gene of the isolates studied varied from 550 to 600 bp (Figure 3).

Fusarium sequences obtained from amplification of conserved ribosomal ITS region were compared with sequences from National Center for Biotechnology Information (NCBI) database using BLAST 2.0 (http://www.ncbi.nlm.nih.gov/ BLAST). Identified species showed 98-100% similarity with the isolates belong same species in NCBI. The most commonly isolated species was *F. nivale*. As with this report, Demirci & Dane detected *F. acuminatum, F. oxysporum. F. equiseti* and *F. nivale in Anatolia Region* in their study. In contrast, Tunali *et al*. (2008) reported that *F. culmorum* and *F. pseudograminearum were the most common species in Central Anatolia Region*. At the same time they were detected that more than 20 species of *Fusarium* e.g. *F. acuminatum, F. avenaceum, F. chlamydosporum, F. compactum, F. equiseti, F. lateritium, F. heterosporum, F. oxysporum, F. poae, F. proliferatum, F. semitectum, F. solani, F. sporotrichioides, F. tricinctum* and *F. verticillioides* were isolated from roots and crowns of wheat in their study. Bentley *et al.* (2006) isolated 16 *Fusarium* species from wheat stem bases across 25 sites in parts of the Aegean, Marmara, and Black Sea regions, with *F. oxysporum, F. equiseti, F. acuminatum, F. sambucinum, F. culmorum,* and *F. armeniacum* being the most frequent. *F. solani, F. pseudograminearum* and other species were found at low frequencies.

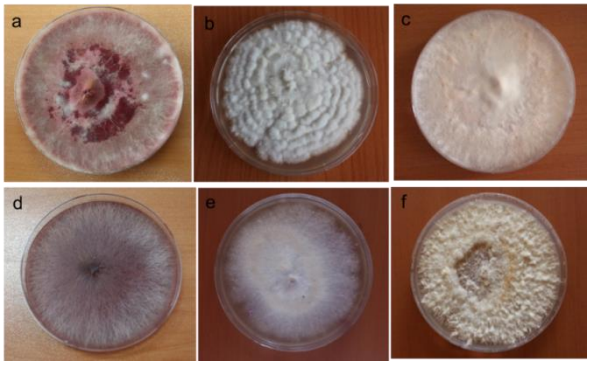

Figure. 2. *Fusarium spp.* on PDA, (a) *F. graminearum*, (b) *F. chlamydosporum*, (c) *F. nivale*, (d) *F. culmorum*, (e) *F. tricinctum*, (f) *F. equiseti*

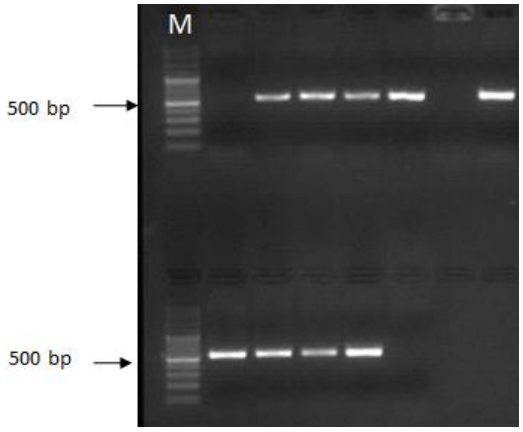

Figure 3. Amplification of conserved ribosomal regions of *Fusarium* spp. using the primers ITS-1 and ITS-4 (M: Markör Gene Ruler 100 bp DNA ladder MBI Fermantase)

Table 1. Diseases severity, origin, and number of *Fusarium* species isolated from wheat fields in Central Anatolia Region

***Fusarium* Species**	**Origin**	**Number of Isolate**	**Disease severity (%)**
F. acuminatum	Konya, Ankara, Eskişehir, Yozgat, Kayseri, Kırıkkale, Kırşehir,	26	23-80
F. avenaceum	Konya, Ankara, Eskişehir, Yozgat, Kayseri, Aksaray, Nevşehir	27	61-78
F. brachygibbosum	Ankara, Eskişehir, Yozgat,	17	48-72
F. cerealis	Konya, Ankara, Yozgat, Kayseri, Nevşehir	56	57-81
F. chlamydosporum	Konya, Ankara, Eskisehir, Kayseri, Nevsehir, Aksaray,	25	68-88
F. culmorum	Konya, Ankara, Eskisehir, Kayseri, Nevsehir, Aksaray, Yozgat, Kirsehir, Kirikkale	52	86-96
F. equiseti	Konya, Ankara, Eskisehir, Kayseri, Nevsehir, Aksaray, Yozgat, Kirsehir, Kirikkale	67	61-73
F. graminearum	Konya, Ankara, Eskisehir, Kayseri, Nevsehir, Aksaray, Yozgat,	21	83-90
F. incarnatum	Konya, Ankara, Yozgat, Kirsehir	11	
F. lacertarum	Konya, Ankara, Nevsehir, Aksaray, Yozgat,	28	8-46
F. longipes	Konya, Ankara, Yozgat, Aksaray	22	23-72
F. nivale	Konya, Ankara, Eskisehir, Kayseri, Nevsehir, Aksaray, Yozgat, Kirsehir, Kirikkale	166	80-94
F. oxysporum	Konya, Ankara, Eskisehir, Kayseri, Nevsehir, Aksaray, Yozgat, Kirsehir, Kirikkale	54	1-48
F. proliferatum	Konya, Ankara, Eskisehir, Kayseri, Nevsehir, Yozgat	24	58-80
F. redolens	Kirsehir, Kirikkale	21	65-72
F. solani	Konya, Ankara, Aksaray	9	14-40
F. sporotrichioides	Ankara, Eskisehir, Kayseri, Nevsehir, Aksaray	13	32-58
F. tricinctum	Konya, Ankara, Eskisehir, Nevsehir, Aksaray, Yozgat, Kirsehir, Kirikkale	29	84-94

In consequence of the pathogenicity, it was determined that the most virulent group were respectively, 86,72-96%, 84,67-94% ve 80,67-94,67% with diseases severity *F. culmorum, F. tricinctum* and *F. nivale* but Aktaş *et al*. revealed that *F. verticillioides* was one of the most virulent pathogens on crowns of wheat and *F. culmorum* also was observed highly pathogenic reactions on winter wheat variety Katea A-1 under greenhouse conditions. Similarly our study, Tunali *et al.* (2008) has clearly demonstrated under greenhouse conditions that a range of *F. culmorum, F. pseudograminearum* and *F. graminearum* isolates are all highly pathogenic on crowns of winter, whereas other species such as *F. subglutinans, F. oxysporum, F. acuminatum, F. solani,* and *F. verticillioides* were weak pathogens. As with our study, Demirci & Dane (2003) examined the cause of crown and root rots on winter wheat Kirik under greenhouse conditions and found that *F. nivale* was the most virulent pathogen, while *F. acuminatum, F. equiseti, F. oxysporum,* and *F. solani* were slightly virulent in their study.

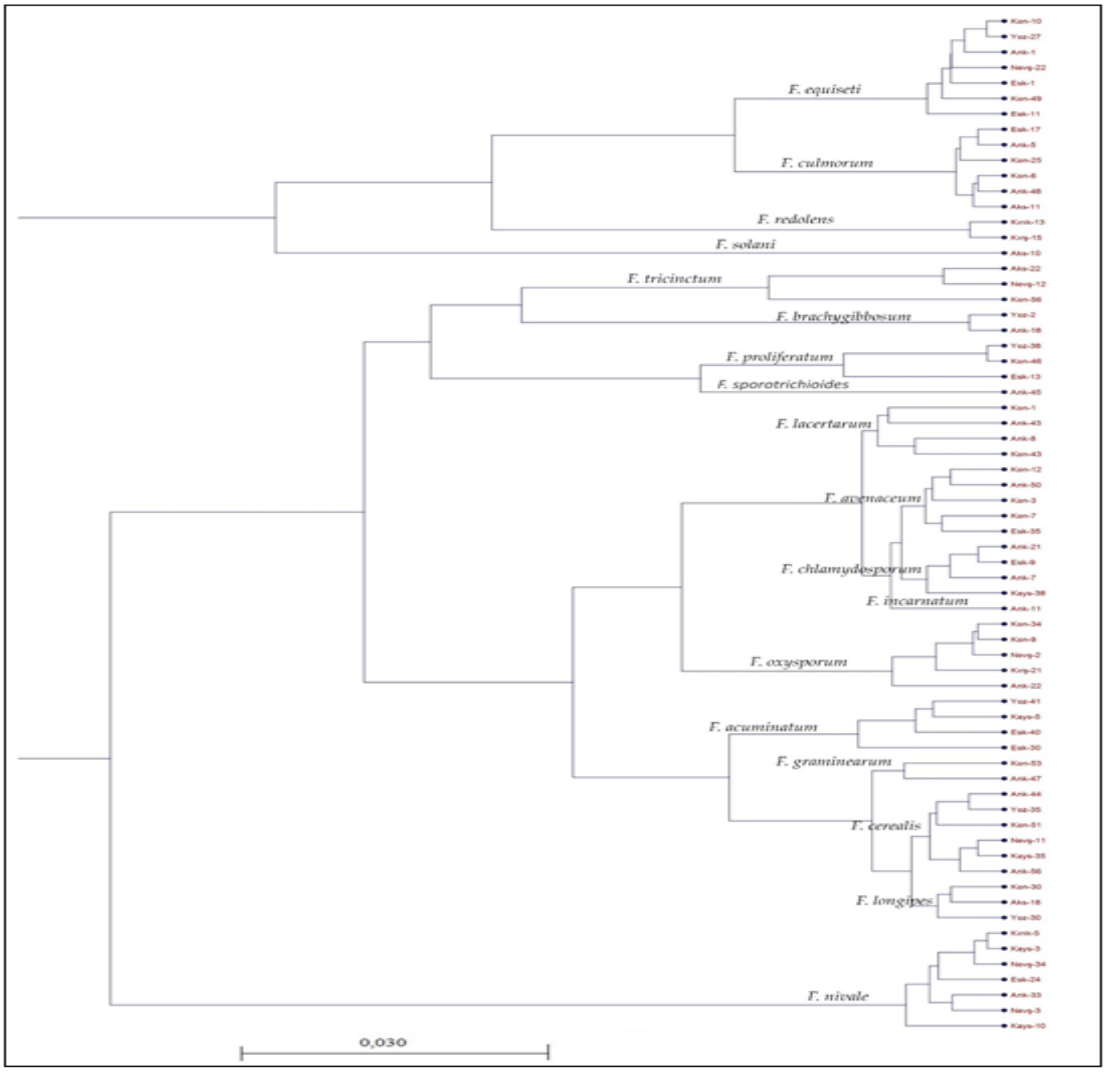

Figure 4. UPGMA cluster analysis obtained by sequence analysis of *Fusarium* isolates ITS region

Sixty six *Fusarium* isolates obtained from diseased wheats and selected by isolate numbers were subjected to UPMG cluster analysis in the CLC Main Workbench 7.7.3 program to assess genetic differences. Phylogenetic analysis grouped the *Fusarium* isolates into eighteen clusters (Fig. 4). UPGMA cluster analysis of rDNA squence data separated the isolates of each particular species into unique groups based on high genetic similarity (Figure 4).

CONCLUSIONS

Fusarium acuminatum, F. avenaceum, F. brachygibbosum, F. cerealis, F. chlamydosporum, F. culmorum, F. equiseti, F. graminearum, F. incarnatum, F. lacertarum, F. longipes, F. nivale (Microdochium nivale), F. oxysporum, F. proliferatum, F. redolens, F. solani, F. sporotrichioides, F. tricinctum can cause root rot and head blight in Central Anatolia Region. The most commonly isolated species was *F. nivale.* The most virulent isolate is *F. culmorum.* The results obtained may contribute in developing an integrated control program for *Fusarium* diseases.

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REFERENCES

Appel DJ, Gordon TR.1996. Relationships among pathogenic and non-pathogenic isolates of *Fusarium oxysporum* based on the partial sequence of the intergenic spacer region of the ribosomal DNA. *Molecular Plant Microbe Interactions*, 9, 125-38.

Aroca, A., Raposo, R**.** 2007. PCR-based stragety to detect and identify species of *Phaeoacremonium* causing grapevine diseases. *Applied and Environmental Microbiology*, 73, 2911-2918.

Bentley, A. R., Tunali, B., Nicol, J., Burgess, L. W., and Summerell, B. A. 2006. A survey of *Fusarium* species associated with wheat stem bases in northern Turkey. *Sydowia* 58:163-177.

Bottalico, A., & Perrone, G. 2002. Toxigenic *Fusarium* species and mycotoxins associated with head blight in small-grain cereals in Europe. European Journal of *Plant Pathology*, 108, 611–624.

Burgess, L. W., Backhouse, D., Summerell, B.A., and Swan, L. J. 2001. Crown rot of wheat. Pages 271-295 in: Fusarium – Paul E. Nelson Memorial Symposium. B. A. Summerell, J. F. Leslie, D. Backhouse, W. L. Bryden, and L. W. Burgess, eds. *American Phytopathological Society*.

Cobos, R., Martin, M.T. 2008. Molecular characterisation of *Phaeomoniella chlamydospora* isolated from grapevines in Castilla y León (Spain). *Phytopathol. Mediterr.,* 47, 20–27.

Demirci, E., and Dane, E. 2003. Identification and pathogencity of *Fusarium* spp. from stem bases of winter wheat in Erzurum, Turkey. *Phytoparasitica* 31:170-173.

Fernandez, M. R., and Chen, Y. 2005. Pathogenicity of *Fusarium* species on different plant parts of spring wheat under controlled conditions. *Plant Dis.* 89:164-169.

Ichielevich- Auster M., Sneh, B., Koltin Y., Barash I.,1985. Suppression of Damping-Off Caused by *Rhizoctonia* Species by a Nonpathogenic Isolate of *R. solani*. *Phytopathology* 75:1080-1084.

Karman, M. 1971. Bitki Koruma Araştırmalarında Genel Bilgiler, Denemelerin Kuruluşu ve Değerlendirme Esasları, Bornova-İzmir, 279s.

Lemmens, M., Bűrstmayr, H., Krska, R., Schumacher, R., Grausgruber, H., & Ruckenbauer, P. 2004. The effect of inoculation treatment and long-term application of moisture on *Fusarium* head blight symptoms and deoxynivalenol contamination in wheat grains. European Journal of *Plant Pathology*, 110, 229–308.

Leslie JF and Summerell BA 2006 The Fusarium Laboratory manual. (Blackwell Publishing: Iowa, USA).

Mishra PK, Fox RT, Culham A. 2003. Development of a PCR-based assay for rapid and reliable identification of pathogenic Fusaria. *FEMS Microbiol Lett*,218(2): 329-32.

Nicholson P, Simpson DR, Weston G, Rezanoor HN, Lees AK, Parry DW, Joyce D. 1998. Detection and quantification of Fusarium culmorum and Fusarium graminearum in cereals using PCR assays. *Physiological and Molecular Plant Pathology*, 53: 17–37.

O'Donnell K, Cigelnik EH, Nirenberg I. 1998. Molecular systematic and phylogeography of the *Gibberella fujikurori* species complex, *Mycologia*, 90: 465-93.

O'Donnell K, Kistler HC, Tacke BK and Casper HH. 2000. Gene genealogies reveal global phylogeographic structure and reproductive isolation among lineages of *Fusarium graminearum*, the fungus causing wheat scab. Proceedings of the National Academy of Sciences USA 97:7905–7910.

O'Donnell K, Sutton DA, Fothergill A, McCarthy D, Rinaldi MG, Brandt ME, Zhang N, Geiser DM 2008. Molecular phylogenetic diversity, multilocus haplotype nomenclature, and in vitro antifungal resistance within the *Fusarium solani* species complex. *J Clin Microbiol*, 46: 2477-90.

Parry DW, Jenkinson P and MacLeod L (1995) *Fusarium* ear blight (scab) in small grain cereals – a review. *Plant*

Pathology, 44: 207–238.

Schiling A.G., Möller E.M., Geiger H.H. Polymerase Chain Reaction-Based Assays for Species-Specific Detection of *Fusarium culmorum*, *F. graminearum*, and *F. avenaceum*. *Phytopathol.* 1996; 86:515–522.*m* species.
Plant Protect. Sci. Vol. 46, 2010, No. 2: 59–65.

Smiley, R. W., and Patterson, L. M. 1996. Pathogenic fungi associated with *Fusarium* foot rot of winter wheat in the semiarid Pacific Northwest. Plant Dis. 80:944-949.

Stepien, Ł., Popiel, D., Koczyk, G., & Chełkowski, J. 2008. Wheat-infecting Fusarium species in Poland-their chemotypes and frequencies revealed by PCR assay. Journal of Applied Genetics, 49(4), 433–441.

Tan MK, Niessen LM. 2003. Analysis of rDNA ITS sequences to determine genetic relationships among, and provide a basis for simplified diagnosis of, *Fusarium* species causing crown rot and head blight of cereals. *Mycol Res*, 107(Pt 7): 811-21.

Tunalı B, Nicole JM, Hodson D, Uçkun Z, Büyük, O, Erdurmuş D, Hekimhan H, Aktaş H, Akbudak MA, Bağcı SA. 2008. Root and crown root fungi associated with spring, facultative, and winter wheat in Turkey. *Plant Disease*, 92:1299-1306.

Voight K, Schleier S, Bruckner B. 1995. Genetic variability in *Gibberella fujikuroi* and some related species of the genus *Fusarium* based on random amplification of polymorphic DNA (RAPD). *Current Genetics*, 27, 528-535.

White TJ, Bruns T, Lee S, Taylor JW. 1990. Amplification and direct sequencing of fungal ribosomal RNA genes for phylogenetics. In: PCR Protocols: A Guide to Methods and Applications, eds. Innis, MA, Gelfand DH, Sninsky JJ, White TJ. Academic Press, Inc., New York. pp. 315-322.

Yıldırım, A. F., Kınacı, E., Hekimhan, H., Çeri, S., 1999. Konya, Karaman, Niğde ve Aksaray yörelerinde tahıllarda önemli hastalıkların durumu ve bunlara dayanıklılık kaynaklarının araştırılması, *Hububat Sempozyumu, Konya*, s: 404-413.

EURASIAN JOURNAL OF AGRICULTURAL RESEARCH

The Effect of Volcanic Structures on Residential Areas (Between Nevşehir-Konya), Central Anatolia, Turkey

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Abstract

This study aims at analysing the relationship between settlement areas and topography in the volcanic areas around Aksaray, Ereğli, Karaman, Karapınar and Niğde between Kayseri and Konya where the Central Anatolian Volcanics are spread.
Lava and pyroclastic materials from different periods constitute a significant part of the geological structure. Working morphodynamic and morphoclimatic denudational processes led to the emergence of diverse topographic appearances. Settlement areas established in this neighbourhood face natural risks that often reach to the extent of disaster.
From past to the present, the fundamental problem of the settlement areas is not to consider the adequacy and sustainability capacities of the topography. Floods and various mass movements (landslides, dislocation, stone block flows) are important incidents that often occurred recently. Revealing potential natural risk areas in the geography means solving a significant part of the settlement areas problems.
In the study, the settlements were categorized in terms of natural risk areas, and data on housing areas were synthesized and assessed in the digital environment.
In the studies, the active role of mass movements and rain and flood waters that could reach the extent of disaster was taken into consideration, particularly in the selection of spatial locations. Certain predictions were developed in terms of different risk factors between the settlements and possible risks that may arise in the future.

Keywords: Land Use, Natural Risk Areas, Settlement, Sustainability, Volcanic Topography

INTRODUCTION

The studies were conducted in a region that has various definitions such as "Central Anatolian Volcanic Region", "Cappadocia Volcanics" and "Central Anatolian Volcanics" (Arcasoy & Toprak & Kaymakci, 2003; Sungur, 1970, Sür, 1992; Ardos, 1992; Ercan, 1986) (Figure 1).

Many volcanic colonies in the region came into existence in the Neotectonic period Tertiary areas. They were shaped by morphodynamic and morphoclimatic processes and formed the present topography. Since the early times of the human history, Anatolian people have benefited from opportunities provided by the topography and still continue to do so.

Although people have lived in settlements such as Çatalhöyük and Kömürcü village since the earliest times, environmental developments happening since then induced settlement areas to relocate to a great extent. However, today, addressing the needs of a growing population has become more dangerous for the future, because the topography has a significant impact on human activity.

The dynamic processes in the nature are not stable. Changing environmental conditions have determined all living conditions for people who have been using this geography. For people, adapting to a location that they settled and continue their economic activities is only possible when

they know about the place. Changing environmental conditions and the present topography required the residents to take certain measures.

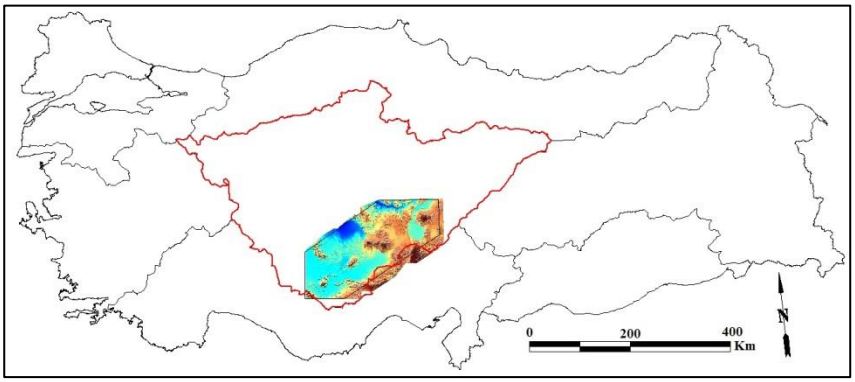

Figure1. Locational map of the study area

A great part of the current problems stems from the fact that humans "have become distanced from sustainable policies" and have not known the environment well enough. Volcanic materials and sedimentary fills are areas preferred for agricultural activities and settlement purposes. When the distribution of settlements is analysed on the geological map of Turkey at a scale of 1: 100.000 drawn by MTA, it is seen that the majority of the settlements are located in basins that volcanic and other transported materials were stored (Figure 2).

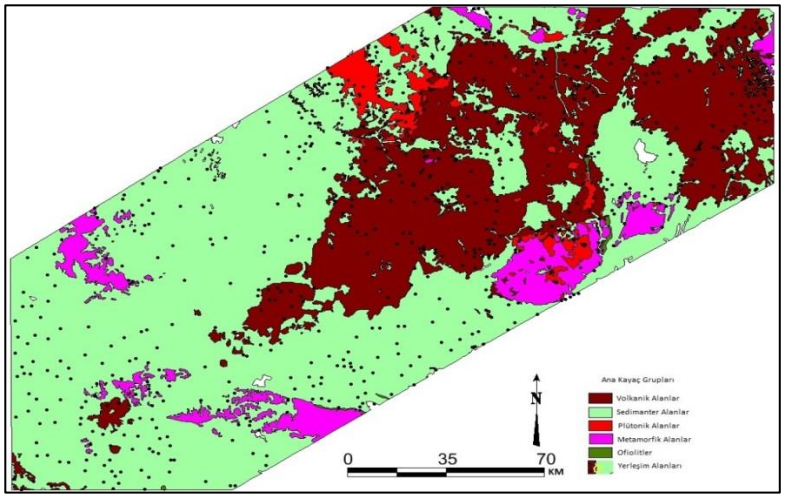

Figure 2. Distribution of settlement areas geological units

In plutonic and metamorphic areas, settlements are generally seen in lower slope lines. In areas that slope is above 20 degrees, stone-block falls pose serious risks. On the other hand, plains near such areas are under the influence of waters with surface flow.

Climatic changes in the natural environment cause to the beginning of chain incidents and serious disruptions in the economic structure. Today, the movement from rural areas to the cities actually results in a significant decrease in the use of agricultural lands. Such movements can be defined as anthropogenic pressures (Bayer Altın, 2008, 2016). Urbanization has quickly moved to the plain bases. Groundwater level has fallen and there is a shortage of irrigation water. Also, the drying of lakes and wetlands has disrupted the ecological balance of the region.

Sands in former lake beds were moved by the wind and have become a threat for agricultural areas. The negative impacts of cities on the atmosphere, the lack of rain and increasing temperature averages (Bayer Altın, 2012) have increased salinization in the soil. Dune invasions are witnessed.

On the other hand, as result of the fall in groundwater level as in Karaman and Karapınar neighbourhoods, swallow holes are formed and affect living areas in the region. During the past 10 years, the formation of more than 100 swallow holes was recorded.

Today, people move from rural settlements to urban settlement areas at a great pace. Human pressure on the environment has increased widely. The percentage of available agricultural areas in the region is no more than 18%.

Within the scope of this study, existing or potential "natural risk areas" that are directly "under the control of the volcanic structure" were examined. The correlation and classification of data were conducted in digital environment. Results obtained by the authors with regard to the land use in the same region (Altın & Kahvecioğlu, 2016) were evaluated in the study in terms of mutual interactions between settlement areas and topography.

TOPOGRAPHIC CONSTRAINTS

Plains that are considered as the remains of the former lacustrine areas in the Central Anatolia and volcanic mountainous and hilly areas constitute two important topographical units. Another topographical unit is plateau areas cut by streams (Figure 3). High volcanic masses are primary topographical constraints. Mt. Kara and Mt. Karaca draw attention with their calm topography despite the fact that they are important volcanic exits. The settlements were usually established on slopes, ridge or alluvial fans.

Mt. Hasan, Mt. Keçiboyduran, Mt. Melendiz and Mt. Erciyes volcanics have serious risk areas for neighbouring settlements with their faulty and high topography. In the region, floods as well as numerous disaster-sized incidents including rock-block falls occurred and the settlement areas were altered to a great extent. Therefore, many settlements obtain such preceding names as “upper (Yukarı) - lower (Aşağı)” or “old (Eski), new (Yeni)”. Eski Gümüş, Aşağı Tepeköy, Yukarı Bozköy are some examples.

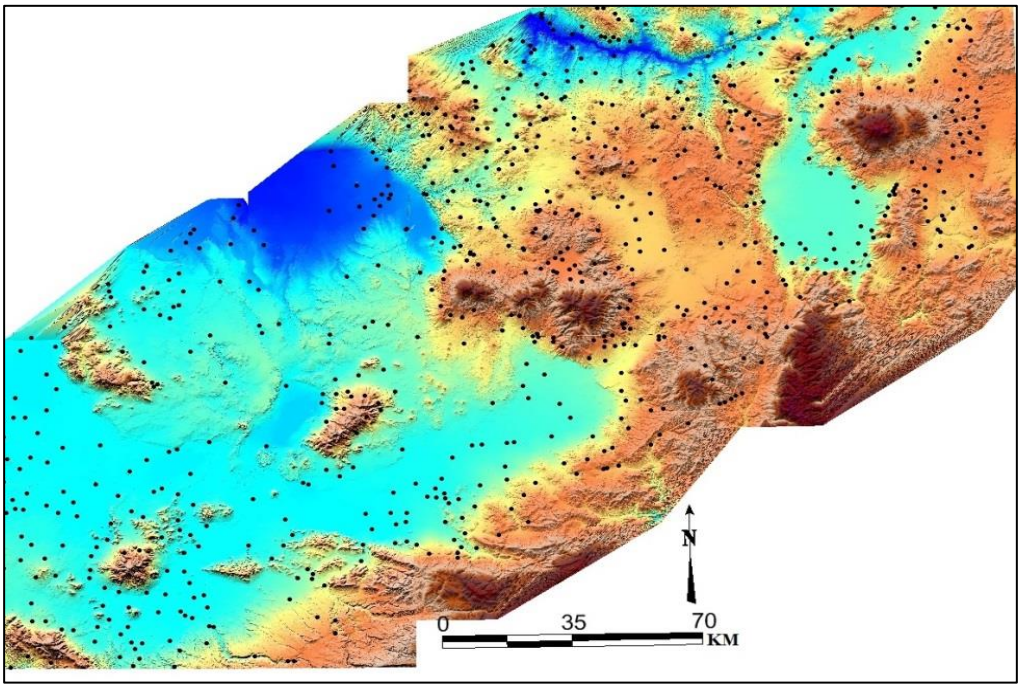

Figure 3. Distribution of settlement areas in the topography

As in the southern part of Aksaray-Ortaköy neighbourhood, settlements in areas dominated by plutonic rocks are scattered as slope settlements although they are few. The majority of them are located on flat ridges reaching to plain bases.

Important sedimentary fill areas such as Konya Plain, Bor (Emen) Plain and Misli Plain should be considered as agricultural areas. However, 60% of these plain areas are out of agricultural use or they need to be irrigated. The biggest problems for settlements in these areas are changes in bottom water and subsidence and swallow holes created on the ground. In this respect, Karaman, Karapınar and Niğde- Sazlıca, Bahçeli, Emen neighbourhoods are noteworthy.

River valleys are important in terms of floods and overflows. Although many settlements were established on valley slopes and structural plains, adverse events were recorded many times (Figure 4).

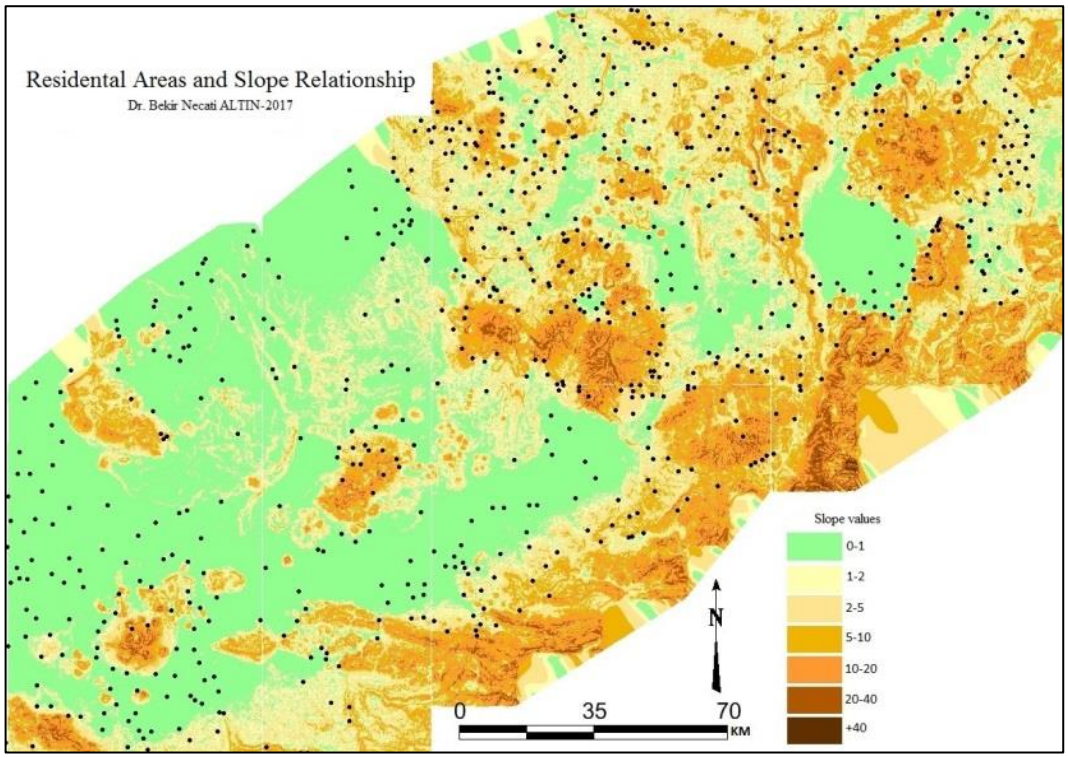

Figure 4. Distribution of settlements according to the topographic slope

In the study area, 34 settlements were established in plutonic areas while 268 settlements were established in volcanic areas. 242 settlements are located on the volcanic structures of Mt. Hasan and Mt. Erciyes. Other settlement areas are located on sedimentary rocks. While 673 settlements are below 1500 m altitude, 80 settlements are above 1500 m altitude. Only 8 settlements are above 1750 m altitude. The slope value of 362 settlements varies between 1-5 (%) while it is between 10-20 (%) for 370 settlements and above +20 degree for 24 settlements. Although the general outlook seems to present no negative aspect for the settlement areas, actually more than 70% of the settlement areas remain as part of "partial-field" risk areas.

When the settlement and agricultural areas are examined in terms of natural risk areas, some notable common elements are discovered. For this reason, the study addresses the relationship between the topography and settlement areas after they are categorized. The categorization is based on 5 different morphological units. They are a) Assessment of areas dominated by volcanic pyroclastic materials b) Assessment of alluvial cone areas and slopes c) Assessment of river valleys d) Assessment of dried wetlands e) Assessment of sedimentary circular or elliptical fill areas.

Settlements and Risk Assessment

Undoubtedly, no one would like to live or keep their property under threat. However, in nature, unexpected disaster-sized incidents can sometimes occur unexpectedly. The important point to consider is observing the nature before, understanding traces they left in the past, developing a foresight that similar events may occur in the future and being prepared for unexpected incidents.

In fact, it should not be forgotten that the settlement areas evolve in time or certain risks are ignored to create practical living conditions. Actually, the view emerging from the study area is a result of such approaches.

Assessment of Areas Dominated By Volcanic Pyroclastic Materials

Niğde, Aksaray and Nevşehir neighbourhood covers a large part of settlement areas located on pyroclastic volcanic materials such as ash, tuff and ignimbrite. Ürgüp-Göreme plateau, Göre, Mt. Göllü, Nargölü, Selime and Yaprakhisar neighbourhoods are areas that are extensively cut by streams. Not only surface erosion but also mass movements occurring in the cornices and slopes of flat structures are frequently seen here. As loose material is easily solved in such areas, it is easier for disintegrated materials to be carried. Block disintegration is common due to the abundance of cooling grikes in the structures. Thus, mass movements are widely seen in the region.

Assessment of Alluvial Cone Areas and Slopes

Alluvial fans and accumulation cones formed at the outfalls of rivers descending from volcanic mountainous areas were mostly preferred as settlement areas. Settlements lining up on mass slopes peripherally face the blocking of flow channels or sudden rain-wash in many places. Moreover, the slide of many settlements into cone slopes increases the risk.

Almost all rivers are temporary seasonal streams in the region. In wet periods, they carry from higher areas to lower areas the materials that are disintegrated depending on the amount and duration of the precipitation. Therefore, irregular rainfall may cause flash floods or slides. Here, the actual risk stems from the construction of residences on cone slopes or terraces.

Assessment of River Valleys

Settlements in river valleys are usually located in valleys with relatively broad bases. In areas that the structure is horizontal and hard-soft rock intercalation is seen, flowing surface waters descending from cornice slopes are a dynamic factor in badlands topography. Particularly Ürgüp-Göreme plateau and the area of fairy chimneys are such examples.

Valley slopes and structural platforms that mostly have a narrow space are not preferred for settlement. However, today it is seen that residences are moved to the upper parts of the slopes. It is also known that these areas were preferred as underground settlements in the past. Notwithstanding the empty valley bases, settlements remaining within flood lines are common. Some settlements such as Kayırlı, Sultanpınarı, Yaprakhisar, Nar village descended from valley slopes down to the base.

Assessment of Dried Wetlands

Former wetlands like Konya Plain, Hotamış Reeds, Sultan Reeds are usually non-agricultural plains that dried or were dried. They are dry, salty areas that are out of use due to changing climatic

characteristics in the past 15 years. Although surrounding settlement areas are located on former lake or flood slope lines, they occasionally suffer from floods.

It is no different in Bor-Emen Plain, between Niğde-Nevşehir, Gölcük, Misli Plain and the northern parts of Mt. Hasan and between Niğde and Aksaray. Such places with irrigated farming also suffer from floods.

The biggest problem for such areas is flooding impacts of temporary seasonal streams descending from the mountainous areas. Many settlement areas are affected by flood waters. Human efforts to canalize normal drainage make the situation worse.

Assessment of Sedimentary Circular or Elliptical Fill Areas

In the east and north of Mt. Hasan-Mt.Melendiz volcanic extension, agricultural areas range in a framed space to form a circle or elliptical line. These enclosed bowl areas that are usually inclined to the centre from peripheral areas suffer from frequent floods in sudden and violent rains.

Settlement areas such as Derinkuyu, Suvermez, Yazıhöyük, Ağcaşar, Alay, Kiledere, Hasaköy, Gölcük, Bağlama, Konaklı, Belkaya near Mt. Karaca are located in the central parts of these agricultural areas ranging on circular lines between Nevşehir and Niğde.

Such areas are bowl-shaped areas with broad lava exits in lands with lower bases probably from the early Miocene period. These areas were filled with materials stemming from subsequent volcanic activities or other materials carried from the environment, and became covered. The existence of an old flattened mass in the immediate vicinity of each unit also increases the doubts. They are separated from each other by 3-10 metres elevation difference in the surface of erased topography. Surface flow usually tends towards the settlement areas in the central parts. This might be the reason why these settlements frequently suffer from floods (Figure 5). Apart from these, settlements like Keçikalesi, Obruk near Mt. Hasan, Gölören, Kutören, Beyören near Mt. Karaca were established in former volcanic bowl-shaped areas.

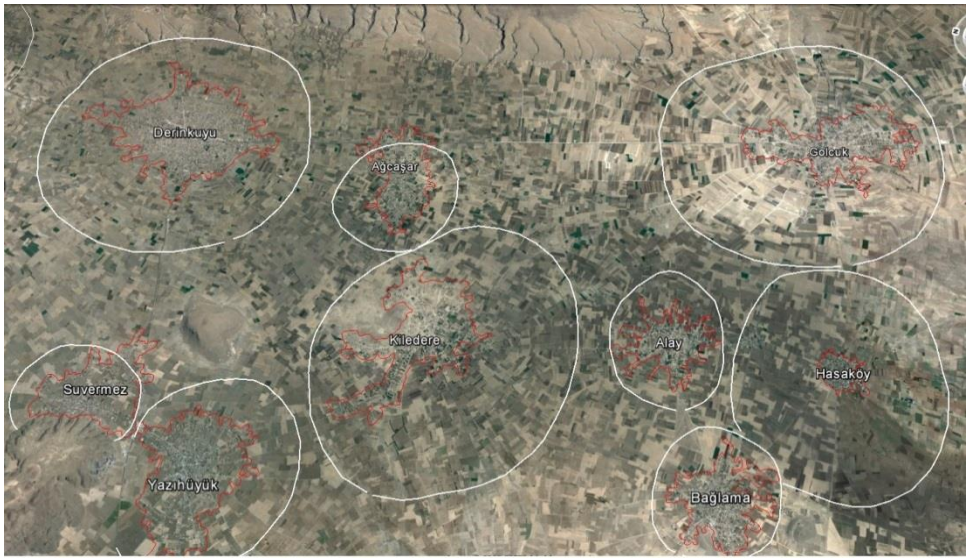

Figure 5. General appearance of settlement areas with notable circular or elliptical patterns

Wrong Anthropogenic Approaches

Most of the settlements were established on andesitic and basic lava and pyroclastic materials. Near or above such settlements, unpredictable natural process depending on climatic conditions and slope sensitivity always poses risks. The source of problems settlements have faced from the past to

the present is faulty site selection and practices in the topography. The protection of geographical structure and adaptation to these geographical conditions are as important as points considered in the site selection (Bayer 2008; Altın, 2016) (Figure 6).

The preference of river valleys, river terraces, steep slopes, the areas with heavy mechanical disintegration due to the impressive scenery; the destruction of natural vegetation protective cover of the ground – and the canalization of stream drainage are frequent mistakes. In addition, roads reaching from valley slopes to higher areas disrupt the slope balance and lead to slides.

Among significant mistakes by humans are ignoring the working of topography and faulty site selection for residences. When other human activities such as irrigation lagoons and drying of wetlands are added to such mistakes, it is not unusual to face undesirable consequences.

RESULTS and DISCUSSION

Since the settlement areas are controlled by geologic structure and topography, changes in natural environmental conditions and sudden disasters affect the loss of life and property of the residents as well as economic structures.

Therefore, economic assets, new housing in the settlement areas, previous local projects and current land use in the Central Anatolia need to be reassessed. It is highly important to consider all aspects of the Geography" in projects that are implemented by Konya Plains Project Regional Development Administration (KOP) under the Ministry of Development in cooperation with regional universities and accordingly develop future projects. The mapping of numerical land use of the settlement and economic activity areas, and identifying natural risk areas are critical for the future.

Figure 6. Some examples of first-degree risky settlement areas

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REFERENCES

Altın B. N. & Kahvecioğlu D. 2016. *The Effect of Volcanic Landforms on Land Use (Between Kayseri-Konya) in Central Anatolia*, TÜCAUM 2016 International Geography Symposium, 813, Ankara.

Arcasoy A. & Toprak V. & Kaymakci N. 2003. *Turkey-A New Method for Detecting Alignments from Point-like Features; an Application to The Volcanic Cones of Cappadocian Volcanic Province,* Abstract of the Geological Congress of Turkey, 56, 189-190.

Ardos M. 1992. *Türkiye'de Kuaterner Jeomorfolojisi*, İstanbul Üniversitesi Edebiyat Fakültesi Yayınları No: 3737, İstanbul.

Bayer Altın T. 2008. Melendiz ve Keçiboyduran Dağları'nda Yanlış Arazi Kullanımının Vejetasyon Dağılışı Üzerindeki Etkileri, *Türk Coğrafya Dergisi*, 51, 13-32.

Bayer Altın T. 2016. Geographic, Geologic and Human Factors Affecting the Selection of Church Sites in Niğde Province, Central Anatolia Region, Turkey, *Journal of Balkan and Near Eastern Studies*, 1-20.

Bayer Altın T. & Barak B. & Altın B. N. 2012. Change in Precipitation and Temperature Amounts over Three Decades in Central Anatolia, Turkey, *Atmospheric and Climate Sciences,* 2(01), 107-125.

Ercan T. 1986. Orta Anadolu'daki Senozoik Volkanizması, *MTA Dergisi*, 107, 119-140.

Sungur K. A. 1970. Konya Ereğli Havzasında Volkanik Faaliyetler ve Volkanik Şekiller, *İstanbul Üniversitesi Coğrafya Enstitüsü Dergisi*, 9(17), 103-110.

Sür Ö. 1972. *Geomorphological Research in the Volcanic Area of Turkey, Especially in Central Anatolia*, Ankara Üniversitesi, Dil ve Tarih-Coğrafya Fakültesi, Yayın No:223, Ankara.

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The Nutrition Status of *Punica Granatum L. Gardens* On Soils with Limited Conditions In Semi-Arid Southeastern Anatolia, Turkey

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Abstract
As the soils without limiting condition for plant growth is about 10% of the country's all arable lands, cultivation generally undertaken at soils with shallow, stony, sloping and deficient nutrient contents which is also valid for Adıyaman region. The pomegranate orchard establishment manifested a very rapid growth recently due various reasons alike subsidies however soil properties in the region is not well known. Soil and plant sampling were taken from 40 points for determination of plant nutrient and soil relations of pomegranate grown in soils with limiting properties in this study. Orchards were generally set 5 to 6 years ago with Hicaz variety. Soil samples were collected from 0-30 and 30-60cm depth, plant leaves were sampled during 20 August – 20 September period of the year 2015. Pomegranate soils have shallow-moderate depth (30-60cm) with alkaline pH, calcareous and clayey texture. While all orchards soils have high phosphorous and potassium content, the iron, zinc and organic matter were determined as insufficient. In case of leaf analysis nitrogen, phosphorous, potassium, magnesium, iron, copper and manganese were determined as sufficient while zinc was deficient. For example, excess bottom fertilizing particularly resulted phosphorous accumulation and it is determined that lack of decent knowledge on soil plant nutrient in the region induced zinc and iron deficiency. Soil organic matter was a disregarded property by farmers and its importance is not well-known by them. Finally, along with limiting soil conditions the inadequate nursing knowledge determined as constraining factor of Adıyaman pomegranate production.

Keywords: Pomegranate, plant nutrient elements, horticulture, limiting soil conditions

INTRODUCTION

While the Mediterranean Region of Turkey is in the first place with 61% production in fruit growing, it is followed by the Aegean Region with 28%, and the South-Eastern Anatolia Region with 10% production. In Adıyaman province, the share of the fruit production area in the agricultural production areas is 15.59%. According to the data of 2011, a total of 10.000 da area in Adıyaman has 164.185 pomegranate trees and the total production amount is 3.230 tons (Anonymous 2012).

In the study conducted by Çıtak and Sönmez (2013) for determining the nutritional status of the pomegranate gardens in Antalya and surrounding areas, soil samples taken from pomegranate gardens revealed areas lacking in Zn and deficiency, and plants were found to be deficient in terms of Fe, Cu, Zn and Mn.

Antioxidant activity for fruit quality is definitely associated with the amount of phenolic material. Phenolic substances in the peel that pass from the peel to the juice during the pressing of the fruit cause the bitter taste of pomegranate juice (Bravo 1998).

To date, no studies have been carried out to determine nutritional problems and proper fertilization program of pomegranate gardens in Adiyaman province and its vicinity. In order to determine the nutritional problems of pomegranate cultivation and to improve the economic situation of the farmers of the region, a field observation study was needed to determine the fertilization program, which is the most important of the cultural processes.
In this study, it was aimed to reveal the nutritional status and soil-plant relationships of the pomegranate gardens spreading rapidly in and around Adiyaman province and the priority problems were put forward.

This study was carried out with the aim of revealing the nutritional status and soil-plant relationships of pomegranate gardens that are is spreading rapidly in and around Adiyaman province.

MATERIAL and METHOD

Leaf and soil samples were taken from the plants found in 40 different pomegranate orchards which were established with the grown-up Hicaz variety in the areas with limited soil characteristics in Adiyaman area.

Soil Sampling and Analyses

A total of 80 soil samples were collected from 40 different points, which represent the Adiyaman Region, from 0-30 cm and 30-60 cm depth (Carter 1993).

Soil samples collected from pomegranate orchards are passed through a 2 mm sieve, and stored in plastic containers for physical and chemical analysis. Soils analyses were undertaken as follows: texture by Bouyoucos hydrometer method (Bouyocous 1952), calcimetric carbonates according to Allison and Moody (1965) pH and EC in saturation paste [15, 28], organic matter according to the modified Walkley Black method, 1947, cation exchange capacity (CEC) with saturated ammonium method (Chapman and Pratt 1961).

Total nitrogen according to Kjeldahl method (Bremner 1965), available phosphorus, sodium bicarbonate (pH 8.5) by the method of Olsen and Sommers, 1982, available potassium with 1.0 N neutral (pH 7.0) ammonium acetate (CH_3COONH_4) and extracted with the flame photometer (Pratt, 1965), and available Fe, Cu, Zn and Mn were determined with DTPA (Karaman et. al. 2007).

Leaf Sampling and Analyses

Leaf specimens were taken from August 20 to September 20, 2015, from 40 pomegranate gardens representing the region. The leaves with stems located in the middle of the shoot of the year which were completed the development, were taken from four sides of the trees (Arslan 2002). Collected leaf samples were prepared according to the Kaçar ve İnal, 2008 for analyses.

After the plants are ground, nitrogen was determined according to the Kjeldahl method. The P, K, We, Mg, Fe, Mn, Zn and Cu determinations of leaves were made in extracts obtained by the dry combustion of samples at 500°C (Kaçar, 1984). The obtained soil and leaf values were compared with limit ranges for evaluating the nutrient status of pomegranate orchards.

Total Phenolic Material Determination

The total phenolic compounds of extracts prepared by six different solvents (acetone, ethanol, ethyl acetate, chloroform, methanol and water) were determined according to the Folin Ciocalteu's phenol reaction. Total phenolic compounds were colorimetrically determined by UV spectrophotometer (Singleton et. al. 1999). Gallic acid was used as phenolic compound standard.

First, in order to create standard chart five different concentrations prepared with Gallic acid solution (0.1-0.5 mg/ml) is taken to the tubes, and the volume was completed to 1 ml with distilled water.

Folin-Ciocaltaeu reactant (2.5 ml) and sodium carbonate solution (7.5 ml, w/v, water) were mixed in the test tube and allowed to stand at room temperature for 2 hours. The sample solutions prepared using methanol, ethanol, ethyl acetate, chloroform, acetone and distilled water were taken into 0.5 ml tubes and treated with the above-mentioned Folin-Ciocaltaeu reagent.

At the end of the reaction, the absorbance values of the samples were read against the witness at a wavelength of 760 nm in the spectrophotometer. The total amount of phenolic compound in the samples is given in µg/g FW.

RESULTS AND DISCUSSIONS

Soil Analyses

The results of physical and chemical analyzes of soil samples taken from 0-30 cm and 30-60 cm depths in October 2015 in 40 different pomegranate orchards in Adiyaman province were compared with the limit values (Table 1). The minimum, maximum and average values are given in Table 2. Pomegranate gardens show slightly alkaline and alkaline reactions according to pH analysis results (Evliya 1964), (Table 1).

The pH values of the regional soils are very high. For this reason, it is suggested that the pH of pomegranate gardens soil should be reduced by using acid-based fertilizers or sulfur. Similar results were reported by Albayrak and Katkat 2007. Soils' lime ($CaCO_3$) when the results of the analysis were classified according to Çıtak and Sönmez (2013), it is seen that they are high and very high calcareous soils (Table 1). Minimum, maximum and average values are given in Table 2. When EC analysis results of soil samples were classified according to Singleton et. al.(1999). It was determined that the soil of pomegranate garden where the research was made was salt-free (Table 1). When the organic matter content of soil samples is classified according to SSS, 1951. It is seen that the pomegranate horticultural soil is poor in organic matter and have low humus content (Table 1). Thus, organic matter should be increased by applying animal manure or other organic sources such as compost and green manuring. The soil samples of the study were found to have significant differences between texture classes, but they were mostly clayey and clayey soils (Table 1).When soil is classifiable according to Lindsay and Norvell (1978) for their available Fe analysis, Fe deficiency is observed in 90% of all soil samples (Table 3). However, it can be argued that the vast majority of pomegranate gardens have a slight alkaline and alkaline pH, as well as high lime content (Table 3) along with high P and Cu in the soil. Thus, that Fe is more likely to be converted into unavailable form that plants cannot uptake. As a matter of fact, this situation

has been reported by many researchers (Kaçar and Katkat 2007, Karaman et. al. 2007 and Karaçal, 2008). There is visible iron deficiency in plants. This situation can also be caused by not applying fertilizers containing micro elements in the region. Available Mn and Cu analysis, results show that the soil samples are in sufficient level according to Lindsay and Norvell (1978) and there is no nutritional problem in pomegranate horticulture in terms of Mn and Cu (Table 3).

Table 1. Classification of soil samples some chemical and physical analysis results according to their limit values

Soil Porperties	Limit Values	Assesment	Depth (cm) 0-30 (Sample numbers)	30-60 (Sample numbers)	0-30 (%)	30-60 (%)
pH	6.6-7.3	Nötr	3	1	8	2.5
	7.4-7.8	Slightly alkaline	27	36	67	90
	7.9-8.4	Alkaline	10	3	25	7.5
$CaCO_3$ (%)	0-2.5	Low	-	-	--	-
	2.6-5	Adequate	-	-	-	-
	5.1-10	High	40	40	100	100
	10.1-20	Very high	18	22	45	55
	20+	Extreme	18	18	45	45
EC (mmhos cm^{-1})	0-4	Unsalted	40	40	100	100
Organik madde (%)	0-2	Inadequate	2	22	5	55
	2-5	Adequate	38	18	95	45
	5-10	High	-	-	-	-
Texture	Loamy		7	1	17.5	2.5
	Clay-loam		25	12	62.5	30
	Clay		8	27	20	67.5
P_2O_5 (kg ha^{-1})	0-30	Low	-	-	-	-
	60-90	Medium	-	2	-	5
	90-120	High	40	38	100	95
K_2O (kg ha^{-1})	0-200	Low	-	-	-	-
	300-600	Adequate	-	-	-	-
	600-1000	High	-	-	-	-
	1000≥	Very high	40	40	100	100
Fe (mg kg^{-1})	2.5-4.5	Inadequate	36	40	90	100
	4.5≥	Adeguate	4	-	10	-
Zn (mg kg^{-1})	0-0.5	Low	23	29	57.5	72.5
	0.5-1.0	Adeguate	9	11	22.5	27.5
	1.0≥	Good	8	-	20	
Mn (mg kg^{-1})	1≤	Inadequate	-	-	-	-
	1≥	Adequate	40	40	100	100
Cu (mg kg^{-1})	0.2≤	Inadequate	-	-	-	-
	0.2≥	Adequate	40	40	100	100

When the Zn analysis results are classified according to 21, the Zn contents of the soil samples are found to vary from deficient to good (Table 3). Considering the high soil pH and high lime content (Table 2) of pomegranate gardens and the adverse effects on Zn availability (Kaçar and Katkat 2007, Karaman et. al. 2007 and Karaçal 2008), it seems that pomegranate gardens may have problems in Zn nutrition.

On the other hand, when the P contents of pomegranate orchards are taken into consideration due to the antagonistic interaction between P and Zn (Table 3), it seems that the plants may have problems for Zn uptake (Kaçar and Katkat 2007). In addition, the Zn uptake of plants is decreased as the P content increases due to the excess fertilization.

Table 2. Soil samples of some chemical and physical analysis results according to their maximum and average values

Soil Properties	0-30 cm			30-60 cm		
	Min.	**Max.**	**Ort.**	**Min.**	**Max.**	**Avearge**
Texture	Tın	Killi-Tın	Killi-Tın	Killi	Killi-Tın	Killi-Tın
pH	6.49	7.97	7.60	7.26	7.90	7.45
EC (mmhos cm^{-1})	528	1773	791.3	486	1548	784
$CaCO_3$ (%)	8.4	33.2	17.4	11.6	26.4	11.3
Organik matter (%)	1.48	3.76	2.79	0.89	2.65	1.10
P_2O_5 (kg ha^{-1})	88.8	622.8	339.9	76.5	492.3	238
K_2O (kg ha^{-1})	1150	10300	4154	1275	6950	3144
Fe (mg kg^{-1})	1.2	5.2	2.57	0.9	3.9	2.05
Cu (mg kg^{-1})	1.3	4.4	2.54	0.89	3.4	1.94
Zn (mg kg^{-1})	0.04	2.20	0.65	0.02	0.64	0.38
Mn (mg kg^{-1})	6.80	46.8	30.84	5.6	38.4	22.9

Table 3. Plant samples of some chemical analysis results according to their maximum, minimum and average values

	N	**P**	**K**	**Mg**	**Fe**	**Cu**	**Zn**	**Mn**
	%				mg kg^{-1}			
Min.	0.80	0.50	0.65	0.66	18.7	0.80	5.5	9.8
Max.	2.43	0.91	1.68	1.49	257	40.2	48.4	80.4
Average	1.60	0.74	1.10	1.00	152.2	9.33	13.35	40.3

Plant Analyses

The minimum, maximum and average values of leaf samples selected from 40 different pomegranate orchards in Adiyaman Region are given in Table 3 and the average of two year findings are provided in Table 4. The N contents of leaf samples taken from the pomegranate gardens around Adiyaman Region area vary between 0.80-2.43% (Table 4).

When the analysis results of leaf samples are compared with the qualification limit values given by Sheil, 2006; 5% of the gardens had a deficiency, 10% has adequate and 85% has excess N content. Since the chemical fertilization is usually done without soil analysis in the region, excess N is found in the majority of the orchards. This situation causes great loss in terms of human health and farmer's economy. In addition, during the pomegranate period, the difference between the day and night temperatures in the region is large and the N concentration in the plant is high, which both increase the cracking rate of fruits. High nitrogen availability can adversely affect plant yields as plants prolong the vegetative growth period and degrade the nitrogen potassium balance. Due to the high content of N, the fruit storage life is shortened and it is more susceptible to some storage diseases (Aktaş and Ateş 1998). The content of leaf samples phosphorus ranged between from 0.50 to 0.91% (Table 4). Phosphorus in all leaf samples was above the sufficient level (Sheik 2006).

The reason for this is the unconscious use of base fertilizer (18-46 or compound) application by farmers. The vast majority of the orchards P level was found high. The high P especially in marl, clay and alkaline soils hinders Fe, Zn and Cu uptake of plants which causes low production. The K content of the pomegranate leaves ranged from 0.65% to 1.68%

(Table 4). Leaf specimens obtained from the study were found to be at a sufficient level as high as the K content of the gardens when compared with the qualification limit values given by Richards, 1954. In the remaining 7.5%, potassium was found to be more than the sufficiency limit.

Comparing the results of the leaf samples obtained from the survey with the qualification limit values given by (Richards, 1954), the K contents in the gardens were found to be satisfactory at 92.5%. In the remaining 7.5%, it was determined that the K level exceeded the sufficient limit. The adequate level of potassium in pomegranate orchards, or even excess, actually does not stem from applied K fertilizer to the gardens. The high potassium in the gardens is primarily due to clay content and irregularly applied animal manure fertilizer. As a result, no K deficiency problems are observed in orchards. However, by paying attention to the desired N/K ratio (1/4), fertilization will increase fertility and quality, and may reduce fruit cracking, which is seen intensely in the region. In some pomegranate varieties, there was a correlation between fruit cracking and nutrition level. The leaf N and K/Ca ratio were found to have a high correlation with fruit cracking (Hepaksoy et. al. 1998). The Mg concentration of the plants ranged from 0.66 to 1.49% (Table 4).

Table 4. Classification of plant samples chemical analysis results according to their limit values

Plant Nutrient	Limit Values	Assesment	Sample Numbers	%
N	Inadequate	≤0.90	2	5
	Adequate	0.91-1.66	4	10
	High	≥ 1.66	34	85
P	Inadequate	≤0.11	-	-
	Adequate	0.12-0.18	-	-
	High	≥0.18	40	100
K	Inadequate	≤0.60	-	-
	Adequate	0.61-1.59	37	92.5
	High	≥1.59	3	7.5
Mg	Inadequate	≤0.15	-	-
	Adequate	0.16-0.42	-	-
	High	≥0.42	40	100
Fe	Inadequate	≤70	2	5
	Adequate	71-214	35	87.5
	High	≥214	3	7.5
Cu	Inadequate	≤28	39	97.5
	Adequate	29-72	1	2.5
	High	≥72	-	-
Zn	Inadequate	≤13	22	55
	Adequate	14-72	18	45
	High	≥72	-	-
Mn	Inadequate	≤28	11	27.5
	Adequate	29-89	29	72.5
	High	≥89	-	-

When the analysis results of plant samples are compared with the limit values given by Sheik, 2006; The Mg concentration was measured over the sufficient limit in all of the gardens. Though Mg is not given by fertilization in Adiyaman Region. Thus, the source of Mg source is most probably high clay content and the type of clay. The clay suite of the region is dominated by Mg rich smectite and palygorskite. Also, because of high lime in the soil, the Mg concentration of plants has been measured as elevated amounts (Yılmaz 1999). The Zn contents of the samples varied between 5.5-48.4 ppm (Table 4). When the Zn leaf analysis results obtained from the study are compared with the limit values; 55% of the

gardens have deficient in their Zn content, and 45% of the gardens contain less than 13 ppm of Zn, which is the adequate limit for plants (Table 4).

The pomegranate gardens of the study show that the majority of the soil is deficient in Zn nutrition (Table 6), and leaf analysis also revealed low Zn contents. Both findings indicate a problem in Zn nutrition of plants in the region. It should not also ignored that the high P contents has negative effect on Zn uptake of plants. In addition to these drawbacks, there is almost no micro-element fertilization to the soil or plant leaves in Adiyaman region.

The Fe contents of leaf samples taken from pomegranate gardens ranged from 18.7 to 257 ppm (Table 4). When the leaf analysis results were compared with the limit values (Sheik 2006), it was determined that while 87.5% of the gardens' had sufficient Fe, the 5% had deficient and 7.5% had excess Fe contents (Table 4). Although Fe concentration is inadequate in the majority of the garden soil, sufficient Fe level in the plant may be due to the Fe intake mechanism that the pomegranate plant developed, or it is thought to be originated from Fe-containing pesticides such as iron sulfate that farmers applied.

The leaf coverage of pomegranate gardens showed varying Cu contents ranging from 0.8 to 40.2 ppm (Table 4). When the analysis results of leaf samples are compared with the limit values given by Richards, 1954; 2.5% of pomegranate gardens were found to be have adequate Cu and 97.5% of them contained low Cu (Table 3). This fact is thought to be caused by high pH and lime origin. The Cu, is more strongly bound to the organic substance than other cationic micronutrients such as Zn^{+2} and Mn^{+2}. Therefore, Cu is regulated by organic Cu complexes in the soil and, when compared to other cations, Cu is also strongly bound to the inorganic exchange surfaces in the soil (Mengel and Kirkby 1982). Therefore, it is thought that adsorbed Cu ions can not be easily taken up by plants although it is exchangeable. The Mn contents of leaf samples taken from pomegranate gardens ranged from 9.8-80.4 ppm (Table 4). When the leaf analysis results were compared with the sufficiency limit, it was determined that the 72.5 %of the gardens have sufficient Mn contents whereas 27.5% has deficient Mn content (Table 4). This also revealed the need of micronutrient fertilization in Adiyaman region.

Total Phenolic Compounds of Leaves

The amount of total phenolic compounds ranged from 0,436462 to 2,005794 μg/g FW of pomegranate leaves (Table 5). Phenolic compounds contribute to the aroma and taste of many foods. Bitterness and resentment are the source of phenolic compounds in foods (Nizamlıoğlu and Sebahattin 2010).

Although the sampled pomegranate varieties are the same, the amounts of phenolic substances are measured differently. Nutrition and climatic conditions may change the amount of phenolic substances in plants. In a study of some foods with regard to their total phenolic content, the total phenolic content of the pomegranate plant was determined to be 2046 mg/kg. In the pomegranate plants in the Adiyaman Region, the total phenolic substance amounts were all lower than the average value indicated above. This situation arises from conditions such as the cultivation of pomegranate in arid conditions and areas with limited growing characteristics, such as insufficient irrigation and soils with low micronutrients. For this reason, when considering the effects of phenolic substances on fruit and human health, detailed planning of plant feeding and irrigation programs is required to correct this situation.

Table 5. Amounts of total phenolic compounds in plant samples (µg/g FW)

No	Total phenolic compounds µg/g FW	No	Total phenolic compounds µg/g FW	No	Total phenolic compounds µg/g FW	No	Total phenolic compounds µg/g FW
1	0.863212	11	0,882194	21	1.034567	31	1,081499
2	0,436462	12	1.268424	22	1.268790	32	1,509463
3	0.652314	13	0.856426	23	0.987532	33	1,087292
4	1.235611	14	0.705468	24	1.054783	34	0.458761
5	1.547852	15	0.445761	25	1.678123	35	2,005794
6	0.865478	16	0.664755	26	0.785124	36	1,076091
7	1.254785	17	0.799584	27	0.564781	37	1,406721
8	1.654782	18	1.180245	28	1,156431	38	0,382773
9	0.468791	19	1.125486	29	1.457825	39	0.864217
10	1.456723	20	0.874652	30	1,137891	40	0.756326

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REFERENCES

Albayrak, B., Katkat, V. (2007). Güney Doğu Marmara'da Yetiştirilen Bodur Anaçlı GrannySmith Elma Çeşidinin Beslenme Durumunun Belirlenmesi. J.of Agr. F., 21(1), 93-105.

Aktaş, M., Ateş, M. (1998). Bitkilerde Beslenme Bozuklukları Nedenleri ve Tanımları. ISBN: 975-320-033-1, İstanbul, Türkiye, pp. 44- 45.

Allison, L.E. and C.D. Moody. (1965). Carbonate. In: Method Soil Analysis. Part 2. Chemical and Microbiological Proper (Black, C.A., ed.), pp. 1379-1396, American Society of Agronomy, Madison, WI.

Anonim, (2012). http://www.Adiyaman.gov.tr. Visited on date: August 2012.

Anonim, (1983). Antalya İli Verimlilik Envanteri ve Gübre İhtiyaç Raporu. Toprak Su Genel Müdürlüğü Yayınları No: 736, Ankara.

Arslan, R. (2002). Yaprak Analizi İçin Örneklerin Alınması. Tarım ve Köy İşleri Bakanlığı Tarımsal Araştırmalar Genel Müdürlüğü Alata Bahçe Kültürleri Araştırma Enstitüsü, Yayın No: 17, Mersin.

Bouyoucous, G. J. (1952). Arecalibration of Hydrometer for Making Mechanical Analysis of Soils, Agron. J. 43: 434-438.

Bravo, L. (1998). Polyphenols: Chemistry, Dietary Sources, Metabolism and Nutritional Significance. Nutr Rev, 56, 317-333.

Bremner , J. M.(1965). Nitrogen Availability Indexes. Agronomy 9:1324-45.

Carter, M. R. (Ed.). (1993). Soil Sampling and Methods of Analysis. CRC Press.

Chapman, H.D. and F.P. Pratt, (1961). Ammonium Vandate-molybdate Method for Determination of Phosphorus. Methods of Analysis for Soils, Plants and Water, 1 edn, California University. Agriculture st Division, U.S.A., pp: 184- 203.

Çıtak, S. ve Sönmez, S. (2013). Antalya İli ve Çevresindeki Nar (Punica granatum) Bahçelerinin Beslenme Durumlarının Belirlenmesi. Akdeniz Üniversitesi Ziraat Fak. Der., 26(1), 65-71.

Evliya, H. (1964). Kültür Bitkilerinin Beslenmesi. Ankara. Üniversitesi. Ziraat Fakültesi Yayınları, Yayın No:36, Ankara.

Hepaksoy, S., U. Aksoy, H.Z. Can, M.A. Ul. (1998). Determination of Relationship Between Fruit Cracking and Some Physiological Responses, Leaf Characteristics and Nutritional Status of Some Pomegranate Varieties. I. Int. Symp. on Pomegranate, 15-17 October, p:87-92.

Jackson, K. A. (1958). Liquid metals and solidification. *Asm, Cleveland*, *174*.

Kaçar, B. (1984). Bitki Besleme Uygulama Kılavuzu. Ankara Üniversitesi Ziraat Fakültesi Yayınları : 900, Uygulama Kılavuzu: 214, Ankara, 140 s.

Kaçar ,B. ve Katkat, V. (2007) . Bitki Besleme. Nobel Yayın Dağıtım, Ankara.

Kaçar, B. ve İnal, A. (2008). Bitki Analizleri. Nobel Yayın Dağıtım, Ankara.

Karaçal, İ. (2008). Toprak Verimliliği. Nobel Yayın Dağıtım, Ankara. Karaman R, Brohi A.R., Müftüoğlu N.M., Öztaş T, Zengin, M. (2007). Sürdürülebilir Toprak Verimliliği. Detay Yayın Dağıtım, Ankara. Lindsay WL, Norvell WA (1978) Development of a DTPA soil test for zinc, iron, manganese and copper. Soil Sci. Soc. of American J. 42: 421-428.

Karaman, R., Brohi, A.R, Müftüoğlu, N.M., Öztaş, T., Zengi, M. (2007). Sürdürülebilir Toprak Verimliliği. Detay Yayın Dağıtım, Ankara.

Lindsay, W. L., Norvell W. A., (1978). Development of a DTPA Soil Test for Zinc, Iron, Manganese and Copper. Soil Sci. Soc. Am. J. 42, 421–428,

Mengel, L., Kirkby E.A. (1982). Principles of Plant Nutrition. Int. Potash Institute, Bern.

Nizamlıoğlu, N. M. ve Sebahattin, N. (2010) Meyve ve Sebzelerde Bulunan Fenolik Bileşikler; Yapıları ve Önemleri. Electronic Journal of Food Technologies,5(1), 20-35.

Olsen, S , Sommers E.L. (1982). Phosphorus Soluble in Sodium Bicarbonate. In: Page AL, Miller PH, Keeney D.R (Eds), Methods of Soil Analysis Part 2: Chemical and Microbiological Properties. American Society of Agronomy, Madison, pp. 404-430.

Soil Survey Staff (1951) Soil Survey Manuel. Agricultural Research Administration, US Department of Agriculture, Handbook No:18, New York. Thun R, Hermann R, Knickman E (1955) Die Untersuchung von Boden Neuman Verlag, Berlin.

Pizer, N.H. (1967). Some Advisory Aspect Soil Potassium and Magnesium. Tech. Bull. No: 14-184.

Pratt, P. F. (1965). Potassium. Methods of soil analysis. Part 2. Chemical and microbiological properties, (methodsofsoilanb), 1022-1030.

Richards, L.A. (Ed.) Diagnosis and Improvement of Saline and Alkali Soils. Washington: United States Salinity Laboratory, (1954). 160p. Agriculture Handbook, 60. Righes, A.A.; Amaral, L.G.H. do; Costa, R.D

Sheik, M.K. (2006). The Pomegranate. International Book Distributing, New Delhi. Soil Survey Staff (1951) Soil Survey Manuel. Agricultural Research Administration, US

Department of Agriculture, Handbook No:18, New York. Thun R, Hermann R, Knickman E (1955) Die Untersuchung von Boden Neuman Verlag, Berlin.

Singleton, V. L., Orthofer, R. ve Lamuela-Raventos, R.. M. (1999). [14] Analysis of TotalPhenols and Other Oxidation Substrates and Antioxidants by Means of Folin-ciocalteu Reagent. Methods in Enzymology, 299, 152-178.

Soil Survey Staff, (1951). Soil Survey Manuel. Agricultural Research Administration, US Department of Agriculture, Handbook No:18, New York

Thun, R., Hermann, R., Knickman, E. (1955). Die Untersuchung von Boden Neuman Verlag, Berlin.

Walkley, A. (1947). A CriticalExamination of a Rapid Method for Determining Organic Carbon Soils: Effect of Variations in Digestion Conditions and of Inorganic Soil Constituents. Soil Sci. 63:251-263.

Yılmaz, K. (1999). The Genesis of Smectite and Palygorskite on Harran Plain's Soil Series. Turkish Journal of Agriculture and Forestry, 23 (EK3), 635-642.

EURASIAN JOURNAL OF AGRICULTURAL RESEARCH

Sustaining Vetiver grass Handicrafts: An Innovative Focus on Rural Area and Tourism

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Abstract

In Turkey, agriculture has a great economic, cultural and ecological significance for tourism. Agricultural products to be obtained from handicraft products, especially to contribute to cultural tourism and agricultural tourism. The tourism contribution of the sale and exhibition of these products is also important for the development of the region and local people. Vetiver grass (Vetiveria zizanioides (Linn.) Nash), is known in the world as a plant of water and soil protection (wind, water and soil erosion, flood, etc.). When the studies are investigate, it is found that espicially the roots and leaves of the plant are valuable and it facilitates the development of rural development economically. Vertically growing plant roots have been shown to be a miracle plant for handcrafts, perfumery products and a wide range of applications as well as for soil and water protection. It has also increased the living standards of those living in rural areas and directed them to activities related to Vetiver grass.Vetiver grass has been tested for soil erosion in the Eastern Black Sea Region of Turkey (Maçka / Trabzon) and its roots have been shown to show improvement. The aim of this study is to discuss the contribution of rural arts and crafts to the crafts that can be obtained from the roots of the Vetiver grass and encourage the people in the regions and regions that are suitable for the production of vetiver craft products. It also aims to demonstrate the contribution of the products that can be obtained from their roots to marketing and to reduce environmental destruction, to protect agricultural lands from destruction (flooding, soil loss, pollution, etc.) by appropriate methods.

Keywords: Vetiver grass, Agritourism, Handicraft, Rural

INTRODUCTION

Turkey is a hidden paradise with the rural areas that many of us do not know or see. The population living in rural areas is mainly labored in agriculture and stock raising. The population has begun to decrease in rural areas in order to increase degree of urbanization, development of technology and gain prosperity. But this decrease does not harm the presence of the rural area. Rural areas provide environmentally attractive environments in many parts of Turkey.

The rural area is also defined as the opposite of the urban area as it is in terms of weighted production activities, population and administrative status (Kayıkçı, 2009). The concept of rural area is a concept used to distinguish rural and urban areas from each other and to determine areas with low urban density.

The development of rural areas is also important in terms of people living in urban areas as well as people living in rural areas (Kayıkçı, 2009). In some of the rural areas in Turkey, development presents a poor prospect for future generations to improve. For this reason, it is important to develop rural tourism for future generations.

Tourism is one of the fastest and largest flameless industries in the world (Neto, 2003; Boz, 2011). Tourism is considered to be a viable tool for raising economic activity for both developed and developing countries (Hall, 1994).

One of the most important tools in Turkey for rural employment is seen as tourism. Eco-tourism, agro-tourism or cultural tourism activities are gradually starting to come to Turkey. Even if these initiatives are limited, urbanization also encourages rural migration (Örnek, 2007).

In rural areas poor people have different skills and crafts to reach good income. However, it is still up to the policies and projects developed to transform these skills into employment levels and create workforce. Rural areas offer many development opportunities such as for new sectors, tourism opportunities, becoming a center of attraction for living and working, diversity towards natural resources (Örnek, 2007).

The Eastern Black Sea is a region suitable for agricultural areas, tableland, ecological, aesthetic and cultural sense of rural tourism. Handicrafts are an alternative source of livelihood in an environment with fewer employment opportunities. Eastern Black Sea is a region famous for its local products (oil, cheese, etc.), handicrafts (basket, clothing, etc.). In this region farmers who are engaged in agriculture and households with a low level of employment generally earn additional income from handcraft production.

It is necessary to develop and expand the handicraft industry in parallel with tourism in developing countries. Both are logical and powerful combinations of development projects (Benson, 2014).

The Eastern Black Sea has topographically sloping rural areas. Landslides and flood disasters occur in these areas. Water and soil must be protected worldwide and necessary precautions must be taken. Cındık (2012) used Vetiver grass for water and soil protection in its erosion prevention work. Vetiver grass is a natural barrier to soil with its strong roots and wide-tight crown formation.

Vetiver grass, an economic proposition is used as perfume, cosmetics, handicrafts and artifacts, bouquet and animal food, obtained from fragrant roots. This plant is used in China, Australia, Vietnam, Thailand, Philippines and Bangladesh and many world countries (Panichpol, Waipanya, Siriwongse and Srichoo, 1999; Islam, Bhuiyan, and Hossain, 2000; Chomchalow, 2008). There are studies with Vetiver grass in Turkey (Demirel and Demirel, 2005; Memişoğlu Bingöl, 2008; Kirici, Inan, Turk and Giray, 2011; Cındık, 2012).

In this study, Vetiver grass is aimed to protect suitable rural farming areas, to provide handicrafts, employment and economic input to be obtained.

INFORMING: VETIVER GRASS

The Vetiver name is derived from the word "vettiver", which is the Tamil vocabulary. Known on the Réunion Island as Vetivert, it is a plant that is naturalized and said to have been brought from India through Indonesia (Lavania, 2008). India recognizes Vetiver grass for aromatic and medical use. There are also environmental and rural uses in India and elsewhere.

Vetiver grass; Poaceae (Gramineae) family, a fast-growing, broad adaptive, rooted and perennial C4 plant (Chaudhry and Sarwar, 2006), (Figure 1).

Figure 1. Vetiver grass

Vetiver plants grow and bloom throughout the year where the temperature is convenient, and are not affected by light changes. If the shade was once planted, it could live in these dark shady areas for many years. The most important feature of veterinary plants, which should be taken into consideration in the fight against erosion, the roots are in large, spongy masses. One of the biggest advantages of Vetiver grass, where it is planted is permanent. For this reason it is not invasive, it rarely spreads into the environment (National Research Council - NRC, 1993). There are roots that hold the soil and soil in depth. Its roots keep the land and soil in depth. Even in very heavy rain, the root zone protects the land from abrasion and does not allow it to flow away from the soil (Lavania, 2003).

Vetiver grass plant has many uses. They are used to perform specific functions in agricultural and non-agricultural applications; soil and water conservation, incline of slope/slope stabilization, fill stabilization, erosion control, environmental protection, reclamation of problematic soils (saline, acidic, sodic), contaminated soil rehabilitation, absorption of heavy metals, disaster damage mitigation, contaminated water rehabilitation , etc. In addition to livestock grazing, feed plants, ornamental plants, landscape plants, carbon sequestration and crafts (Chomchalow and Chapman, 2003).

Handicrafts: Tourism Contribution

In the 21st century, tourism is a major source of economic income. In addition, the development of culture tourism has increased the attractiveness of handicrafts. A strong combination of tourism and handicrafts. Handicrafts are an experience for tourists, gifts and memories of a good holiday.

Tourism increases the quality of life for the craft and their families, creates employment and provides economic growth (O'Connor, 2006). Tourism is a journey, a holiday and an adventure where people often seek something other than normal life experiences. In a word tourism is usually an opportunity to encounter, appreciate and even purchase "alterity" that is "otherness" (Graburn, 2006).

Traditional handicrafts have a "local" character because they are the products that people make out of the materials that they can easily find around them to meet their needs. In this way they also explain the formation of different traditional cultural elements in different ecological environments and cultural diversity (Karabaşa, 2012). Handicrafts are not just souvenirs in tourism. They are a dynamic part of the contemporary tourism world (Graburn, 2006).

Hand crafted products are genuine and valuable as long as they carry and reflect the characteristics of the crafting. The raw materials of the products, the pattern, the production technique and the ability of the person making the production cause the product to gain different value (Özcüre and Yavuz, 2006).

Craftsmen need to continue to be service providers rather than beneficiaries in the tourism sector, especially in the rapid growth of cultural tourism. The economic and social significance of tourism and handicrafts is related to the international arena. Recognizing the region where handicrafts are visited is an important part of tourism to provide employment and cultural exchange, to stimulate the economy.

VETIVER CRAFTS

Today, handicrafts have an important role in the living and reflecting of the work force, leisure time, traditions and customs of the local raw materials and family members that are produced. In regions where crafts values exist, people can work in tourism and souvenir

production and marketing businesses as well as establish their own businesses (Özcüre and Yavuz, 2006).

The Eastern Black Sea Region is a developed region with alternative rural areas and alternative tourism types. For low-income disadvantaged groups living in rural areas, it may be a source of new income and employment, the development of home and handicrafts, and agricultural products are expected to be marketed on the spot (DPT and JICA, 2004). In eastern Black Sea, weaving, knitting, bags, basket processing, musical instruments, stone and copper workmanship, silver art etc. has developed (Figure 2).

Figure 2. Blacksea region handicrafts (Governor of Trabzon, 2015).

Cındık (2012) has identified the development of Vetiver grass roots and leaves in his work on rural areas to prevent erosion. For this reason, the work to repair the plant may contribute to the locality. The economic and artistic characteristics of the plant should also be evaluated for tourism.

Vetiver grass plants have scented, fragrant roots and firm leaves. For this reason, oils obtained from roots and perfume and cosmetics industry is a commonly used plant. The aromatic smell of the root of the plant directs the plant to different products derived from the roots.Farmers who used vetiver as soil and water conservation plant in rural areas of the world have discovered the plant's susceptibility to handicrafts. Roots and leaves are used in handicrafts (Figure 3).

Figure 3. South Indian Vetiver Handicraft (Truong, 2008).

Plant leaves and roots are used in a wide range of handicrafts in Vetiver countries (Thailand, Indonesia, Chinese, Latin America, Africa, etc.) (Chomchalow and Chapman, 2003). Indonesia sells and exhibits handicrafts made in and around Bali, many tourist towns and villages (Thomas, 2004).

Products obtained from vetiver leaves and stems; (1) handy accessories such as bags, hats, belts and brooches, (2) containers such as baskets, pots, boxes, utility bowls, (3) decorating materials such as clocks, picture frames, lamp shades, dolls, animal figures, flowers; and (4) home appliances such as chairs, stools, room partitions, tables (Chomchalow and Chapman, 2003).

Products obtained from vetiver roots; Fan hangers and flower blends (Chomchalow and Chapman, 2003). In addition, Roman shades, large hampers, vetiver balls, net bags, hand bags, coasters, boxed placemat gift sets, newspaper hampers, placemats and tassels are obtained from the fragrant vetiver roots (Thomas, 2004).

DISCUSSION and CONCLUSION

As regards rural development, first of all, Turkey has to cope with some economic, social and environmental challenges ahead. At the beginning of these, ecotourism, agricultural tourism opportunities should be investigated and put into practice in rural areas. Rural areas are used to support tourism, livelihoods and handicrafts and to prevent immigration to urban areas.

Handicrafts are used in various fields with social, economic and tourism purposes in Turkey. Only projects and ideas related to handicrafts need to be increased. Furthermore, development should be provided to support farmers or people living in rural areas such as the Eastern Black Sea.

Diversifying tourism handcrafts can provide a level of prosperity for people in rural areas. For this reason, efforts should be made to diversify tourism products in order to benefit the wider community.

Vetiver grass has ecological, economic projects that are effective and easy to apply in the countries of the world. In the short term, in order to provide social development in the rural and tourism outdoor areas, it is necessary to introduce the vetiver crafts in Turkey and apply the projects. For this, the local people should be become self-aware and educational support should be provided.

The economic artistic value of the Vetiver grass plant, which has been tested in the Eastern Black Sea, Trabzon, should not be overlooked. Root and leaf development of the plant gave positive results. Vetiver grass is thought to be an additional income for tourism purposes in rural areas. It is thought that local handicrafts will be reinforced in the region. Furthermore, it should not be overlooked that the handicrafts produced and produced according to the style and taste of the region may reflect the local characteristics.

As a result, Vetiver grass plant is used for protection of water and soil in Eastern Black Sea, it can be trained for tourism purposes in empty places. For rural development, handcrafted products for tourism are fed only from talent. And if vetiver grass grows are thought to be economical, we should be prepared for innovative investments.

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REFERENCES

Benson, W., 2014. *The Benefits of Tourism Handicraft Sales At Mwenge Handicrafts Centre In Dar Es Salaam, Tanzania*, Tampereen Ammattikorkeakoulu Tampere University of Applied Sciences Degree Programme in Tourism.

Boz, M., 2011. Leakages and Value Added in International Tourism Revenues; Tourism Satellite Account as A Measurement Method, International Journal of Business and Social Science, 2(24), 198-206.

Chaudhry, M.S. and Sarwar, G., 2006. Leaf Anatomy of a Miracle C4 Grass: Vetiveria zizanioides L. Nash, *Vetiver Systems: The Fourth International Conferance on Vetiver, Vetiver and People, ICV4*, Caracas, Venezuela.

Chomchalow, N., 2008. *Other Uses and Utilization of Vetiver*, Proceedings First Indian National Workshop, Vetiver System for Enviromental Protection and Natural Disaster Management, Chapter-6, 181-193, Cochin, India.

Chomchalow, N., and Chapman, K., 2003. *Other uses, and utilization of Vetiver*, Proceedings of the Third International Conference on Vetiver and Exhibition, Guangzhou, China.

Cındık, Y., 2012. *An Investigation of the Possibilities for the Preventation of Erosion Using Vetiver grass (Vetiveria zizanioides (Linn.) Nash): The Case of Esiroğlu Area in Maçka Province of Trabzon*, Karadeniz Technical University, The Graduate School of Natural and Applied Sciences, Landscape Architecture Graduate Program, Trabzon, Turkey.

Demirel, O., and Demirel, K. 2005. An examination of the "Vetiver Grass" to prevent erosion in Yusufeli Region (Coruh Watershed Area-Turkey): A Case Study, *Journal of Environmental Biology*., 26(2), 409-419.

DPT and JICA, 2004. *Doğu Karadeniz Bölgesinde Turizmin Geliştirilmesine Yönelik Kalkınma Çalışması, Nihai Rapor Yönetici Özeti*. Türkiye Cumhuriyeti Başbakanlık Devlet Planlama Teşkilatı Müsteşarlığı, Japonya Uluslararası İşbirliği Ajansı (JICA), BELDA LTD (Belde Proje Danışmanlık ve Ticaret Ltd. Şti) ve Semor (Seminer Organizasyon Danışmanlık ve Turizm A.Ş), Ankara.

Governor of Trabzon, 2015. El sanatları. http://www.trabzon.gov.tr/el-sanatlari (accessed 20 March 2017).

Graburn, N., 2006. *Tourism and Handicrafts: Modernity and Identity in the Global Marketplace*, Tourism and Handicrafts A Report on the International Conference on Tourism and Handicrafts, 13-15 May, Tehran, Islamic Republic of Iran.

Hall, C.M., 1994. Tourism and Politics: Policy, power & place. Wiley, Chicester.

Islam, M. P., Bhuiyan, K.H., and Hossain, M. Z., 2000. Vetiver grass a potential source for rural development in Bangladesh, *Agricultural Engineering International: the CIGR Ejournal*. Invited Overview No. 5. Vol. X.

Karabaşa, S., 2012. Ekolojizmin Ortak Paydasında Geleneksel El Sanatları,Yeşil Tekstil ve Yavaş Moda (Sultan Sazlığı Örneği), *Akdeniz Sanat Derneği*. 4(8),1-3.

Kayıkçı, S., 2009. *Türkiye'de Kırsal Alan Yönetimi*. Ankara Üniversitesi, Sosyal Bilimler Enstitüsü, Kamu Yönetimi ve Siyaset Bilimi (Yönetim Bilimleri) Anabilim Dalı, Doktora Tezi, Ankara, Türkiye.

Kirici, S., Inan, M., Turk, M., and Giray, E.S., 2011. To study of essential oil and agricultural properties of vetiver (Vetiveria zizanioides) in the southeastern of Mediterranean, *Advances in Environmental Biology,* 5 (2), 447-451.

Lavania, U., 2008. *Historical Perspective and Prospective for Development of Specific Genotypes for Environmental or Industrial Application*, Indian Vetiver Network, National Workshop on the Vetiver System, Vetiver System For Enviromental Protection and Natural Disaster Management, Cochin.

Lavania, U.C., 2003. *Other uses of vetiver: Vetiver oil*, Proceedings of the Third International Conference on Vetiver and Exhibition, Guangzhou, China.

Memişoğlu Bingöl, A., 2008. *Bor ile kirlenmiş toprakların yeşil ıslah (Phytoremediation) yöntemi ile arıtılması / Phytoremediation of soil contaminated with boron*. PhD thesis, Atatürk University, Institute of Science, Department of Environmental Engineering, Erzurum, Turkey.

National Research Council -NRC, 1993. *Vetiver Grass: A Thin Green Line against Erosion*, National Research Council Board on Science and Techonology for International Development, National Academy Press, Washington, D.C.

Neto, F., 2003. A New Approach to Sustainable Tourism Development: Moving Beyond Environmental Protection, ST/ESA/2003/DP/29 DESA, Discussion Paper No. 29, United Nations.

O'Connor, D., 2006. *Handicrafts and Their Linkage with Tourism Artisans Are Also Your Treasures*, Tourism and Handicrafts A Report on the International Conference on Tourism and Handicrafts, 13-15 May, Tehran, Islamic Republic of Iran.

Örnek, A., 2007. *Kırsal Kalkınma El Kitabı*, Heinrich Böll Stiftung Derneği Türkiye Temsilciliği, ISBN 978-975-00954-4-3.

Özcüre, G., and Yavuz, C., 2006. *El Sanatları Ürünlerinin Bulunduğu Yöreye Sosyo-Ekonomik Etkileri ve Katkıları (Ordu İli Örneği)*, Uluslararası Katılımlı Sanat Ekonomisi Sempozyumu Bildiri Kitapçığı, 167-183, Çanakkale, Türkiye.

Panichpol, V., Waipanya, S., Siriwongse, M., and Srichoo, C., 1999. *Analysis of chemical composition of Vetiveria zizanioides Nash for using as feed stuff*, In: Abstracts of papers presented at ICV-3, 141, Thailand.

Thomas, J., 2004. Vetiver Root Crafts in Bali. http://www.vetiver.org/INR_vet%20art_r.pdf (accessed 16 March 2017).

Truong, P., 2008. South Indian vetiver handicraft. http://www.vetiver.org/IND_handicrafts.pdf. (accessed 20 March 2017).

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Developing Silage Maize Hybrids with the Cooperation Among Public Agricultural Research Institutes of Turkey

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Abstract

Due to the need for silage maize in livestock sector, its production in Turkey is increasing. Approximately 32% of the total maize plantings area of Turkey is being used to produce silage maize. Although, both public and private sector organizations released new high yielding and quality hybrids, there is still a gap for different hybrids that have high yield potential and good enough for different environments. To meet the mentioned gap, collaboration between national agricultural research institutes which have been working on maize was initiated. Silage maize inbred lines that developed by different institutes were used in hybridization. During hybridization studies, genetic background of the inbred lines and their yield and quality potential was considered. Experimental hybrids and commercial checks were tested in different locations of Turkey. Every year at least 15 experimental hybrids were evaluated in at least four locations of Turkey. Promising hybrids were determined and used for further investigations by the breeders. The first mutual silage maize hybrid, SAMADA-07 released in 2009. This hybrid's male and female parents belong to two institutions. Another mutual silage maize hybrid AGA is now available for farmers. SASA-5 hybrid also will be released in a near future.
In this study, past and present collaborative efforts on silage maize hybrid development by national agricultural research centers of Turkey were presented and experiment results from different sites were discussed.

Keywords: Maize breeding, animal feed, variety development, yield, quality

INTRODUCTION

Maize silage is an important quality forage source for dairy and cattle fattening in Turkey. Due to high energy potential, high dry matter yield and high silage performance, farmers of Turkey prefer maize silage when compared other feed sources. Maize silage is in the first rank in cattle feeding in Turkey (Sahin and Zaman, 2010). On the other hand, almost all geographic regions of Turkey are suitable for a profitable cultivation of silage maize. Modern technologies such as packing silage in the harvest and using it when need gives small scale farmers many advantageous. Silage aimed maize production in Turkey is increasing (TUIK, 2016).

According to the statistics, currently Turkey is producing 20 million ton silage maize annually (Table 1). Silage yield and quality is also increasing due to modern cultivation technologies (Erdal et al. 2016) and high yielding varieties. In order to improve yield and quality potential, maize breeding takes an important place. Public maize breeding studies related to silage maize in Turkey is still going on (Erdal et al. 2009; Erdal and Pamukcu 2011; Cengiz, 2016).

Table 1. Turkey silage maize planting area (da), production and yield data

Years	Planting area (da)	Production (ton)	Yield (kg/da)
2004	1. 550.000	6.200.000	4.000
2005	2. 000. 000	7.600.000	3.800
2006	2. 598. 913	10.069 968	3.875
2007	2. 690 132	10.259 595	3.814
2008	2. 888.829	11.183.290	3.871
2009	2.740. 031	11. 099. 653	4.051
2010	2. 937. 336	12. 446. 450	4.237
2011	3. 127. 946	13. 294. 380	4.250
2012	3. 540 .882	14. 956 .457	4.224
2013	4 .027 .160	17. 835. 115	4.429
2014	4. 149. 529	18. 563. 390	4.474
2015	4. 231. 233	19. 684. 599	4.652
2016	4. 257. 753	20. 139 .033	4.730

Silage maize breeding studies are being carried out by Bati Akdeniz Agricultural Research Institute (BATEM), Maize Research Institute (MAIM) and Black Sea Agricultural Research Institute (KATAE) national public institutes. Maize inbred lines developed by the institutes used to improve maize varieties separately by each institute. Although there was strong relationship among the institutes related to silage maize breeding, a concept was developed to foster breeding studies. According to this strategy, developed maize inbred lines by each institute were crossed to each other to develop high quality and yielding silage hybrids. Joint hybrids were made with some of the developed lines owned by the Institutes. These hybrids were tested in multiple locations and very promising results were obtained. The first mutual silage maize hybrid, SAMADA-07 released in 2009. This hybrid's male and female parents belong to two institutions. Another mutual silage maize hybrid AGA is now available for farmers. SASA-5 hybrid also is expected to be released in a near future.

In this study, past and present collaborative efforts on silage maize hybrid development by national agricultural research centers of Turkey were presented and experiment results from different sites were discussed.

MATERIALS and METHODS

Silage maize inbred lines that developed by different institutes were used to generate experimental hybrids. The hybrids were coded as SASA during studies. All hybridization studies were done in MAIM institute in Sakarya-Turkey. BURAK, P.31Y43, SAMADA-07 and KILOWATT commercial checks were used in the experiments. Experiments were carried out according to randomized complete block design with three replications. Antalya (Mediterranean region), Sakarya (Marmara region), Samsun (north region of Turkey), İzmir (Aegean region) and Maras and S.Urfa (South east Turkey) locations were used as test sites. Yield trials which were carried out in 2014 year in different sites of Turkey discussed in this study.During studies, traits were determined according to the Technical Instructions for Agricultural Trials in Maize (TTSM, 2015). Content analysis of dry matter (DM, %) and crude fiber (CF, %) was performed according to the Weende analysis method (AOAC, 1984). Neutral detergent fiber (NDF, %), acid detergent fiber (ADF, %) and acid detergent lignin (ADL, %) were determined (Van Soest et al. 1991).

RESULTS and DISCUSSION

Traits of the released mutual silage maize hybrids were presented in Table 2. SAMADA-07 silage maize hybrid was developed by crossing KATAE and MAIM silage maize inbred lines. This variety is a relatively late (FAO-750) hybrid. It has a high yield and quality potential and this variety is suggested for many regions of Turkey. AGA is another mutual silage maize hybrid that developed by cooperation among MAIM and BATEM research centers. This variety was released in 2015 and suggested for Mediterranean, Marmara, Black Sea and Eagan region of the country (Anonymous, 2015).

Table 2. Traits of the released mutual silage maize hybrids improved by national public research institutes

Hybrid	Institute/ Partners	Regst. year	FAO Group	Plant Height (cm)	Forage yield ton/ha	ADF (%)	NDF (%)	Dry Matter (%)
SAMADA-07	KATAE /MAIM	2009	750	345-375	80	29	59	34-39
AGA	MAIM / BATEM	2015	750	320-400	79-80	32.2-36.9	52.4-65.8	29.6

SASA-5 silage maize hybrid was developed by BATEM and MAIM. The registration processes of the hybrid is going on and it was expected that this hybrid will be available for farmers in 2019. The yield trial results of the experimental hybrids including SASA-5 variety plus commercial checks that carried out in 2014 were given in Table 3. According to the combined analysis results, statistically significant high genotype by environment interactions were detected ($p<0.01$). This shows the importance of site-specific hybrid selection for a target environment. Forage yield obtained from Antalya location was given in table 3. According to the results the highest forage yield was taken from BURAK check (9202 kg/da) and SASA-5 candidate variety showed a medium level performance in that site.

However this candidate variety was better than KILOWATT commercial check. In a study carried out in Antalya conditions in 2006 and 2007 years (Erdal et al. 2009) mean experiment yield found as 6345 kg/da and 6504 kg/da respectively. Similar experiment results were obtained from our study. Lower yields were recorded at İzmir location when compared to Antalya Location. SASA-5 showed a good performance along with P31Y43 commercial check in İzmir location. In a study, six maize hybrids compared in order to determine effect of different sowing times on the hybrids at İzmir and they received higher forage yield than our study (Geren et al. 2003). Since they used different varieties and agronomic applications (sowing times) might have been effective in these results. Forage yields were changed between 5960.7 kg/da (SASA-73) and 8451.8 kg/da (BURAK) in Maras location (Table 4). SASA-5 have performed well and our candidate variety in 3rd place (7857 kg/da) passed the check mean of 7741 kg/ da. Highest forage yields were obtained at S.Urfa location when compared to other locations. SASA-5 was better than all checks included in the experiment at that location. Combined analysis of four locations showed that SASA-5 mutual silage hybrid had a high yield potential after BURAK check. SASA-5 candidate variety and four commercial checks subjected to a quality analysis and the results were given in Table 3. According to the quality analysis lower NDF values were obtained from SASA-5 when compared one of the highest yielding check variety BURAK. It is reported that 45–50% NDF range is an indicator of a good silage (Alfalfa Workgroup, 1998; Aurivo co-operative, 2014). Therefore 44.5 % NDF value of SASA-5 hybrid shows that SASA-5 was a good silage maize hybrid. Also lower ADF is an important trait for quality silage. SASA-5 and KILOWAT seemed to be good hybrids in terms of ADF values. Similar results can be said for ADL

values. Crude cellulose levels also showed that this hybrid is good enough for digestibility. Also the hybrid is in the middle in terms of dry matter ratio.

Table 3. Ouality analysis of SASA-5 promising hybrid and four commercial checks

Hybrid	NDF (%)	ADF (%)	ADL (%)	Crude Cellulose (%)	Dry matter (%)
SASA-5	44.5	30.0	1.05	12.0	31.5
BURAK	64.0	45.8	5.96	22.3	28.0
SAMADA 07	41.2	34.9	1.07	12.5	34.1
P.31Y43	44.3	42.3	1.27	17.5	34.9
KILOWATT	34.3	26.9	1.18	13.0	35.0
Mean	45.7	36.0	2.10	15.5	32.7

Table 4. Silage maize forage yield (kg/da) trails and combined analysis results

	Locations									
Hybrids	Antalya		İzmir		Maraş		Ş.Urfa		Combined	
SAMADA-07(St)	9201.3	a	2228.3	g	7793.1	ab	8204.7	bc	6856.9	cde
BURAK(St)	8457.3	a	5399.7	abc	8451.8	a	8152.3	bc	7615.3	a
ADA 12.20	7153.7	b	5457.3	abc	7290.3	bcd	8038.0	bc	6984.8	bc
P.31Y43(St)	6712	bc	6333.3	a	7843.7	ab	6895.0	de	6946	bcd
ADA 12.10	6611.7	bcd	3762.0	def	7867.9	ab	8523.7	abc	6691.3	cdef
SASA-5	*6611.0*	*bcd*	*6181.0*	*a*	*7856.6*	*ab*	*9038.0*	*ab*	*7421.7*	*ab*
SASA-11	6551.3	bcd	5523.7	ab	7847.5	ab	6771.3	de	6673.5	cdef
ADA 12.59	6107.7	cde	4628.7	bcde	6431.9	de	7743.0	cd	6227.8	fgh
SASA-73	6061.3	cde	3924	def	5960.7	e	9324.0	a	6317.5	efg
ADA 12.5	6016.7	cde	4095.3	cdef	6375.8	de	6257.0	e	5686.2	hı
KILOWATT(St)	5982.7	cde	5457.3	abc	6873.6	bcde	7743.0	cd	6514.1	cdef
ADA 12.22	5879.7	cdef	5152.0	abcd	7750.8	abc	6771.3	de	6388.4	defg
ADA 12.44	5716.0	def	4990.7	abcde	7002.6	bcde	8304.7	abc	6503.5	cdef
SASA-72	5503.3	ef	2780.7	fg	6423.1	de	7485.7	cd	5548.2	ı
SASA-74	4956.0	f	3714.0	g	6663.8	cde	8404.7	abc	5934.8	ghı
Experiment mean	6501.5		4641.9		7288.9		7843.6		6554	
Check mean	7588.3		4854.7		7740.6		7748.8		6983.1	
LSD	927.71**		1403.3**		1108.8**		1068.5**		561.8**	
CV	8.53		18.1		9.2		8.14		10.6	
			Genotype x Environment **							

**: statistically significant at 1% level

CONCLUSIONS

Cooperation among national public research institutes to develop silage maize hybrids that have good yield and quality potential for Turkey gave good results. The studies is going on and new hybrids will be developed and release for the farmers in the future.

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REFERENCES

Alfalfa Workgroup, 1998.Interpreting your forage test report. Calif Alfalfa Forage Rev. 2. Available from: http://www.foragetesting.org/files/InterpretingFQReport.pdf. 1998.

Anonymous, 2015. TTSM Variety Cataloque. AGA variety, 62.

AOAC, 1984. Official methods of analysis. (Centennial ed.). Washington (DC): Association of Official Agricultural Chemists.

Aurivo co-operative, 2014. Assesing your silage report'' http://www.aurivo.ie/wp-content/themes/aurivo/documents/assessing-your-silage-report.pdf, 2014.

Cengiz R. 2016. Maize Research of Public Sector in Turkey, Journal Of Field Crops Central Research Institute, 25 (Special Issue-1):304-310

Erdal S & Pamukçu M. 2011. Breeding for silage, popping and white-seeded maize hybrids for Turkey, Adressing climate change effects and meeting demands for Asia. Book of extended summaries. 11th Asian maize Conferance, Nanning, China.

Erdal S., Pamukçu M., Ekiz H., Soysal M., Savur O., Toros A. 2009. The Determination of Yield and Quality Traits of Some Candidate Silage Maize Hybrids. Mediterranean Agricultural Sciences, 22(1): 75-81

Erdal S., Pamukcu M., Curek M., Kocaturk M., Dogu O.Y. 2016. Silage yield and quality of row intercropped maize and soybean in a crop rotation following winter wheat. Archives of Agronomy and Soil Science, DOI:10.1080/03650340.2016.1153801.

Geren H., Avcıoğlu R., Kır B., Demiroğlu G., Yılmaz M., Cevheri A.C. 2003. Effect of different sowing dates on the yield and quality characteristics of some maize cultivars grown as second crop for silage. Journal of Ege University Faculty of Agriculture. 40(3):57-64.

Sahin İ.F & Zaman M. 2010. An important cattle feed: SILAGE, Eastern Geographical Review, 23: 1-17. 2010.

TTSM 2015. Mısır [Maize], Variety Registration And Seed Certification Center. Ankara,. Available from: http://www.tarim.gov.tr.2015

TUIK, 2016. The TUIK website. [Online]. Available: http://www.tuik.gov.tr

Van Soest P.J., Robertson J.B., Lewis B.A 1991. Methods for dietary fiber, neutral detergent fiber, and nonstarch polysaccharides in relation to animal nutrition. *Journal of Dairy Science*. 74:3583–3597

EURASIAN JOURNAL OF AGRICULTURAL RESEARCH

Evaluation of the Göreme Historical National Park in Terms of Tourism Practices

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Abstract

Göreme National Historical Park is located in city of Nevşehir, Turkey. It has cover approx. 9.614 hectares (ha) which involve one city (Nevşehir), two towns (Ürgüp and Göreme) and two villages (Çavuşin, Aktepe). These regions have geomorphological, natural and cultural values. Due to very rich historical assets, it was declared to be National Historical Park in 1986 by Turkish Council of Ministries. It has also added to the list of Natural and Cultural Heritage under the name of *"Göreme National Park and Cappadocia Rocky Areas"* in the 357'th order on the date of 12.06.1985 by United Nations Educational-Scientific and Cultural Organization (UNESCO), and the area is one of the nine places from Turkey which are all located within the list. Göreme Historical National Park, located in the Cappadocia region, which is in a very important position in terms of cultural and historical heritage of Turkey, has been one of the well known places in worldwide. Both the natural formation and the historical remains attract tourists from all around of the world and provide a great development in the region in terms of tourism. Thereby, the most important feature of the National Park is the fairy chimneys formed by the erosion of superficial waters on the rocks and rock assembles. However, Göreme Historical National Park, which has historical resources (underground cities, churches, chapels), geological formations such as fairy chimneys, endemic plant existence, landscape value, rest and entertainment and tourism resource values is a unique place worth seeing. The area is protected due to a national park status and also contains archaeological and urban sites. A number of touristic activities have conducted in these area including nature and culture tourism, balloon tourism, faith tourism, horse tourism, congress tourism and wine productio In this study, the tourism potential and the activities in the area have been examined in detail and current problems have been identified. Some suggestions and opinions for improving tourism potential of that area were given.

Keywords: Göreme, Göreme Historical National Park, Tourism

INTRODUCTION

Tourism can be broadly defines as; a travel and temporary accommodation movement for eliminating the necessities such as holiday, rest, entertainment as a consumer other than the place which is continuously living in general (Bayer, 1992).

However, it can be considered to be an industry without chimney, which strengthens the quality of life and communication in the international arena as well as economic prosperity and enabling socio-cultural exchange and social interaction (Nayir, 2009). In this sense, the tourism sector, which takes the role of locomotive when it is evaluated in Turkey, plays a important role for the development of areas and countries.

Nevsehir city has been a permanent settlement area since Cappadocia region in history. Cappadocia is a world-renowned region with its historic settlements, underground cities, natural valleys, beautiful and interesting scenes of fairy chimneys, endemic plants, landscape value, rest and entertainment and tourism resource values (Evci, 2016). However, Göreme Historical National Park located in Cappadocia Region is clearly seen as one of the tourism centers of Turkey when it is

evaluated in historical process. There is a historical, natural, and cultural harmony in the region that has the potential to attract tourists from all continents of the world. Especially the open-air museums and natural valleys in the region are very interested. In addition, various agricultural activities contribute to the regional economy. It is inevitable to carry out evaluations and initiatives to strengthen tourism activities within the Göreme Historical National Park, which is in a very valuable position in terms of Turkey.

General Characteristics of Göreme Historical National Park Area

Göreme Historical National Park covers many valleys, like open air museums, churches and chapels, agricultural areas. Although the border of the National Park extends to Avanos in the north, the Avanos district center is not included in the national park area.

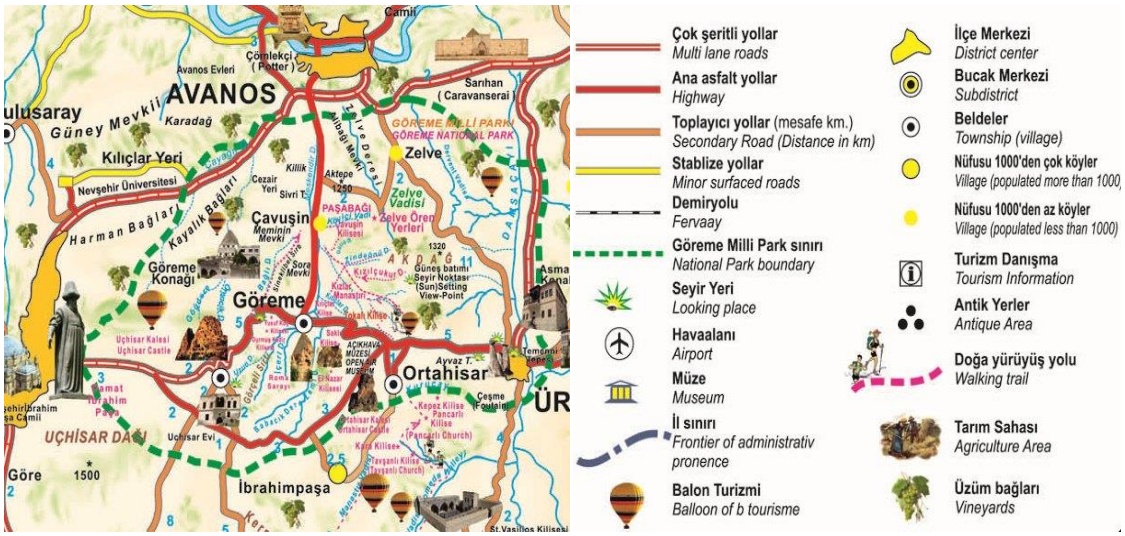

Figure 1. Göreme Historical National Park boundaries (Anonymous 1, 2016).

In the region where terrestrial climate is dominant, there are few clayey, sandy, tuffy and moisture free soils due to terrestrial volcanic formations. These lands, which are very favorable for viticulture and fruit-making, are not suitable for irrigated cultivation. The steppe plant formation, which glow in the spring and turn yellow in summer, is spread throughout the region (Anonymous 2, 2016**).** The tourism season covers a maximum of six months between May and November.

Settlements and Near Environs of Göreme Historical National Park

Göreme Historical National Park is bordered by Kızılırmak river to the north, Yeşilhisar town to the east, Hasan and Melendiz Mountains to the south, The National Park area is reached via the Ankara-Adana highway on the west and south sides and highway from Niğde or Aksaray to Nevsehir. The area is reached via from Kayseri to Avanos or Ürgüp on the eastern and northern (Anonymous 3, 2015).

Ürgüp Town

Ürgüp, which has a large number of name changes in the historical process, is located approx. 20 km east of Nevşehir city. It is one of the most important center of the Cappadocia region.

The town has a geological structure with a volcanic origin, was established in a region where typical examples of interesting natural formations, which are referred to as fairy chimneys, brought rain and wind erosion to the waterfall (Metin, 2010). However, Ürgüp, located in an important

position of Cappadocia in terms of touristic, reflects impressive face of Cappadocia with its natural structure and historical houses, churches and valleys.

Göreme Town

Göreme, 10 km from Nevşehir, is located between the Nevsehir-Ürgüp-Avanos triangle, surrounded by valleys (Anonymous 3, 2015). Göreme is the most diversified region in terms of the most protected and natural landscape of Cappadocia region. The main valleys in Göreme, Bağlıdere (love) valley, Zemi valley, Meskendir valley, Kızılçukur-Güldere valley.

Uçhisar Region

Uçhisar is 7 km away from Nevşehir city. Uçhisar Castle, used for defense and protection purposes in the past, is the highest point of the region. Uchisar reminds history with its location and architectural style which is a place famous for being the most enjoyable place to watch the sun set due to its height. There is a castle in the center of the town, and in its skirts there is a urban texture with traditional rock carved houses (Anonymous 4, 2015).

Ortahisar Region

Ortahisar, located on Nevşehir-Ürgup highway, is 6 km away from Ürgüp. There are very interesting monasteries and churches in Ortahisar valleys. The most prominent structure is Ortahisar Castle, which is carved at the time of Etiler and at an altitude of 86 m. The castle was used for both strategic and settlement purposes. There are examples of characteristic civil architecture of Cappadocia on the skirts of the castle (Metin, 2010).

Zelve Region

Zelve, 5 km from Avanos and 1 km from Paşabağları is located on the steep slopes of Aktepe. Zelve ruins, which consist of three vents, are the place where the fairy chimneys are the busiest. The area that houses the Zelve Open Air Museum was one of the important settlement and religious centers of Christians in the 9'th and 13'th centuries.

Çavuşin Village

Çavuşin, one of the oldest settlements in the region, is 2 km away from Göreme on Göreme-Avanos road. The church built in the name of Baptist Yahya in Çavuşin, is one of the focal points of the region. The oldest church in the region is here.

Present Tourism Activities in Göreme Historical National Park Region

Nature and Culture Tourism

Göreme Historical National Park and its near environs, protected by Turkish National Park Authories and UNESCO; keep to alive nature and culture tourism with historic open air museums, churches, unique valleys, settlements and natural wonders.

In particular, nature walks are held in the valleys with unique natural beauties accompanied by guides. During the march, the structure of the historical textures is explained and the nature-culture integrity is ensured. In addition, various courses are determined by Atv vehicles and the

valleys and settlements are visited. Also, some points are hosted and natural structures in rural areas are examined.

Tourists immortalize these unique formations by photographing their fields of interest. Foreign tourists visiting the open air museums find traces of their culture in the churches and chapels that reflect their past. In addition, the national park with diversity in terms of landscape characteristics provides a great contribution to tourism with green-nature-historical harmony. The dovecotes in some of the valleys offer natural habitat traces. In the region which has panoramic positions, especially Kızılçukur valley, sunrise and sunset are observed from various points.

Carpet-rug stands, pottery workshops which reflect Turkish culture and various ornamental items unique to Cappadocia are exhibited in the national park. These workshops and stands are attracting great interest by local and foreign tourists.

Faith Tourism

Having traces of various civilizations, Cappadocia was influential in spreading many religions. Especially churches carved into fairy chairs in the early days of Christianity and processed religious themes make the area important in terms of religious tourism. Especially the churches, monasteries and chapels in Göreme Open Air Museum constitute the most important parts of the region that have been opened to faith tourism. Foreign tourists come to the country to worship, to remember their past and discover the texture of the area.

Figure 2. Göreme Open Air Museum Dark Church fresco example

Balloon Tourism

Hot air ballooning, which started in 1991 with the Turkish Aeronautical Association in Cappadocia and accelerated with the opening of other businesses in 2006, is one of the high economic return sources of region. Today, 25 balloon companies are serving tourists with about 180 balloons. A representative office has been established by the General Directorate of Civil Aviation for safe flights to the region and all flights are carried out under the supervision of the General Directorate of Civil Aviation (Anonymous 5, 2014).

Horse Tourism

Cappadocia, which is remembered as a beautiful horse country in the past, attracts domestic and foreign tourists with its ever-developing horse tourism. There are approximately 25 equestrian tourism enterprises in the region. These enterprises aim to keep tourists in longer regions by arranging equestrian tours during various periods (Anonymous 5, 2014).

Congress Tourism

The extensive and luxurious facilities, which are established in the field with its attractive history and structure, introduce the region and host many national and international activities such as congresses, workshops and symposiums. The guests who come here attend both the training and the meetings and discover the unique beauties of Cappadocia.

Winery

Cappadocia is one of the important centers that come to mind when it comes to wine making in Central Anatolia. The region, which has a very long tradition of wine making, is famous for the quality of white wines produced from its local grapes. Cappadocia has many businesses that produce wine (İşcen, 2004).

Figure 3. Ürgup Kocabağ wines sales point

Some Suggestions for Improvements Tourism Potantial of Göreme Historical National Park Region. There are a number of problems noted in the Göreme Historical National Park as a result of planning, field use and various recreational tourism activities. Therefore, it is inevitable to take sufficient precautions and to increase the management efficiency analyzes and to make sufficient awareness about the field management. Furthermore, the organization of various organizations and training seminars to raise awareness of the local people are among the most important activities that should be in the region.

Some of the important problems can be summarized as follows:

- Mobile benches gathering at certain points of the valley, damages the visual quality of the area. Especially the benches in Paşabağları are the worst example of that. For sales equipment, special stands must be prepared, collected at certain points, positioned as far away as possible from natural formations, and completely removed from the valley, which will not damage the natural structure and create no bad image.
- There are active ATV vehicle tours within the national park at certain times of the day and these tours enter into the valley. These tours have auditory and physical effects and cause dust, noise and air pollution. For this reason, the routes of the ATV vehicle tours must be changed, especially to prevent entry into the valley walkways.
- The area is destroyed by tourists coming to the area and the natural formation is damaged. For this reason, security checks must be carried out continuously, especially in open air museums, and photographs must not be allowed in churches.

- One of the most striking features of Göreme National Park is the active balloon tourism in the region. Every morning, at the dawn of the sun, hundreds of people rise up to the sky with balloons, witnessing unique views on the peaks of Cappadocia. However, balloon tourism also has various effects on the environment. Especially helium gas affects the viticulture activities in the region negatively. From this point of view, it is necessary to put a quota on the number of air balloons.

- There are shortcomings in the fitted outfits. In particular, the lack of orientation-information plates leads to directional confusion. In particular, it is necessary to increase the information-direction signs that determine the valley entrances and exits, rovers of open air, roots of hiking trails, etc.

- There are a wide variety of maps, brochures, posters, etc., which are different from each other, issued by tourism agencies related to the area. They need to be standardized.
- The area is very poor in terms of accessibility. In order to overcome this weakness, guide strips, disabled ramps and sound warning devices should be used especially in the open air museums.

CONCLUSIONS

As briefly mentioned in above, a number of problems noted in the Göreme Historical National Park as a result of planning, field Göreme Historical National Park located in the Cappadocia region, which is in a very important position in terms of cultural and historical heritage of our country, has been one of the most interesting places of our country to date. Whether it is natural formation or historical remains, attracting tourists from all corners of the world every year and providing great development to the region in terms of tourism.
In the direction of the analyzes carried out, necessary inspections should be made in the region, the harmful effects of tourism should be minimized, the necessary care and careful inspections should be carried out in the protected areas in terms of landscape characteristics, the trip routes and axes should be well defined and the area must be made accessible.

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REFERENCES

Anonymous 1. 2016. General Directorate of Nature Conservation and National Parks,http://www.milliparklar.gov.tr/korunanalanlar/index.htm , (accessed 30 March 2016)

Anonymous 2. 2016. Nevşehir Museum Directorate, Interviews with Nevsehir Museum Directorate, (interviewed 30 March 2016).

Anonymous 3. 2015. Göreme Municipality, Göreme General Information. http://www.goreme.bel.tr/tr/goreme-genel-bilgiler, (accessed 09 April 2015).

Anonymous 4. 2015. Uçhisar Municipality, Uçhisar General Information, http://www.uchisar.bel.tr, (accessed 09 April 2015).

Anonymous 5. 2014. Ahiler Kalkınma Ajansı, Kapadokya'da Turizm Yatırım Olanakları Dergisi. Erişim Tarihi: 22.08.2016. http://ahika.gov.tr/assets/ilgilidosyalar/Kapadokya Turizm-Yatirim-Olanaklari.pdf, (accessed 22 August 2016).

Bayer, M.Z. 1992. *Turizme Giriş, İşletme Fakültesi Yayını*, 531s, *(Introduction to Tourism, Tourism Faculty Publications)*, Istanbul.

Evci, A. 2016. *Göreme Açık Hava Müzesi'nin Erişilebilir Turizm Açısından İrdelenmesi.Süleyman Demirel Üniversitesi, Fen Bilimleri Enstitüsü, Yüksek Lisans Tezi, 157s, (Demonstration of Göreme Open Air Museum in terms of Accessible Tourism, Suleyman Demirel University, Natural Sciences Institute, MSc. Thesis 157 p.*), Isparta

İşcen, Y. 2004. *Kapadokya'da Şarapçılık, Kapadokya Kültür ve Tanıtım Dergisi, (Winery in Capoccadia, Capoccadia Culture and Introduction Journal)*, http://cappadociaexplorer.com/en/detay.php?id=152&cid=81&page=1. (Accessed 08 July 2015).

Metin, N. 2010. *Nevşehir İli Ürgüp İlçesi'nin Sosyo-Kültürel ve Ekonomik Yapısı, Niğde Üniversitesi, Sosyal Bilimler Enstitüsü, Yüksek Lisans Tezi, 259s, (Socio-Cultural and Economical Structure of Ürgüp Town of Nevşehir City, Niğde University, Social Sciences Institute, MSc. Thesis 259 p.*), Niğde

Nayir, O. 2009. *Isparta Yöresi Korunan Doğal Alanlarında Ekoturizm Talep ve Eğilimlerinin Belirlenmesi, Süleyman Demirel Üniversitesi, Fen Bilimleri Enstitüsü, Yüksek Lisans Tezi, 128s, (Determination of ecotourism demand and trends in protected natural areas of Isparta region, Suleyman Demirel University, Natural Sciences Institute, MSc. Thesis 128 p.)*, Isparta

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Evaluation of Relief Morphometry of Kılıçözü and Acıöz Drainage Sub-Basins (Kırşehir, Turkey) in Relation to Flood Events

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Abstract

Morphometric analysis of drainage basins and their channel networks plays an important role in understanding the causes of flood occurrence in basins. In the present study, morphometric analysis was carried out using Geomorphological Information System (GIS) to assess the relief morphometry of Kılıçözü and Acıöz drainage basins which are sub-basins of the Kızılırmak River, the longest river in Turkey. These basins have been subjected to flooding several times. The obtained values of slope and morphometric parameters (basin relief, relief ratio, time of concentration, hypsometric curve and hypsometric integral) indicate that the two basins do not differ from each other with respect to flood occurrence; however the Acıöz subbasin is more prone to flash floods. This result will help in producing a sustainable management plan for the basins to overcome the risk of flooding.

Keywords: Flash flood, Relief morphometry, Basin management, Kırşehir

INTRODUCTION

Large volumes of water falling and accumulating in a short time are among the most important reasons for flash flood events. Sudden and unusual increases in rainfall and temperature are the principal causes of flooding (Özcan, 2006). Variations from the norm in climate and temperature also bring about increased flood and drought risk (IPCC, 2007). This leads to irregular rainfall throughout the year and an increase in sudden rainfall. As a result, floods are deeper and more likely to occur in the catchment basins. For example, flooding has become more frequent and more damaging as a direct result of floodplain loss, especially when combined with the loss of vegetation cover in the drainage basin (Wetland, 2016). A river and its basin, together with the channel networks within the basin, is a shaped area of land resulting from rainfall and the topographic properties (slope, aspect, elevation) of that basin. Morphometric analysis of the drainage basin and channel network play a vital role in understanding the geo-hydrological behavior of the drainage basin and determines the prevailing climate, geology and geomorphology of the catchment (Hajam *et al*., 2013).

Basin morphometry is also effective in understanding and solving the likelihood of floods in the basin; the reason being that outside factors (e.g. land use, rainfall, vegetation) may change considerably and suddenly over a short period, while the basic basin morphometry changes more slowly, if at all (Özdemir, 2011). Most researchers have used morphometric parameters and emphasized their importance in studies on flood events in Turkey (Özdemir and Bayrakdar, 2009; Özdemir and Bird, 2009; Günek *et al*., 2013; Uzun, 2014; Bayer Altın, 2014; Erdede and Öztürk, 2016). The Kızılırmak Basin has, in general, morphometric features that reduce the danger of floods (Erdede and Öztürk, 2016). However, flooding did occur on the Kılıçözü River in the years 1965, 2014 and 2015. The largest and

most catastrophic event occurred in 1965. During this flood, many people lost their homes and harvests were ruined (Gökçe *et al*., 2008). The purpose of this study is to determine the relationship in the Kılıçözü and Acıöz sub-basins between relief morphometric parameters including slope and elevation values of the basins and flood occurrence.

GEOGRAPHIC SETTING and CLIMATE

The study area is located in the Middle Kızılırmak sub-region of the Central Anatolia Region. The Kızılırmak is the main river in the study area. Kılıçözü Stream originates from the northern slopes of Mt. Baranlı. Running not far from the city of Kırşehir and village of Güzler, the Kılıçözü stream enters the main river at the border of Kocabey village (Figure 1). Predominantly flowing from north to south, the stream is about 65 km long and is used to support agriculture. The Kılıçözü sub-basin covers an area of about 791 km^2, and the basin elevation varies from 845 to 1802 m above sea level (asl) (Figure 1). Irrigation regulators were constructed on the stream at Iğdeliöz, Kılıçözü and Güzler to provide irrigation for crops and to prevent flooding. In the summer its flow rate decreases due to irregular rainfall; however, sudden overflows have occurred in winter and spring due to excessive rainfall and melting snow from time to time. Thus, the rapid onset of floods occurred.

The Acıöz sub-basin covers an area of about 595 km^2, and basin elevation varies from 855 to 1123 m (asl). The Acıöz stream originates on the western slopes of highlands to the east of the town of Hacıbektaş and the southwestern slopes of Mt. Ayrı. The stream is about 40 km long and enters the main river near the village of Kesikköprü. There are ponds for irrigation on its tributaries.

A continental and semi-arid climate is dominant over the study area with annual rainfall of 379 mm, received mostly during the winter and spring. The hottest month is July, with a mean temperature of 23.1°C. January is the coldest month with a mean temperature of -0.1°C (Figure 2). This month is followed by February, with a mean temperature of 1.3°C. According to the Erinç Aridity Index (1965) and Thornthwaite's climate classifications (1948), Kırşehir is semi-arid and semi-arid/less humid, respectively (Karabulut *et al*., 2016).

Kırşehir province, which is located within the steppe belt of the Central Anatolia Region, is generally devoid of forest cover and is dominated by steppe vegetation. The area, which was covered with forests in ancient times, has lost forestland as a result of human activity and an irregular rainfall regime. The forestland previously covered 2% of the total area of the province. This has increased to 3.7% due to planting programs in recent years.

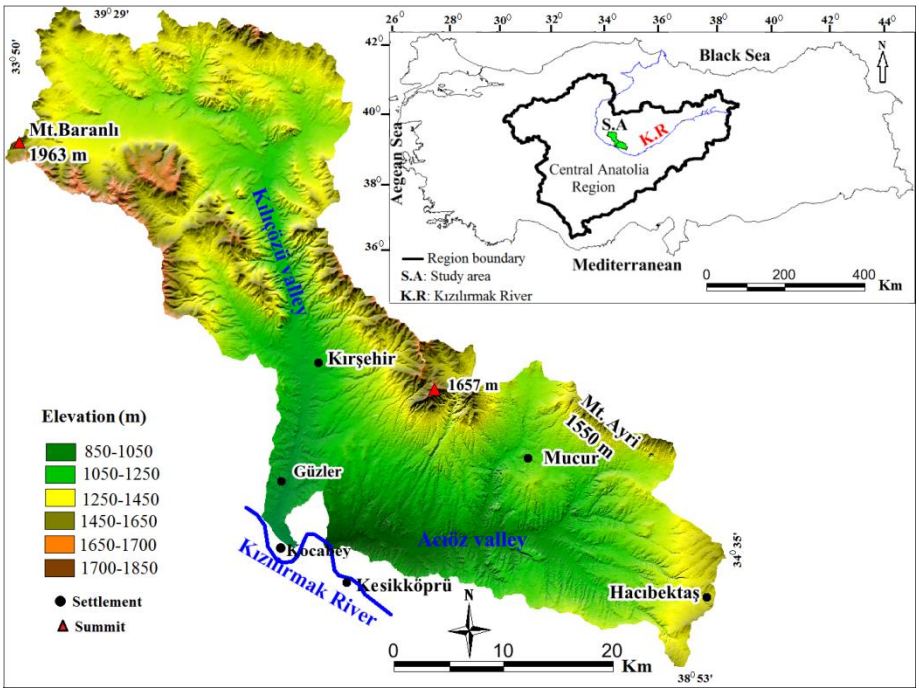

Figure 1. Location and DEM map of study area

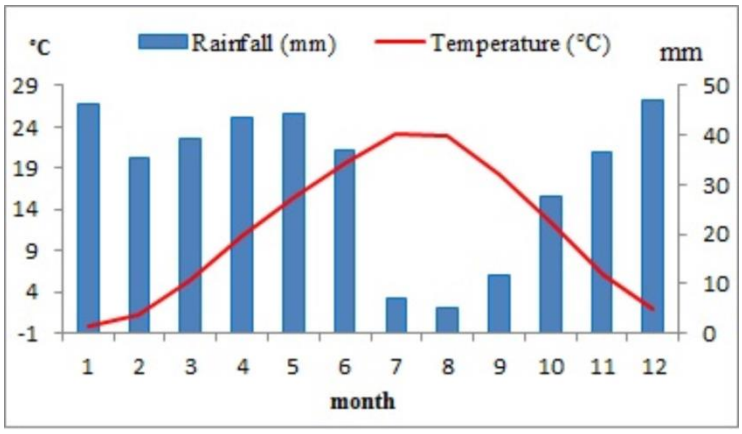

Figure 2. Mean temperatures and total rainfall by month for years 1950-2015 in Kırşehir province.

MATERIALS and METHOD

The drainage network was extracted from a 10-m resolution DEM (Digital Elevation Model) using GIS (Geographic Information System). The DEM was derived from 1:25,000 scale topographic maps including the sheets for Kırşehir (J31-32) and Aksaray (K32-33). The relief parameters such as Basin relief (Bh), Relief ratio (Rh), Time of concentration (Tc), Hypsometric integral (Hi) and curve for the delineated basin area were calculated based on the formulas seen in Table 1.

Table 1. Relief parameters of drainage network and their mathematical expressions

Relief parameters	Formula	Description	References
Basin relief (Bh)	Bh=Hmax/Hmin	Hmin: lowest point,	Strahler, 1957
		Hmax: highest point in the basin	
Relief ratio (Rh)	Rh=Bh (m)/Lb (m)	Lb: maximum basin length	Schumm, 1956
Time of concentration (Tc)	$Tc= 0.0078*L^{0.77}/S^{0.385}$	L: stream length (m),	Kirpich, 1940
		S: gradient slope of the basin (m/m)	
Hypsometric integral (Hi)	Hm-Hmin/Hmax-Hmin	see description of Bh for	Strahler, 1952
		Hmax and Hmin	
		Hm: mean elevation of the basin.	
Hypsometric curve	h/H/a/A	h and a: height and	Strahler, 1952
		area between contours;	
		H and A: total height and	
		area of the basin	
		a/A: relative area; h/H: relative height.	

RESULTS and DISCUSSION

The high value of basin relief shows that higher relief with steeper slopes implies higher runoff rates (Patton, 1988). The Bh value (957) of the Kılıçözü sub-basin is higher than the Bh value (810) of the Acıöz sub-basin (Table 2). As shown in Table 3, the majority of the Kılıçözü sub-basin is comprised of very gentle (0-5%) and gentle slopes (5-10%) that cover about 423 km² and occupy about 26.6% and 26.8% of the total area, respectively. Moderate (10-15%) and moderately steep (15-20%) slopes occupy about 15.6% and 10% of the total area. 21% of the total area corresponds to steep (20-30%) and very steep (+30) slopes.

Table 2. Relief parameters of drainage network derived from DEM.

Sub-basin	Area (km²)	Stream Length (km)	Bh	Rh	Hi	Tc (hours)
Kılıçözü	791	65	957	0.01	0.39	01:49
Acıöz	595	40	810	0.02	0.33	01:34

Very gentle (0-5%) and gentle (5-10%) slopes cover about 509 km² and occupy 41.5% and 44% of the Acıöz sub-basin, respectively. Moderate (10-15%) and moderately steep (15-20%) slopes occupy about 10.1% and 2.75% of the total area. 1.5% of the total area corresponds to steep (20-30%) and very steep (+30) slopes (Figure 3). As a result, it can be said that the Kılıçözü sub-basin, having steep valleys, is more prone to flash flood risk than Acıöz sub-basin with its lower relief.

Table 3. Slope values of sub-basins.

Sub-basin		Slope (%)				
	0-5	5-10	10-15	15-20	20-30	+30
		Area (km²)				
Kılıçözü	211	212	124	80	98	66
Acıöz	247	262	60	17	5	4

Rh values of the Kılıçözü and Acıöz sub-basins are 0.01 and 0.02 (Table 2), respectively. This shows that the area of higher relief with steeper slopes in Kılıçözü sub-basin exceeds the area of higher relief in Aciöz sub-basin. It has been suggested that Rh value

is a measure of the overall steepness of a river basin and is an indicator of the intensity of erosion on the slope of the basin (Schumm, 1956). It is also reveals that the Kılıçözü sub-basin is morphometrically less susceptible than Acıöz sub-basin.

Hi values have a strong relationship with basin hydrology, especially flood response (Perez-Pena *et al*., 2009). Moreover, Hi value is used as a rapid reconnaissance technique to evaluate hydrology characteristics and to quantify the effects of lithology and structural deformation on low stream flow (Kowall, 1976). Basins have been classified (Strahler, 1952) according to their stages of geomorphic evolution as: young stage (convex curve, Hi≥0.6), where the watershed is highly prone to flooding; equilibrium or mature stage (S-Shaped hypsometric curve; concave curve at high elevations and convex curve at low elevations, 0.30≤Hi≤0.6); and peneplain or monadnock stage (concave curve, Hi≤0.30), where the watershed is less prone to floods. The Hi value of the Kılıçözü and Acıöz sub-basins is 0.39 and 0.33, respectively (see Table 2). In other words, both sub-basins are at the mature stage represented by the S-Shaped curve.

The convex form shows that the flow of the streams and the sediments transported by the streams are decreasing, while aggregation is more dominant and more flood discharge is widespread (Özdemir, 2011). This form is more evident in the low-lying land of the sub-basins (Figure 4). The hypsometric curve shows that the upper course of both sub-basins and their tributaries has a convex form. Namely, the western and eastern parts of the Kılıçözü sub-basin and the northern part of the Acıöz sub-basin both have steeper topography, which typically generate more runoff (see Figure 3).

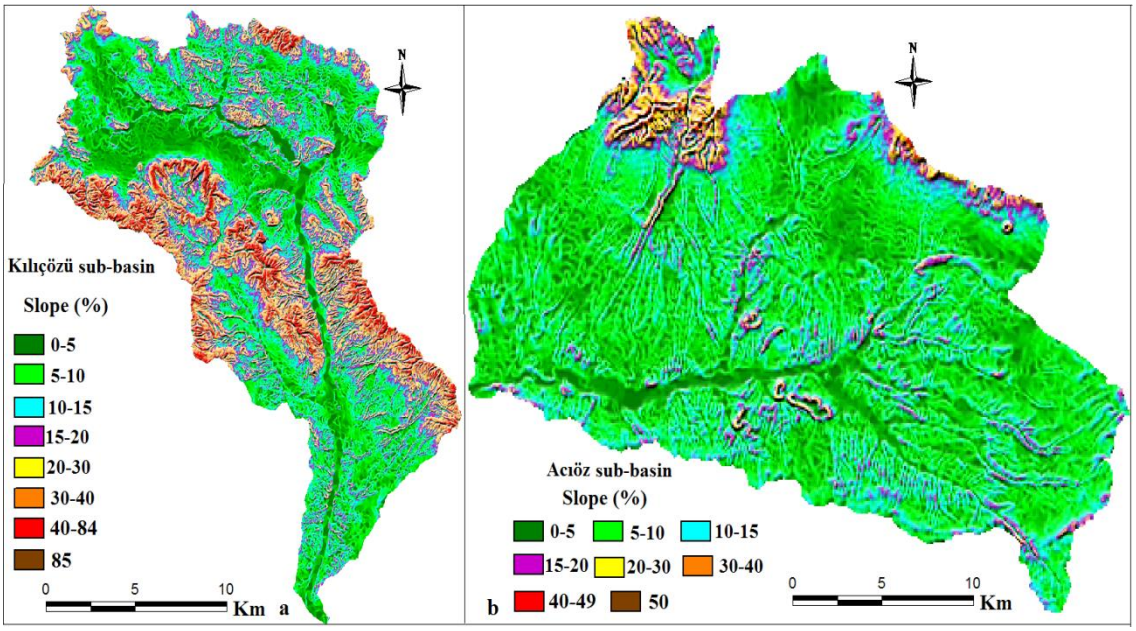

Figure 3. Slope map and values of Kılıçözü sub-basin (a) and Acıöz sub-basin (b).

This is because it is more difficult for water to infiltrate the ground on the steeper slopes and more precipitation finds its way into stream channels (Kanarek, 2012). As shown in Figure 5, elevations of 1170 m and 1080 m have more area than other elevations in the Kılıçözü and Acıöz sub-basins, respectively. These elevations correspond to the slopes of valleys and hills. This condition is noted as a flash flood triggering factor.

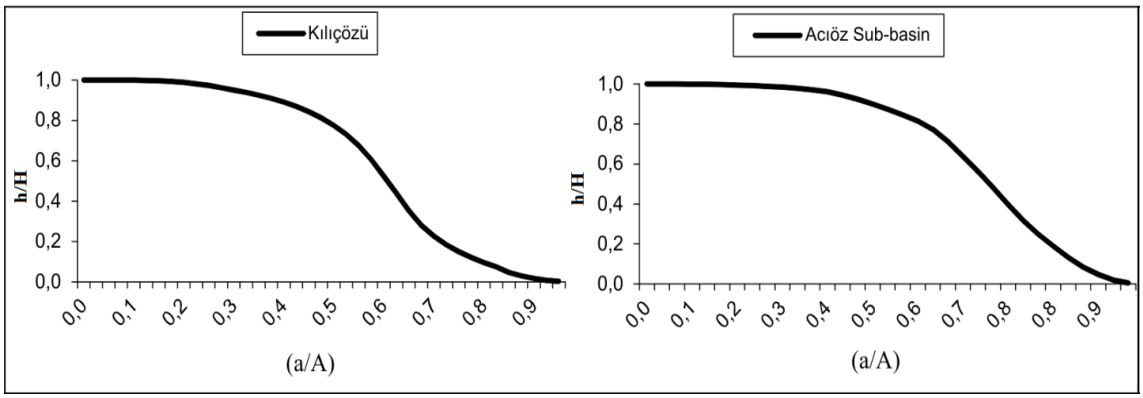

Figure 4. Hypsometric curve of sub-basins

Time of concentration (Tc) is defined as the time taken by water to travel hydraulically from the most distant point of a watershed to its downstream (Verstappen, 1983). Slope conditions affect the concentration time of water in a basin and are inversely proportional to the Tc. The Tc value may decrease as a result of an increase in slope values. The concentration time of water in the Kılıçözü sub-basin is one hour and forty-nine minutes. It is one hour and thirty-four minutes in the Acıöz sub-basin (see Table 2). This shows that there is no significant difference between the Kılıçözü and Acıöz sub-basins in terms of Tc value; however, flow time in the Acıöz sub-basin is shorter than that of the Kılıçözü sub-basin. Although the high slope values cover more area in the Kılıçözü sub-basin, the Tc value is high. This can be explained by its stream length being longer than the Acıöz stream.

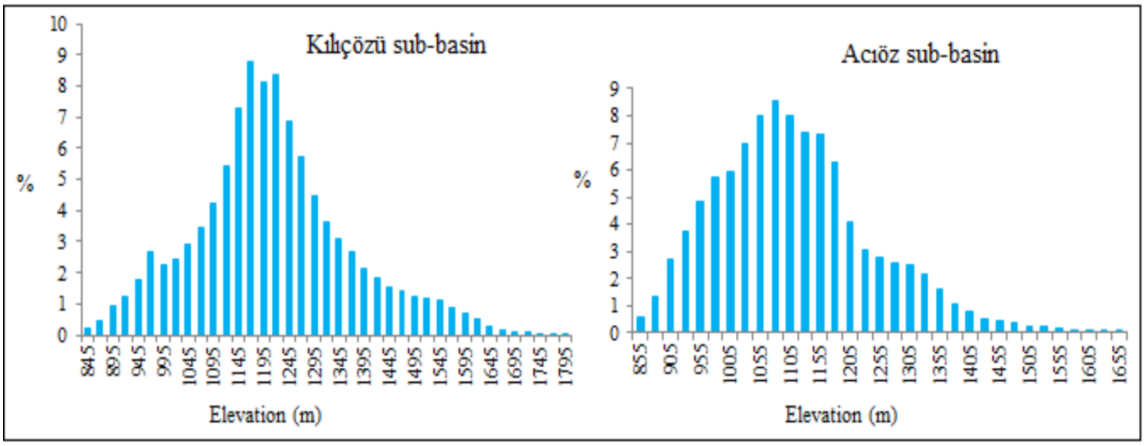

Figure 5. Elevation frequency of sub-basins

CONCLUSIONS

As a result of the Rh, Tc and Hi analyses, it appears that the sub-basins have a lower peak of direct runoff for a longer duration, which reduces the risk of flooding within the sub-basin. However, according to the hypsometric curve and slope values, a convex curve on the upper part of both sub-basins reveals they are highly prone to flooding. Thus, settlements such as villages and rural settings near or around the upper course of the sub-basins are under flash flood risk. Stream length extends runoff travel from the hydraulically most distant point in the Kılıçözü sub-basin. This reduces flood risk, especially in the lower course of the sub-basin. Since the length of the Acıöz stream is shorter, the water formed by sudden rainfall is collected in a short time and the flash flood risk is greater. This risk is more evident on the

upward part of the sub-basin. In other words, the Acıöz sub-basin is more prone to floods than the Kılıçözü sub-basin.

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REFERENCES

Bayer Altın T. 2014. The flood risk of the Yeşilırmak basin (upper course), Turkey. Procedia-Social and Behavioral Sciences, Vol. 120, pp. 460-467.

Erdede B. and Öztürk D. 2106. Kızılırmak havzasının taşkın potansiyelinin çizgisel, alansal ve rölyef morfometrik indisler kullanılarak değerlendirilmesi. In: Proceeding of Remote Sensing-GIS Symposium (UZAL-CBS 2016), 392-399, 5-7 Ekim, Ankara.

Hajam R. A., Hamid A., Dam N.A. and Bhat S.U. 2013. Morphometric analysis of Vishav drainage basin using geo-spatial technology (GST). *IRJGM*, 3 (3), 130-6-146.

IPCC. 2007. Summary of Policymakers. Climate Change 2007: The Physical Science Basis. In: *Contribution of Working Group I to the Fourth Assessment Report of the Intergovernemental Panel on Climate Change*, S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Avery, M. Tignorand H.L. Miller (eds), Cambridge University Press, Cambridge, pp. 1-18.

Gökçe O., Özden Ş. and Demir A. 2008. Türkiye'de afetlerin mekansal ve istatistiksel dağılımı afet bilgileri envanteri. T.C Bayındırlık ve İskan Bakanlığı, Afet İşleri Genel Müdürlüğü, Afet Etüt ve Hasar Tespit Daire Baskanlığı Yayınları, p.118, Ankara.

Günek H., Sunkar M. and Toprak A. 2013. Muş şehrini etkileyen çar ve muş derelerinin bazi jeomorfometrik indislere göre analizleri. In: Proceeding of TMMOB Congress on Geographic Information Systems, 11-13 Kasım, Ankara.

Kanarek M. 2012. Runoff and geomorphic properties of North Carolina rivers, Available:http://www.ce.utexas.edu/prof/maidment/giswr2012/TermPaper/Kanarek.pdf. (accessed 6 March 2017).

Karabulut Y., Çelik M.A. and Karabulut M. 2016. İç Anadolu Bölgesi'nde sıcaklık ve yağışların trend analizi. *Türk Coğrafya Dergisi*, 64, 1-10.

Kirpich Z. P. 1940. Time of concentration of small agricultural watersheds. Civil Engineering, ASCE, 10 (6), pp. 362.

Kowall S. J. 1976. The hypsometric integral and low streamflow in two Pennsylvania provinces. Water Resources Research, 12 (3), 497-502.

Özdemir H. and Bayrakdar C. 2008. Kasım 2007 Tuzla Deresi Taşkınının Nedenleri Üzerine Bir Araştırma (Silivri-İstanbul). *Türk Coğrafya Dergisi*, 49, 123-139.

Özdemir H. and Bird D. 2009. Evaluation of morphometric parameters of drainage networks derived from topographic maps and DEM in point of floods. *Environmental Geology*, 56, 1405-1415.

Özdemir H. 2011. *Havza morfometrisi ve taşkınlar*. Türk Coğrafya Kurumu Yayınları, İstanbul.

Özcan E. 2006. Sel olayı ve Türkiye, Gazi Eğitim Fakültesi Dergisi, 1 (26), 35-50.

Patton P. C. 1988. Drainage basin morphometry and floods. In: *Flood geomorphology*, V. R. Baker, R. C. Kochel, P. C. Patton (eds), USA, Wiley, pp. 51–65.

Perez-Pena J. V., Azanon J. M. and Azor A. 2009. CalHypso: an ArcGIS extension to calculate hypsometric curves and their statistical moments. Applications to drainage basin analysis in SE Spain. *Computers and Geosciences*, 35, 1214- 1223.

Schumm S. A. 1956. Evolution of drainage systems and slopes in badlands at Perth Amboy. New Jersey. *Geol. Soc. Am. Bul*., 67, 597-646.

Strahler A. N. 1952. Dynamic basis of geomorphology. *Bull Geol Soc Am*, 63, 923–938.

Strahler A. N. 1957. Quantitative analysis of watershed geomorphology. *Trans Am Geophys Union*., 38, 13–920.

Uzun, M. 2014. Lale Dere (Yalova) Havzası'nın jeomorfolojik özelliklerinin jeomorfometrik analizlerle İncelenmesi. *Route Educational and Social Science Journal*, 1(3), 72-88.

Verstappen H. Th. 1983. Applied geomorphology. ITC, Enschede.

Wetland. 2016. Ecosystem services, flood control website. Available: http://archive.ramsar.org/pdf/info/services_01_e.pdf. (accessed 6 March 2017).

EURASIAN JOURNAL OF AGRICULTURAL RESEARCH

Determination of Yield and Yield Components Of Some Silage Corn (*Zea mays* L.) Varieties Under Diyarbakır Ecological Conditions

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Abstract

This investigation was conducted to determine yield and yield components of some silage corn varieties that are suitable for Diyarbakir ecological conditions experienced at GAP international Agricultural Research Training Center experiment area in the main growing season 2015. The experimental design was randomised in a complete block design with three replications. Varieties Burak, Samada 07, TK 6063, OSSK 644, Bolson and Hido were used as plant material in present study. The range height of the plants used in the research was 263.33 – 314.66 cm, the range of ratio of stem plant was 41.93-58.50 %, leaf plant was 18.20 – 22.17 %, cob / plant was 20.37 – 38.50 %. The range of green herbage yield was 5694.85 – 10820.85 kg, hay yield 1431.00 – 3006.33 kg, cop weight 220.00 – 317.33 gr /plant. The range of crude protein was 4.09 – 6.27 %, crude protein yield was 79.70 – 125.93 kg, silage pH 3.67 – 3.90, ADF (Acid detergent fiber) 30.40 – 35.97 %, NDF (Neutral detergent fiber) 52.90 – 60.20 %. As a result of the investigation it has been found that Burak, TK6063, Samada 07 and Bolson were the best suitable plants compaire to quality of the silage and green herbage.

Keywords: Corn, green herbage yield, main crop, silage

INTRODUCTION

In countries where the animal husbandry is at an advanced level, corn plants especially as silages, are produced more than the other animal feed. It is very common due to its digestion is very easy, it is very tasty, juicy and economically more convenient, and it has a significant place in milk and meat cattle breeding. Silage corn farming needs to be more widespread in our country in order to ensure the livestock more economical and in order to close the gap of animal feed in a short time and make livestock economical (Sonmez et el., 2001). Corn is one of the most preferred silage in the world due to the facts that it is suitable for machined farming from seeding to the harvest, it is easy to store and easy to use, its digestion level is high, it is a qualified and delicious silage food, its seeds are easy to find and it is easy to ensiled without needing any other additive (Acikgoz et el., 2002). In 2013 in the world, corn silage cultivation area was 1.104.211 ha, the amount of production was 9.776.132 million tons and the yield was 88.535 kg / ha (Anonymous, 2015).

As for Turkey, as of 2015 corn silage cultivation area was 4.015.913 and total amount of production was found out as 18.563.390 tons with the yield of 4.630 kg / da. In the Southeastern Anatolia Region, corn silage production has reached to 781.497 tons with 186.048 yield as of 2015, and it has reached to 85.823 tons of production amount with 21.325 da yield in Diyarbakir (Anonymous, 2015). Corn silage in our country begun to spread in the

last 15-20 years. Depending on the region, the corn produced from 5 to 10 ton / de silage (Yolcu & Tan, 2008).

The economic difficulties that the livestock enterprises have are increasing day by day. Production costs, especially feed costs are pretty high. Within the scope of supporting livestock, the production areas of animal feed has been increased thanks to these supports to animal feed plants, however this was not seen as sufficient. In order make livestock enterprises become profitable enterprises and to obtain animal products at the desired level from these enterprises, it is necessary to evaluate the roughage sources well. There is not sufficient production of feed crops by the regional producer whose income depends on the agriculture and livestock. Our meadow and forage areas have been used of grass down for many years without considering any amenajman rules and regulations. As the maintenance and improvement works for meadow and forage areas are not sufficient, the increases with each passing day. Since the quality of the roughage feed obtained from the production of the existing feed plants cannot reach the desired level, there is insufficiency for the roughage.

There is a study conducted in 1999 in the conditions of Van with 6 types of corn silages as the main product and II. product (Frassino, P 3394, RX -899, P -3335, TTM -815 and Arifiye): in the main product conditions, average plant height 228.50 cm, green grass yield 5704.51 kg / da, weed yield 1482.95 kg / da, single plant weight 893. 17 g, leaf ratio 26.67%, crude protein yield 79.46 kg / 5.36; II. In product terms, the plant height is 269.06 cm, green grass yield is 7403. The ratios are sever a following: 17 kg / da, weed yield 1617.92 kg / da, single plant weight 900.74 g, average leaf ratio 23.29 %, cow ratios 22.09-37.79, crude protein yield 93.31 kg / da, crude protein ratio 5.74 % (Turan & Yılmaz, 2000), in order to determine the types of silage corn that can be grown in Van conditions, it was determined that the corn variety varied in plant height 143.7-242.6 cm, green yield 2729.6-7842.3 kg / da, stem ratio 28.1-43.6 %, leaf ratio 17.3-23.5 %, cob rate 38.2-49.0 % protein ratio 5.52-8.17 % (Akdeniz et el., 2003).

A study was conducted in order to determine the morphological characteristics and feed yields of 8 corn silage (Ada 9516, PR31Y43, Sımon, Braker, Samada, BC 678, Ada 523 and Bolson) cultivars in the application area of the Faculty of Agriculture, Department of Field Crops, Ankara University; plant height 254.00-293.33 cm, green grass yield 4077.77-6537.14 kg / da, leaf rate 22.13-28.89 % in the leaves of the plants, 23.84-32.48 % of the stems in the plants, stem ratio 45.32-52.04 % in the plants, dry matter yield 1374.71-2152.67 kg / da , The crude protein ratio 7.93-9.07 and the crude protein yield 119.84-174.18 kg / da (Kucuk, 2011), 13 varieties of silage maize (Borja, Pr-1550, Mataro, DK-626, DK-C 5783, Poly, Sinatra, Progen 1490, 38, 40, 41, Szegedi, Luce) which can be grown as second crops in 2010 under Tokat-Kazova ecological conditions yield and yield characteristics of the study; the dry matter yields were 733.94-1697.70 kg / da, the crude protein ratios were 3.94 5.11, the ADF ratios were 26.49-45.01 % and the NDF ratios were between 49.79-72.97 % (Akbay, 2012).

A study was conducted in 2005 and 2006 on the experimental fields of the Department of Field Crops of the Agricultural Faculty of Ege University and Odemiş Vocational School of Higher Education: it the goal was to determine silage qualities of some corn varieties (Brasco, ÇT-1, C-955, Helen) in Aegean Region. In the study conducted it is observed that it changes between 30.22-30.74 % of silage dry matter content, pH value of silage 3.98-4.04, fleig score 100, silage smell 12.92-13.40, silage structure 3.43-3.77, silage color 1.85-1.93 and DLG score 18.22-19.06 (Kavut & Soya, 2012), another study carried out with the aim of determining the self-healing lines suitable for silage hybrid corn breeding; Dry matter yields of variety candidates ranged from 602-2175 kg / da, ADF ratios were 20.38-30.76 %, NDF ratios were 43.07-57.66 % and raw protein ratios were between 7.09-9.82 % (Oz et el., 2012).

In 2013, a study was carried out in Igdir conditions using C955, Sakarya F1, Dako 626, Cadiz, Borja, Progen 1610, Pasha, 71 May 69, 70 May 82 silage corn varieties as plant material: plant height value is 256.0-319.0 cm, stem ratio is 38.8-57.6 %, stalk ratio is 24.6-38.3 %, leaf ratio is 15.7-27.2, green grass yield is 4673.7-8753.7 kg / da, dry weight ratio is 24.1-30.0 %, dry hay yield 1249.9-2570.2 kg / da, the ratio of crude protein is 5.2-7.0 % and the yield of crude protein is 83.8-169.2 kg / da (Kabakcı, 2014), another research conducted to determine the possibilities of silage cultivation of some maize varieties under the ecological conditions of the Middle Kizilirmak basin; Plant height 228-260 cm, stem diameter 20.05-24.54 mm, leaf ratio 12.3-17.3 %, cob ration 38.2-50.1 %, handle ratio 34.2-47.8 % , Gross yield was 8461-13190 kg / da, dry matter yield was 2838-4163 kg / da, crude protein content was 4.80-7.02 % and crude protein yield was 149.8-257.5 kg / da (Kusvuran et el., 2015).

With this study conducted in the ecological conditions of Diyarbakir; it has been detected that it is significant to use coarse feed sources together with rational feeding in order to get the desired yield from animal husbandry and therefore it is important to increase the cultivation areas of corn silage which has an important place in the feeding of dairy cattle and to spread the breeding.

MATERIAL and METHOD

This study was conducted during the main product training period in 2015 in the field of trial and application of the Directorate of GAP International Agricultural Research and Training Center in Diyarbakir.

Material

The Climate Features of the Study Field

The province of Diyarbakir, which has continental climate, is hot and dry in summers and cold and rainy in winters. The average annual precipitation for many years is 490 mm (Anonymous, 2015). The long-term climate data for the same cycle as the April-August vegetation period of 2015, when the survey was conducted, are presented in Table 1.

Table 1. Data for the Climate of the Study Field*

Humidity (%)	Average Temperature (°C)		Maximum Temperature (°C)		Rainfall (mm)		Average Relative	
Months	Years (1950-2015)	2015	Years (1950-2015)	2015	Years (1950-2015)	2015	Years (1950-2015)	2015
April	13.8	12.4	20.4	19.2	68.7	48.6	56.0	69.6
May	19.2	18.8	26.5	27.1	44.3	48.2	31.0	57.6
June	26.3	26.1	33.6	34.4	8.8	7.4	27.0	34.5
July	31.1	31.7	38.4	40.0	0.5	0.0	28.0	21.8
August	30.4	30.9	38.2	39.3	0.4	0.0	32.0	25.5

*Anonymous, http://tuikapp.tuik.gov.tr/bitkiselapp/bitkisel.zul, 2016.

As it is seen in Table 1, the lowest average temperature values were observed at 12.4 °C in April and the highest at 30.9 °C in August when the study was conducted. When the average temperature values for many years are taken into consideration, it is observed that the lowest temperature is 13.4 °C in April and the highest temperature is 30.4 °C in August. The lowest maximum temperature values were recorded in April at 19.2 °C, the highest in August at 39.3 °C. For many years the average maximum temperature values have been determined to be the lowest in April at 20.4 °C and the highest in August at 38.2 °C. In addition, the lowest amount of rainfall in this period during which the survey was conducted decreased in June

with 7.4 mm, and with the highest in April with 48.6 mm. For many years the average minimum precipitation amount was 0.4 mm in August, the highest in April with 68.7 mm. The lowest relative humidity was observed in July at 21.8 % and at the highest in April at 69.6 %. For many years, the lowest average relative humidity was found to be 27.0 % in June and the highest in April, with 56.0 %.

Soil Characteristics of the Study Field

According to the results of soil analysis performed at the GAP International Agricultural Research and Training Center laboratory, soil samples taken before planting were determined to be clayey, with slightly alkaline character and no salinity problem (Table 2).

Table 2. Physical and chemical characteristics of the soil in the trial area (0-20 cm)*

Structure (%)			pH	Salt (EC) mmhos/cm	Lime ($CaCO_3$) (%)	Organic Substance (%)	Phosphor to be taken (P_2O_5) kg/da	Potassium to be taken (K_2O) kg/da
Clay	Sand	Silt						
50.24	28.70	21.06	7.92	1.499	12.36	0.85	0.56	60.23

*: The analysis was carried out at the GAP International Agricultural Research and Training Center Laboratory.

As it is seen in Table 2, it has been determined that the organic substance of the test soil is very low, the lime scale is medium lime, the soil contains very little phosphor, and the potassium is rich.

Some characteristics of the corn silage type

The morphological groups of the corn silage types used in the study, the breeding organization and some characteristics are given in Table 3.

Table 3. Some characteristics of the corn silage type

THE NAME of THE TYPE	BRIEF CHARACTERISTICS	THE REFORMENT INSTITUTION
OSSK 644	The number of days to maturity is 90-100 days (FAO 650). It is tall and has a high leaf rate. Green grass yield and silage quality is high.	Tareks A.Ş.
HİDO	The number of days to maturity is 100-110 days (FAO 700). Adaptability is high. The staygreen feature is very good.	May Tohumculuk
BOLSON	FAO 600 is in the maturation group. Adaptability is broad. It is tall, silage yield and high quality.	Polen Tohumculuk
TK 6063	The number of days to maturity is 95-110 days. FAO has 650 groups.	Tareks A.Ş.
BURAK	The number of days to maturity is 130-135 days (FAO 750). Silage yield potential is very high.	Batı Akdeniz Tar.Araş.Enst.
SAMADA 07	It is a middle-aged, maturity days are 95-105 days (FAO 700). It is tall and silage quality.	Karadeniz Tar. Araş. Enst.

The trial was set up in three replications, according to the design of random blocks. The area is 70 cm and the area of each parcel (5 m x 4 m x 0,70 m) is arranged as 14 m^2. The planting is made manually, after the last frosts in spring and when the temperature of the soil reaches 10 °C (20.04.2015) and when the soil is in the boil, 9715 seeds. According to soil analysis results, pure nitrogen (N) half (10 kg / da) and pure phosphorus (P_2O_5) were given as 20.20.0 composition fertilizer in whole (10 kg / da). Plants; when the paint reaches 10-15 cm, the first anchor is hand first, and when 40-50 cm is empty, the second anchor and throat filling operations are performed with an anchor. During throat filling, the remaining half of nitrogenous fertilizer (10 kg / da) was given as ammonium nitrate (33 % N). Irrigation after the planting until the output is irrigation, plants 15-20 cm after the watering is done by the

furrow method. During the harvesting, 1 part of the parcel was taken from the sides and 50 parts from the beginning of the parcels were harvested in the milking period after being placed as edge effect.

FINDINGS and DISCUSSION

F values and significance levels of variance analysis results of silage maize varieties are given in Table 4.

Table 4. F values and significance levels of silage maize varieties

V.K.	Green grass	Dry Grass	Size of the Plant	Crude Protein Ratio	Crude Protein Yield	Stem/Plant ratio	Leaf/Plant ratio	Corncob/Plant ratio	Weight of Corncob	pH of the silage	ADF	NDF
F_{cesit}	12.09**	11.52**	25.82**	1.90	1.06	48.74**	5.68**	27.48**	3.36*	0.65	0.07	1.14

*: significant at the level of P<0.05, **: significant at the level of P<0.01

Plant size (cm) and stem/plant ratio (%)

According to the variance analysis results, the difference between the varieties in terms of the size of the plant and stem/plant ratio was statistically significant at 1 % level (Table 4). When the highest value was obtained in Burak variety with 314.66 cm; the lowest plant height value was determined in the Hido range with 263.33 cm. The highest stem / plant ratio was obtained in the Burak variety with 58.50 % and the lowest stem / plant ratio was obtained in the TK 6063 range with 41.93 % (Table 5).

Table 5. Average values of the size of the plant and stem/plant ratio for the corn varieties and the Results of Duncan

Size of the plant (cm)			Stem/plant ratio (%)		
Varieties	Averages	Groups**	Varieties	Averages	Groups**
OSSK 644	301.66	a	OSSK 644	51.60	a
HİDO	263.33	b	HİDO	42.40	b
BOLSON	294.00	a	BOLSON	45.90	cd
TK 6063	263.66	b	TK 6063	41.93	d
BURAK	314.66	a	BURAK	58.50	a
SAMADA 07	313.33	a	SAMADA 07	48.70	bc
AVERAGE	291.77		AVERAGE	48.17	

**: The values for the same letter group are not different by Duncan 1 %

Findings in the study in terms of the size of the plant; have parallels with the findings of Kucuk (2011); also these findings have been observed to be higher than the findings of Kusvuran et al. (2015). The differences obtained in the research can be shown as originated from breeding period, ecological factors, cultural processes and genotypic differences. As a matter of fact, Uyanik (1984) stated that factors such as light, water, nutrient status and plant density affect the size of the plant alongside the genetic factors are affective to determine the size in corns. Stem/size of the plant related findings have parallels with Kucuk (2011), Akdeniz et al. (2003). Researchers report that the stem ratio negatively affects the quality of feed, which is why it can be regarded as a positive feature in terms of feed quality (Carpici, 2009).

Leaf/plant ratio (%) and corncob/plant ratio (%)

According to the results of the variance analysis, the difference between varieties in terms of leaf / plant ratio and corncob / plant ratio was statistically significant at 1 % level (Table 4). The highest leaf / plant ratio was obtained from Samada 07 with 22.70 % and the lowest leaf / plant ratio comes from OSSK 644 with 18.20 %. The highest ratio of corncob / plant was obtained from TK 6063 with 38.50 % and the lowest corncob / plant ratio from Burak with 20.37 % (Table 6).

Table 6. Average values of leaf/plant ratio and corncob/plant ratio for the corn varieties and the Results of Duncan

Leaf/plant ratio (%)			**Corncob/plant ratio (%)**		
Varieties	Averages	Groups**	Varieties	Averages	Groups**
OSSK 644	18.20	b	OSSK 644	30.10	bc
HİDO	21.00	ab	HİDO	36.47	ab
BOLSON	19.47	ab	BOLSON	34.50	abc
TK 6063	19.40	ab	TK 6063	38.50	a
BURAK	21.00	ab	BURAK	20.37	d
SAMADA 07	22.70	a	SAMADA 07	28.47	c
AVERAGE	20.30		AVERAGE	31.40	

**: The values for the same letter group are not different by Duncan 1 %

Findings obtained in terms of leaf / plant ratio in the study; Akdeniz et al. (2003) and Kabakci (2014) findings were found similar as the findings of Kucuk (2011) was observed lower. Although the nutrient value and digestibility of the leaves are low in spite of their low values, the ratio of leaves in green grass is required to be high because these ratios are high (Sade et al., 2002). Findings related to the ratio of corncob / plant ratio; happened to be found consistent with the findings of Kucuk (2011), Turan and Yilmaz (2000) and Kabakci (2014); Akdeniz et al. (2003)'s research results were found to be low. The high ratio of leaf and cob in silage is important for silage quality. It can be said that statistical differences in corncob and stem ratios of corn are changed according to locations and genotypes. İptas et al. (2002) reported that the ratio of corn in the corn plant varied according to the genotypes. Kirbas (2009) stated that obtaining silage at high quality from corn and accepting semi-concentrate feed of corn silage is largely attributed to the high ratio of corn and grain in the total crop.

Green grass yield (kg/da) and dry grass yield (kg/da)

According to the results of the variance analysis, the difference between varieties in terms of leaf / plant ratio and corncob / plant ratio was statistically significant at 1 % level (Table 4). The lowest yield of green grass (5694.85 kg / da) and dry grass yield (1431.00 kg / da) were obtained from the Hido variety, while the highest yield was obtained from grass seeds (10820.85 kg / da) and dry grass yield (3006.33 kg / da) (Table 7).

Table 7. Average values of the green grass yield and dry grass yield for the corn varieties and the Results of Duncan

Green grass yield (kg/da)			Dry grass yield (kg/da)		
Varieties	Averages	Groups**	Varieties	Averages	Groups**
OSSK 644	7109.14	bc	OSSK 644	1797.33	bc
HİDO	5694.85	c	HİDO	1431.00	c
BOLSON	6552.85	bc	BOLSON	1792.00	bc
TK 6063	7765.99	abc	TK 6063	1982.33	bc
BURAK	10820.85	a	BURAK	3006.33	a
SAMADA 07	9532.28	ab	SAMADA 07	2447.66	ab
AVERAGE	7912.66		AVERAGE	2076.11	

**: The values for the same letter group are not different by Duncan 1 %

Findings obtained in terms of green grass yield have parallels with Kusvuran et al. (2015). It is thought that factors such as organic matter abundance, number of plants in the unit, variety characteristics, and extreme temperature cause low yields in the area where the experiment is carried out. Some factors, which Soya et al. (1997) produces, such as the number of plants in the unit, the type of corn grown, the maturation period lead to a quantitative character that is affected by all of the factors. Findings related to dry grass yield have some parallels with Kabakci (2014) and Turan and Yilmaz (2000). In harvests during and after the milking period, the minimum levels of assimilate production of plants and the reduction of water content in plant tissues are decreasing in green grass yield, increasing the carbohydrate content and dry matter content (Turan & Yilmaz, 2000).

Weight of corncob (g/plant) and crude protein yield (kg/da)

According to the results of variance analysis, 5 % level was found to be significant in terms of corncob weight statistics, but crude protein yield statistic was insignificant (Table 4). When the highest weight of the corncob was obtained with 317.33 g / plant in accordance with TK 6063; the lowest weight was determined at 220.00 g / plant and Hido. The crude protein yields of the varieties, which were not significantly different between the groups, ranged from 79.70 kg / da to 125.93 kg / da (Table 8).

Table 8. Average values of weight of corncob and crude protein yield for the corn varieties and the Results of Duncan (**: The values for the same letter group are not different by Duncan 1 %)

Corncob Weight (g/plant			**Crude protein yield (kg/da)**	
Varieties	**Averages**	**Groups****	**Varieties**	**Averages**
OSSK 644	227.33	b	OSSK 644	108.75
HİDO	220.00	b	HİDO	79.70
BOLSON	243.00	ab	BOLSON	116.33
TK 6063	317.33	a	TK 6063	104.09
BURAK	232.00	b	BURAK	124.88
SAMADA 07	288.00	ab	SAMADA 07	125.95
AVERAGE	254.61		AVERAGE	109.94

Findings in terms of corncob weight in the study was found lower than Kirbaş (2009) results. It can be considered that factors such as ecological conditions, genetic structure of the crops, number of plants in the unit, low organic matter in the soil cause low corncob weight.

Findings related to crude protein yield were found to be lower than the results of the Kabakci (2014) research.

Crude protein yield is a more realistic criterion than dry hay yield in terms of yield-based preference. Because, for nutritional aspects, the maximum yield of crude protein in the unit area for a feed plant is more important than dry grass yield (Carpici, 2009).

Crude protein ratio (%), pH of silage, ADF ratio (%) and NDF ratio (%)

According to the results of the variance analysis, the difference between the crude protein ratio, pH of silage, ADF and NDF ratios was statistically insignificant (Table 4). The crude protein ratio of the varieties with no statistically significant difference ranged from 4.09 % to 6.27 %, silage pH from 3.67 to 3.90, ADF ratio from 30.40 % to 35.97 % and NDF ratio from 52.90 % to 60.20 % (Table 9).

Table 9. Average values of crude protein ratio and pH of silage and ADF and NDF ratios for the corn varieties and the Results of Duncan

Crude Protein Ratio (%)		**pH of Silage**		***1.1. ADF (%)***		***1.2. NDF (%)***	
Varieties	Averages	Varieties	Averages	Varieties	Averages	Varieties	Averages
OSSK 644	6.08	OSSK 644	3.78	OSSK 644	33.27	OSSK 644	57.83
HİDO	5.49	HİDO	3.85	HİDO	33.47	HİDO	58.17
BOLSON	6.27	BOLSON	3.90	BOLSON	30.40	BOLSON	52.90
TK 6063	5.28	TK 6063	3.69	TK 6063	35.97	TK 6063	60.20
BURAK	4.09	BURAK	3.83	BURAK	35.73	BURAK	56.70
SAMADA 07	5.10	SAMADA 07	3.67	SAMADA 07	33.03	SAMADA 07	57.03
AVERAGE	5.39	AVERAGE	3.79	AVERAGE	33.65	AVERAGE	57.14

**: The values for the same letter group are not different by Duncan 1 %

Findings related to crude protein ratio are found to be lower than Oz et al. (2012)'s findings, but has some parallels with Kusvuran et al. (2015). It was found higher than the research results of Akbay (2012). Findings obtained in terms of silage pH in the study have some parallels with the findings of Kavut and Soya (2012). Senel (1986) indicates that the pH value should be 3.8-4.2 in a quality silage. Our findings are consistent with the values specified by the investigator. Findings related to ADF and NDF ratio in the study are in parallel with Akbay (2012)'s findings; but they are higher than Oz et al. (2012)'s findings. Variations among varieties are estimated to depend on ecological conditions, the genetic makeup of varieties, organic matter in the soil and other plant nutrients.

CONCLUSION

This study was conducted in order to determine some corn silage types which can be grown as the main crop suitable for the climate conditions of Diyarbakir. The result of this study is statistical data of varieties of plant variety, stem / plant ratio, leaf / plant ratio, cow / plant ratio, green grass yield. Crude protein ratio, crude protein yield, silage pH, ADF and NDF ratios were not statistically affected. According to the findings of the study; Plant yields were 263.33-314.66 cm, stem / plant ratios were 41.93-58.50 %, leaf / plant ratios were 18.20-22.70 %, cob / plant ratios were 20.37-38.50, wet grass yields were 5694.85-10820.85 kg / Crude protein yields of 4.09-6.27 %, crude protein yields of 79.70-125.93 kg / da, silage pH values of 3.67-3.90, ADF ratios of 30.40-35.97 % and NDF ratios of 52.90 % -60.20. BOLSON type, leaf / plant type in terms of plant size, stem / plant ratio, green grass yield, BURAK type, cow / plant ratio, in terms of raw protein yield, the SAMADA 07 variety came

to the forefront. Considering the efficiency and quality elements in silage production; BURAK type, which stands out especially in terms of parameters such as age and hay yield, along with plant height, stem ratio, plant leaf ratio, crude protein yield and ADF, can be recommended as silage corn variety in Diyarbakir province climate and soil conditions. More extensive studies should be carried out in different ecological conditions and locations, both as a main crop and as a second crop, in order to better identify the yield differences and feed value of the varieties used in this study.Corn agriculture is increasing every day in the region of Diyarbakir. Demonstration work should be done by organizations engaged in silage maize production to provide information to the regional farmers on variety, harvesting and breeding techniques and thus to obtain better levels of silage maize production in the region. Demonstration work should be done by organizations engaged in silage maize production to provide information to the regional farmers on variety, harvesting and breeding techniques and thus to obtain better levels of silage maize production in the region.

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REFERENCES

Acıkgoz E., Turgut İ., Filya İ. 2002. Silage Plants Cultivation and Silage Production. *Hasad Yayıncılık Ltd. Şti.,* ISBN 975-8377-19-1, 86s

Akbay S. 2012. Tokat Determination of yield and yield characteristics of some corn silage varieties (*Zea mays* L.) which can be grown as second crop in ecological conditions, Master Thesis, *Gaziosmanpaşa Üniversitesi Fen Bilimleri Enstitüsü,* Tokat

Akdeniz H., Yilmaz İ., Andic N., Zorer S. 2003. A research on yield and feed values in some corn varieties *Yüzüncü Yıl Üniversitesi Ziraat Fakültesi Dergisi*,14(1):47-51

Anonymous, 2015. http://faostat.fao.org

Anonymous, 2015. Annual and Long-Term Climate Data for the city Diyarbakır, Meteoroloji Bölge Müdürlüğü, Diyarbakır, 2016b.

Anonymous, 2016. http://tuikapp.tuik.gov.tr/bitkiselapp/bitkisel.zul

Carpici B. E. 2009. Assessment of plant density and different amounts of nitrogen applications in corn silage cultivation in terms of stress physiology, PhD Thesis. *Uludağ Üniversitesi Fen Bilimleri Enstitüsü*, Bursa, s.242

İptas S., Oz A., Boz A. 2002. First crop corn silage production opportunities in Tokat-Kozova conditions, *Tarım Bilimleri Dergisi* 8(4): 267-273

Kabakci S. 2014. Determination of corn silage varieties (Zea mays L.) suitable for Igdir ecological conditions, Master Thesis, *Iğdır Üniversitesi Fen Bilimleri Enstitüsü*, Iğdır

Kavut Y.T. & Soya H. 2012. A study on silage quality characteristics of some corn silage varieties (Zea mays L.) under conditions of Ege region, *Ege Üniversitesi Ziraat Fakültesi Dergisi,* 49(3) s: 223-227

Kirbas A. 2009. Effects of different seed milling and shape on silage hybrid corn yield and some yield items. Master Thesis*, Selçuk Üniversitesi Fen Bilimleri Enstitüsü* Konya, s.31-33

Kucuk B. 2011. Determination of Morphological Characteristics and Feed Yields of Some Corn Silage Varieties Master Thesis, *Ankara Üniversitesi Fen Bilimleri Enstitüsü*, Ankara, 29-38

Kusvuran A., Kaplan M., Nazli R. İ., Saruhan V., Karadag Y. 2015. Determination of some corn silage (Zea mays L.) varieties growing facilities under the ecological conditions of Orta Kızılırmak basin *Gaziosmanpaşa Üniversitesi Ziraat Fakültesi Dergisi*, 32(1): 57-67

Oz A., İptas S., Yavuz M., Kapar H. 2012. Determination of self-healing lines suitable for silage hybrid corn breeding, *Tarım Bilimleri Araştırma Dergisi,* 5(1): 42-46

Sade B., Budak M. A., Acar R., Arat E. 2002. Determination of suitable corn silage varieties in Konya's ecological conditions, *Hay. Araş. Derg*., 12 :1-2

Senel H.S. 1986. Animal Feeding, *İstanbul Üniversitesi Veteriner Fakültesi Yayınları*, İstanbul

Sonmez F., Ulker M., Ciftci V. 2001. A study on the effect of different cultivars on the yield of some corn cultivars and their effects on different characteristics, GOÜ Ziraat Fakültesi Dergisi, 18(1):113-118

Soya H., Avcıoglu R., Geren H. 1997. Feed plants, Hasad Yayıncılık Ltd. Sti., Pk: 212, S: 223, Kadiköy- İstanbul

Turan N. & Yilmaz İ. 2000. In the Van conditions, Determination of the yield and some yield components of some silage corn cultivars grown as crops, *Atatürk Üniversitesi Ziraat Fakültesi Dergisi*, Erzurum, 31 (2) : 63 – 71

Uyanik M. 1984. Botanical characteristics of the corn plant, *Karadeniz Bölge Zirai Araştırma Enstitüsü Yayınları No*: 1984-1, Samsun

Yolcu H. & Tan M. 2008. An Overview of the Agriculture of Forage Bred in Turkey, *Tarım Bilimleri Dergisi, Ankara Üniversitesi Ziraat Fakültesi* 2008 14(3) 303-312

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Comparison of Some Chemical Properties of Amik, Gavur and Golbasi Lakes Soil's

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Abstract

In this study, were carried out the chemical and total elemental analyses of the wetlands, Amik, Gavur and Golbasi Lakes. Amik Lake has a higher level of degradation and mineralization than the other two lakes. Therefore, the high pH and salt value of the plain soil caused the proportions of calcium carbonate and active crime in the soil to increase, the organic matter level and the altitude to be low. The salinity of the soil is less in the Golbasi Lakes. It is related to geological location and land use as it is related to less degradation of area land. Gavur Lake caused more soil organic matter content to remain under water due to inadequate drainage conditions. The presence of limestone and serpentine as a dominant cation of convertible calcium and magnesium in the Eastern Mediterranean Region, the material transported by the surface waters of the rains falling to the region was considered as the main factor in increasing the concentrations of calcium and magnesium in the lake areas. Golbasi Lake has lower sodium adsorption rate values than the soil of Gavur and Amik Lake soil, it can be said that the degradation of the soil is less and it is the result of the effect of the parent material in the region. In the results of the chemical analysis of three wetlands, Al_2O_3 and SiO_2 were hight found to be insoluble and resistant oxides, elements such as CaO, MgO and Na_2O are soluble and mobile elements, it was obtained as a result of this study that the soil is at high levels.

Keywords: Eastern Mediterranean, wetland, soil, chemical property

INTRODUCTION

Wetland, being a part of nature and natural events, was forced to undergo various changes through several interventions over time. The changes in the ecosystem brought about due to artificial interventions have considerably increased in the 20th century and wetland has been drained to attain new cultivated areas not only in Turkey but also in other countries (Finlayson & Davidson, 1996; Özesmi & Özesmi, 1997). Deterioration of wetland is encountered almost anywhere in the world. Changes in the hydrologic conditions being the foremost reason, the reasons of deterioration are listed as urbanization, marinas, industrialization, agricultural activities, silviculture and timber manufacture, peat supply and atmospheric accumulation (Altunbaş & Sarı, 2011).

Due to overirrigation, in areas, such as Çukurova, Gediz, Söke and Amik plain, the quality of soil has decreased, the rate of salinisation and fatal illnesses has increased and the fertilization has dropped. While the rising temperature and vaporization of the wetland speed

up the rate of the deterioration of the organic substances in these areas, it also causes the rainfall which is an important source for wetland to decline (Gülsaçan, 2008).

Reviewing the studies on the chemical properties of the soil, it was found that the content of organic properties were different between the old lake soil of the Kestel Lake and Golhisar Lake. The content of organic properties of the soil of the Kestel Lake was noted as 8.2% and that of the Golhisar Lake was found to be 74.1%. These values were compared with the values above the average of Turkey. The lime content of the Kestel Lake was found to be 22%, pH value of 8.3, and that of the Golhisar Lake was found to be 6.5%, pH value of 4.7. The analysis of properties, such as texture, structure, lime, organic matter and pH, before and after the deterioration of wetland showed a change in soil properties, and that these areas are insufficient in terms of agricultural activities (Altunbas, 2005). It was indicated that the soil salinity occurred with the increase of the Ca, Na, K and Mg cations and the value of EC. Furthermore, a positive relationship was found between the Na and pH and Na and SAR values in this study (Horneck et al, 2007). A study on the soil of the Van Castle wetland determined that the pH value of the soil was neutral and that the rate of salinity was within the limits (Kılıç et al, 2004). According to the results of the chemical results on the soil profiles in the Muratbagi village, Şarkikaraağaç province, Isparta which is located in the region of lakes, the amount of SiO_2 declined with the decrease of depth, and consequently this caused a decline in dissolution. In addition, the amount of CaO increased, and the rise in the amount of $CaCO_3$ in the soil was presented as an evidence (Senol, 2012).

As indicated in the above given review of literature, the wetland of our country and the world was claimed of having a high importance and the chemical properties of the soil area were investigated. In the present study the total chemical properties of the wetland of Amik, Gavur and Golbasi Lakes, which are among the most significant wetland regions in the East Mediterranean Region, and the relationship among them was investigated.

MATERIALS and METHODS

Being among the most important wetland areas in Turkey, the Amik Lake in the Hatay province, the Gavur Lake in the Kahramanmaras province and the Golbasi Lake in the province of Adiyaman were chosen for the area of study. The plain of Amik is positioned in the Asi basin which is on the 35°47’ and 36°24’ east meridian, and 35°48’ and 36°37’ north latitude (Kılıç et al. 2004). Being the second area of study, Gavur Lake is located in the deepest pit of the Saglik plain on the 37°18’ north latitude and 36°51’ east meridian (Korkmaz, 2005). Chosen as the third are of study, the Golbasi Lakes (İnekli Lake, Azaplı Lake, Golbasi Lake), which are the most important wetland areas between the Mediterranean and South-east Anatolian Region are located in the Golbasi depression in the East Anatolian fault zone (Master plan). A total of 89 soil horizon was determined in the areas of study.

The soil samples gathered based on the principles of Jackson (1962) were dried in a laboratory environment and were sifted through a 2 mm sieve. The saturation percentage (Demiralay, 1993), soil reaction (Thomas, 1996), electrical conductivity (Tüzüner, 1990), total of lime (Gülçur, 1974), active lime (Yaloon, 1957) were conducted based on the method of wet decomposition, and organic matter [20], useful phosphorus (Kuo, 1996 & Mcnelson et al, 1996), assignment of alternable cation (Helmke & Sparks, 1996) and the total chemical analyses were conducted based on the HF phusion (Yılmaz, 1990). The obtained analysis results were computed into the SPSS program (IBM SPSS Advanced Statistics version 19.0.0) and analysis of variance was conducted. After the analysis of variance of both the soil of the area and the soil in the mirror of the lake the difference of significant groups were analyzed with the Duncan multiple range test.

RESULTS and DISCUSSION

The results of the chemical analysis of the three different soil areas are presented in Table 1. The table shows that the soil of the Amik Lake has an average saturation value of 72.3%, a pH value of 8.24 and a total value of salinity of 0.56%. The soil of the Gavur Lake was found to have a saturation value of 101.6%, a pH value of 7.78 and a total value of salinity of 0.12%. The Gavur Lake has a higher water saturation percentage than the other two soil areas which is caused by the high level of organic matter of the soil of the lake area. The higher value of soil reaction of Lake Amik compared to the other two soil areas is explained by the fact that the deterioration value of the Amik plain is high and that it lost its wetland properties long before the Gavur Lake and the Golbasi Lakes. The decrease of organic matter which lowers pH that increased due to the dissolution of minerals in the soil plays an important role in the increase of the pH level. It was found that the soil of the Amik Lake holds 27.52% of total lime content and 0.28% of active lime, the soil of the Gavur Lake holds 19.71% of the total lime content and 0.23% of the active lime and the soil of the Golbasi Lakes holds 19.81% of the total lime content and 0.22% of the active lime. The fact that the Amik plain is surrounded by large mountains, which are generally made out of lime rocks, influenced the high level of lime content. Moreover, the finding of the high level of active lime contents in the soil of the Amik plain promotes the idea that the lime in this plain was transferred through water. In consequence of the low organic matter (1.23%) in the soil of the Amik Lake, the draining as the first dried area among the wetlands and mineralization the organic matter contents of the soils dropped a significant level. It was stated that the high level (11.42%) of organic matter in the soil of the Gavur Lake was an indication that the drying and drainage system in the lake area were not working in the expected effectiveness. The average of the useful phosphorus was found to be 6.95 mg kg^{-1}, 9.39 mg kg^{-1} and 10.69 mg kg^{-1} for the soil of the Amik, Gavur and Golbasi Lake, respectively.

Table 1. *Chemical properties of the soil of the research area*

								Exchangeable Cations				
	Satur.	pH	Total salt	Total $CaCO_3$	Active $CaCO_3$	Organic matter	Available P	Ca	K	Mg	Na	SAR
	%		%	%	%	%	mg kg^{-1}	cmolc kg^{-1}	cmolc kg^{-1}	cmolc kg^{-1}	cmolc kg^{-1}	
						Amik Lake						
Min.	33.9	7.91	0.02	7.52	0.10	0.31	1.13	14.70	0.10	9.38	0.08	0.02
Max.	126.6	8.45	2.27	62.07	0.70	3.31	28.52	31.11	3.59	18.49	10.23	2.95
Avrg.	72.3	8.24	0.56	27.52	0.28	1.23	6.95	24.41	0.88	14.45	2.65	0.64
						Gavur Lake						
Min.	49.2	7.46	0.05	1.13	0.01	0.77	0.63	5.36	0.20	2.99	4.92	1.03
Max.	193.8	8.22	1.09	49.40	0.54	50.96	28.67	37.34	1.52	17.95	8.36	3.77
Avrg.	101.6	7.81	0.36	19.71	0.23	11.42	9.39	23.63	0.45	8.57	6.57	1.80
						Golbasi Lakes						
Min.	38.7	6.51	0.04	0.79	0.05	0.42	0.61	18.87	0.16	0.98	0.05	0.01
Max.	289.0	8.09	0.96	61.26	0.42	35.67	42.25	38.26	1.40	18.02	6.24	1.40
Avrg.	76.4	7.78	0.12	19.81	0.22	5.44	10.69	28.83	0.61	9.44	1.90	0.42

Table 2. *Total chemical analysis results of the study area soil*

	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	MnO	K_2O	Na_2O	SO_3	P_2O_5	Cl
	%	%	%	%	%	%	%	%	%	%	%	%
						Amik Lake						
Min.	50.38	3.35	3.54	0.33	11.23	0.92	0.05	0.96	0.69	0.15	0.01	0.01
Max.	72.40	9.50	6.94	0.89	28.29	3.82	0.17	2.62	3.10	3.92	0.03	0.02
Avrg.	62.49	6.01	5.30	0.52	18.01	2.19	0.11	1.86	2.20	1.13	0.02	0.02
						Gavur Lake						
Min.	47.59	4.67	1.35	0.44	9.78	0.42	0.05	0.87	1.77	0.19	0.001	0.01
Max.	74.76	9.80	4.61	0.86	28.84	3.19	0.17	2.59	3.22	3.19	0.12	0.02
Avrg.	66.22	6.79	2.81	0.62	16.08	1.86	0.09	1.43	2.60	1.48	0.04	0.02
						Golbasi Lakes						
Min.	52.60	3.38	2.03	0.34	9.65	0.35	0.05	0.96	1.25	0.00	0.00	0.01
Max.	75.83	9.87	7.77	0.66	28.91	3.19	0.20	4.22	3.30	3.63	0.19	0.02
Avrg.	66.46	6.54	4.57	0.48	14.26	1.38	0.11	2.22	2.52	1.34	0.06	0.01

The changeable Ca of the areas of study was revealed to be between 24-28 $cmol_c\ kg^{-1}$ and it was found to be the highest among changeable cations. The finding of a high level of calcium was caused by the widespread presence of lime rocks rich in calcium in the sedimentary rocks. Ranked as number two, Mg was found to be between 8-14 $cmol_c\ kg^{-1}$ and being among the ultra basic rocks serpentine, which is rich in both lime stone and Mg, takes up large areas. The changeable magnesium contents of the soil of the Amik Lake is higher than the magnesium contents of the Gavur and Golbasi Lakes because of the widespread existence of serpentine based rocks in these areas. There is a strong possibility that the reason why the changeable potassium contents of the soil of the Amik Lake are higher than those of the soils of the Gavur and Golbasi Lake is the fertilizers with potassium which are used due to a larger agricultural production in this area. As a matter of fact, it was observed during the fieldworks that agricultural production was more intensive in the Amik plain than the other areas and that a high level of fertilizers, some of which included potassium, was used. The highest sodium adsorption rate (SAR) of the three different areas of study was found in the soil of the Gavur Lake (SAR 1.80), the second highest in the soil of the Amik Lake (SAR 0.64) and the lowest in the soil of the Golbasi Lake (SAR 0.42). Because the Golbasi Lakes have lower SAR values compared to the Gavur and Amik plains, it was deduced that soil deterioration developed less, the drainage conditions are better and the main material of the area can be influential factors.

The analysis of the total element in the soil of the lake area was presented in Table 2. As a result of the analysis the total value of SiO_2 (62.49-66.46 %) was found to be of higher rate than the other elements. The second most found element was CaO (14.26-18.01 %) and the third most found was identified as the total Al_2O_3. In more detail, the total element analysis showed that the CaO was as high as 14% in the soil of the Golbasi Lake, 16% in the soil of the Gavur Lake and 18% in the soil of the Amik Lake. It was considered that the calcium level was connected with the lime rock commonly found in area and it was evaluated as product of the runoff water coming from these areas. The decline in soil reaction due to the rise in altitude and the decline in the level of total calcium oxide and magnesium oxide were evaluated as being coherent. The evidence of this phenomenon was that the value of total MgO level was the lowest in the soil of the Golbasi Lake which is also the lake with the highest altitude. The Amik Lake wetland which was the first dried area was found to have the highest total Fe_2O_3 level. The lower level of silicon and aluminium in the soil of the Amik plain compared to the other areas of study and the proportionately high level of iron oxide was interpreted as the impact of the presence of volcanic basaltic rocks. The fact that decipherable elements, such as calcium, magnesium and sodium, are cumulative in the soil profile can be asserted as an indication that the drainage system is not very prospering. The commonly found lime rocks rich in calcium and the runoff water that reaches the area through passing serpentine rocks rich in magnesium are significant factors influencing the increase in these areas. It is stated that substantial rates of sodium which cause issues in terms of alkaline soil was found and that it is necessary to monitor these areas in terms of alkaline.

The statistical analyses of the soils the Amik, Gavur and Golbasi Lake found a significant negative relationship (0.01 %) between the saturation and pH value of the soils. It is interpreted that a high saturation level indicates a high number of small particles in inorganic soils. Movements in the profile of basic elements are more limited in heavy than in light textured soil. It was observed that the movements of basic cations in heavy textured soil in wetland are bigger (Abacı Bayan, 2016). A significant positive relation was found between the saturation value of the soils and the changeable Ca and Na parameters (5 %, 5 %). Furthermore, a significant positive relation was discovered between the pH values of all soil samples and the total $CaCO_3$ and active $CaCO_3$ values (1 %, 1 %). Due to the climate zone,

geological structure and geographical position of Turkey, soils hold a high level of lime and pH and low content of organic matter. A significant positive relation was reached between the soil's pH and the total lime ($p<0.01$) and a strong and positive correlation was found between the content of $CaCO_3$ and pH (Ersahin et al, 2013). The findings of the correlation analysis of the soils of study showed a significant negative relation between the pH level and the value of organic matter and phosphorus. Moreover, they also revealed a positive relation between the changeable Mg and the total MgO values (0.1 %, 5 %, 5 %).

A significant positive relation was found between the total lime and active lime content, as well as between the total lime content and changeable calcium (0.1 %). However, a negative relation was revealed between the total lime and organic matter content (1 %, 1 %).

Recent studies reported that the movement of granular, large lime in the soil is lower than the clay-sized lime which is also known as active lime (Abacı Bayan, 2016). This clay-sized lime's fraction increases in parallel with the increase of the content of lime. Conducted on the soil of the Harran plain, Şanlıurfa province, based on the horizon principles, the results of the mineralogical and chemical analysis revealed that the active lime value, which is an indicator of fine lime, increases the more the value of the total lime increases. In addition, a positive correlation was found between the active and the total lime (0.1 %) (Yılmaz, 1997). Similar results were reported in the studies by Reyes et al (2006) and Altun Gül & Karaca (2011). A significant positive relation was found between the active lime content in the soil and the changeable calcium content (1 %). It was stated by Yaloon (1957) that the concentration of calcium and ion in the soil is increased by the large rate of $CaCO_3$ content in the soil. A significant negative relationship was identified between the useful phosphorous contents and changeable calcium. Moreover, a significant negative relationship was found between the useful phosphorous contents and changeable magnesium (1 %, 0.1 %). This negative relationship revealed that a high level of Ca and Mg had an impact on the phosphorous level which can be obtained in circumstances where the pH of the soil is alkaline. The results of the statistical analyses indicated a significant negative relationship between the changeable calcium content and rate of sodium adsorption (0.1 %). Calcium, which ensures flocculation, and sodium, which causes dispersion, possess opposite movement mechanisms. Similar findings were reported by the studies of Olusegun and Samuel (2014) and Mahmood et al (2013).

The correlation analysis resulted with a negative relation between the changeable magnesium content and SAR. Moreover, a negative relation was found between the changeable magnesium content and P_2O_5 (5 %, 5 %). In a study on the Malaysian forest soils, a high value of changeable cations was reported despite the low number of the total phosphorous content (Amlin et al, 2013). A significant negative relationship was reached between the changeable sodium content and Fe_2O_3 content, and a positive relationship between the changeable sodium content and SAR value. Consistent results were found in the soil sediments of wetland in the south-west of Nigeria (Olusegun and Samuel, 2014). The statistical analyses found a significant negative relationship between the contents of the rate of sodium adsorption of the soils and the P_2O_5 content (5 %). In the study on saline soil, it was reported that the more the total phosphorous content increases, the lower the SAR value drops (Mahmood et al, 2013).

After the one-way analysis of variance on the chemical distribution of the soils of study, the significant groups were compared with the use of the Duncan Multiple Rage test and the results are presented in Table 3. The reason why the saturation percentage of the Gavur Lake is different and higher than the other two lake soils is the fact that the soil of the Gavur Lake holds a large rate of organic matter. The finding that the soil reaction of soil of the Amik Lake is different and higher from the other two lake soils is a result of not only the

high total and active lime contents in the soils of the areas of study, but also the very low organic matter, useful phosphorous and elevation. It was interpreted that the lower value of salinity of the soil of Golbasi Lakes compared to the other two lake soils is an indication of the low level of degradation and minor misuse leading to salification on these soils.

The fact that the large mountains surrounding the Amik plain are generally made out of lime rocks in terms of active lime properties, that these soils hold a high amount of lime content and that the active lime properties are also high supports the idea that the lime of the plain was carried through water. The amount of organic matter of the soil of Amik Lake rapidly decreased depending on the oxidation conditions because of its low organic matter content and being dried before the other soil areas of study. Among the soils of study, the least degraded ground soil is the soil of Golbasi. Because the lake is being protected, the soil samples were collected from the coastal region of the lake. In spite of the fact that the soil's organic matter level was found to be lower than the soil of the Gavur Lake, it is detected that the organic matter level of the organic profiles are high once the mineral profiles are overlooked. A strong possibility exists that the reason why the soils of the Amik Lake possesses a higher and statistically different level of changeable potassium contents from the Gavur and Golbasi Lake soils is the fact that more intensive agricultural production were conducted in this area compared to the other two areas which lead to the use of potassium fertilizers. Indeed, it was observed during the fieldworks that the Amik plain is more intensively used for agriculture than the other areas, that an extensive amount of agricultural fertilizers are used and that potassium fertilizers are among these fertilizers. The finding of the lowest silicon and aluminum level in the soil of the Amik plan and the highest level of iron oxide is considered to be caused by the features of the main material in the soil region. Furthermore, the presence of large basaltic areas rich in iron close by Hassa, which sustains the plain, is considered to be influential in the high level of iron oxide.

It was interpreted that the high amount of total $CaCO_3$ content in the soil of the Amik plain, and consequently, a higher level of CaO in these soils is effective in the scarcity of SiO_2. It was found that the level of total potassium in the soils of the Golbasi Lakes are higher compared to the other lake soils, and the total potassium level of the soil of Gavur Lake was revealed to be the lowest. It was observed in the fieldworks that the use of potassium fertilizers in the Amik plain was considerably higher than the other areas due to intensive agricultural activities. As a result of this implementation, the level of changeable potassium was found to be higher than the other areas.

Table 3. *Duncan Test results of soil chemical properties*

Area	Satur.	pH	Total salt	Total $CaCO_3$	Active $CaCO_3$	Organic matter
	%		%	%	%	%
Amik Lake	$72.3^{b}\pm8.4$	$8.2^{a}\pm0.5$	$0.6^{a}\pm0.06$	$27.5^{a}\pm2.48$	$0.3^{a}\pm0.02$	$1.2^{c}\pm1.33$
Gavur Lake	$101.8^{a}\pm7.4$	$7.8^{b}\pm0.5$	$0.4^{a}\pm0.08$	$19.7^{b}\pm2.17$	$0.2^{ab}\pm0.02$	$11.4^{a}\pm1.16$
Golbasi Lake	$76.4^{b}\pm5.7$	$7.8^{b}\pm0.4$	$0.1^{b}\pm0.09$	$19.8^{b}\pm1.69$	$0.2^{b}\pm0.02$	$5.4^{b}\pm0.91$
Significant level	$p<0.012$	$p<0.00$	$p<0.00$	$p<0.025$	$p<0.00$	$p<0.00$

Mean values indicated by different symbols in the same column are statistically significant at $p\leq0.05$ level according to Duncan test.

Table 4. *Duncan Test results of soil chemical properties (continue)*

Area	Available P	Exchangeable Cations				
		Ca	K	Mg	Na	SAR
	mg kg^{-1}	$cmol_c$ kg^{-1}	$cmol_c$ kg^{-1}	$cmol_c$ kg^{-1}	$cmol_c$ kg^{-1}	
Amik Lake	6.95±1.54	24.41^{b}±1.04	0.88^{a}±0.09	14.45^{a}±0.72	2.65^{b}±0.40	0.64^{b}±0.11
Gavur Lake	9.39±1.35	23.63^{b}±0.91	0.45^{b}±0.08	8.57^{b}±0.63	6.57^{a}±0.35	1.80^{a}±0.10
Golbasi Lake	10.69±1.05	28.83^{a}±0.70	0.60^{b}±0.06	9.44^{b}±0.49	1.90^{b}±0.27	0.42^{b}±0.08
Significant level	p<0.06	p<0.00	p<0.001	p<0.00	p<0.00	p<0.00

Mean values indicated by different symbols in the same column are statistically significant at p≤0.05 level according to Duncan test.

CONCLUSION

In conclusion, having undergone various agricultural activities, the soil of the Amik Lake has lost its properties as a wetland due to its high level of soil deterioration based on its earlier drying compared to the other lake soils. Despite the areal rise in the agricultural land through drying, it was concluded that nowadays the soil productivity in terms of plant production of the Amik plain is low and that issues will be encountered in the future, considering the existing negative properties of the soil. Being dried in the second rank, the Gavur Lake became a wetland. It was realized that agricultural production did not develop to the expected level in the area which is under water for most of the year due to the lack of drainage channels in the soil. Additionally, it was observed that these wetland areas were lacking in providing economic and natural contributions because it lost the property of being a wetland. Having the least soil deterioration and being protected by the ministry of forestry and water affairs, the Golbasi Lakes were detected to maintain the wetland property of their soils at better level compared to the other lake soils (Abacı Bayan, 2016).

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REFERENCES

Abacı Bayan A.A. 2016. Characteristics, Efficiency Levels and Problems of Soils in Wetlands in Eastern Mediterranean Region. Kahramanmaraş Sutcu Imam University, Institute of Science, Department of Soil Science and Plant Nutrition, PhD thesis.

Altun Gül S. & Karaca A. 2011. Determination of Agricultural Usage Potential of Organic Soils of Denizli-Çivril Gökgöl. Soil And Water Symposium.

Altunbaş S. 2005. Investigation of the Degradation Dimensions of Some Wetlands in the Lakes Region at Substrate Level. Doctoral Thesis. Akdeniz University, Institute of Natural Sciences, Department of Soil Science, August.

Altunbaş S. & Sarı M. 2011. Relations Between Some Physical Properties and Production Potentials of Soils Gained from Dried Kestel Lake, Akdeniz University, Journal of Agricultural Faculty, 24 (1):61-65.

Amlin G. Suratman M.N. Nadhirah N. & Isa M. 2013. Soil Chemical Analysis of Secondary Forest 30 Years after Logging Activities at Krau Wildlife Reserve, Pahang, Malaysia. ScienceDirect. Pp.75-81.

Arslanargun H. 2011. Morphological and Taxonomic Investigations on Some Spathid Ciliates (Protista, Ciliophora, Haptoria) in Wetlands of Van Castle. Graduate thesis. Yüzüncü Yıl University, Institute of Science, Van.

Babalola T.S. Oso T. Fasina A.S. & Godonu K. 2011. Land evaluation studies of two wetland soils in Nigeria. International Research Journal of Agricultural Science and Soil Science (ISSN: 2251-0044) Vol. 1(6) pp. 193-204 August.

Demiralay İ. 1990. Soil Physical Analysis. Atatürk University Agricultural Faculty Publications No: 143, ss: 131, Erzurum.

Erşahin S. Aşkın T. Sünal S. Bender Özenç D. Tarakçıoğlu C. Korkmaz K. Kutlu T. & Dikmen Ü. 2013. Spatial Variability of Colloidal-Alluvial Soils in Central Black Sea Region. III. National Soil and Water Resources Congress 22-24 October.

Finlayson C.M. & Davidson N.C. 1996. Global Review of Wetland Resources and Priorities for Wetland Inventory: Project Description and Methodology. Environmental Research Institute of the Supervising Scientists, Jabiru, Australia. International Co-ordination Unit, Wetland International, Wageningen.

Gülçur F. 1974. Physical and Chemical Analysis Methods of Soil, Istanbul University Forest Faculty Publications, İ. Ü. Yayın No: 1970, O. F. Yayın No: 201, Kutulmuş Matbaası, İstanbul.

Gülsaçan M. 2008. No Wetlands and Greenhouse Gas Emissions, Science and Technology Magazine, Science and Technology News, September.

Helmke P.A. & Sparks D.L. 1996. Lithium, Sodium, Potassium, Rubidium, and Calcium, in Sparks, D.L., (Ed) Methods of Soil Analysis, Part 3, Chemical Methods, SSSA Book Series Number 5, SSSA., Madison,WI, P:551-574.

Horneck D.A. Ellsworth J.W. Hopkins B.G. Sullivan D.M. & Stevens R.G. 2007. Managing SaltAffected Soils for Crop Production. A Pacific Northwest Extension. Oragen State University.

Jackson M.L. 1962. Soil Chemical Analysis. Advanced Course. 2nd ed. Published by the Author, University of Wisconsin, Madison, 8955.

Kılıç G. Ağca N. & Yalçın M. 2004. Soils of Amik Plain (Turkey): Properties and Classification. Jour. of Agron. 3: 291-295.

Korkmaz H. 2005. Effects of the Drying of Amik Lake on Local Climate. MKÜ. BAP. Project, Proje No: 03 F 0701, Antakya.

Kuo S. 1996. Phosphorus in D.L. Sparks (Ed) Methods of Soil Analysis, Part 3, Chemical Methods, SSSA Book Series Number 5, SSSA., Madison,WI, P: 869-921.

Mahmood I.A. Ali A. Aslam M. Shahzad A. Sultan T. & Hussain F. 2013. Phosphorus Availability in Different Salt-affected Soils as Influenced by Crop Residue Incorporation. Internatıonal Journal Of Agrıculture & Bıology 1814-9596 12-905/2013/15-3-472-478.

McNelson D.W. & Sommers L.E. 1996. Total Carbon, Organic Carbon, and Organic Matter. P: 9611011. In D.L. Sparks (ed) Method of Soil Analysis: Chemical Methods. Part 3. SSSA, Madison, WI.

Olsen S.R. Cole V. Watanabe F.S. & Dean L.A. 1954. Estimation of Available Phosphorus in Soils by Extraction With Sodium Bicarbonate, USA.

Olusegun A.J. & Samuel A.A. 2014. Assessment of soil sediments and salinity status of wetland landscape as affected by climate change in south-western Nigeria. Standard Global Journal of Agricultural Sciences Vol1 (1): 001-009, April.

Özesmi U. & Özesmi S. 1997. Definition and Conservation of Wetlands in the United States: For Turkey. III. National Ecology and Environment Congress, Kırşehir, s. 40-42.

Reyes J.M. Campillo M.C. & Torrent J. 2006. Soil Properties Influencing Iron Chlorosis in Grapevines Grown in the MontillaMoriles Area, Southern Spain. Communications in Soil Science and Plant Analysis, 37: 1723-1729.

Şenol H. 2012. Physical, Chemical and Mineralogical Properties of Common Large Soil Groups in. PhD Thesis Soil Science and Plant Nutrition Department. Süleyman Demirel University Graduate School of Natural and Applied Sciences-Isparta.

Ministry of Agriculture and Rural Affairs, Project for Supporting the Preparation of Master Plan for Provincial Agriculture and Rural Development, Adıyaman Agriculture Master Plan, December,

Thomas G.W. 1996. Soil pH and Acidity. pp:475-491. In D.L. Sparks (ed) Method of Soil Analysis: Chemical Methods. Part 3. SSSA, Madison, WI.

Tüzüner A. 1990. Soil and Water Analysis Laboratories Handbook. T.C. Ministry of Agriculture, Forestry and Rural Affairs General Directorate of Village Services. pp.21-27.

Yaalon D.H. 1957. Problems of Soil Testing on Calcareous Soils. Plant and Soil,8,275- 288.

Yıldız O. Eşen D. Sargıncı M. &Toprak B. 2008. Change in Carbon Storage Capacity of Soil Eluant Soil Area and Soil, VIII. National Ecology and Environment Congress,20-23 october 2008 Girne/KKTC Vuni Palace Hotel Kongre Merkezi.

Yılmaz K. 1990. Mineralogical Characterization of Harran Plain Soils. Doctoral Thesis. Ç. Ü. Institute of Science and Technology, Adana.

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Tissue Culture Applications in Lettuce (*Lactuca sativa* L.)

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Abstract

Lettuce (*Lactuca sativa L.*) is a major fresh leafy vegetable and belongs to the *Asteraceae* family (Compositae). The focus of modern lettuce breeding objectives is to improve horticultural characteristics such as quality, resistance to early bolting and breeding for resistance to pests and diseases. These characteristics may be improved using biotechnology and gene transfer strategies. Tissue culture methods have proved successful in rescuing selected lettuce genotypes and producing seeds in a disease-free environment. And also overcome the limitations of *in vivo* techniques by shortening period of breeding programmes. The genetic engineering of lettuce requires a reliable and efficient tissue culture methods. Among these methods haploidization is of great interest for producing pure lines. Shoot organogenesis may aid the use of genetic engineering to improve important characteristics of lettuce. Embryo rescue is an important application for transfering the resistance to downy mildew, *LMV*, and beet western yellows virus from *L. virosa* and *L. saligna* into cultivated lettuce. Somatic hybridization via protoplast fusion has also been used to gain access to exotic, sexually incompatible germplasm. Propagation from axillary and apical buds of lettuce plants can also be routinely carried out. If propagation through tissue culture can be done efficiently on a large scale, it may be used to produce F_1 hybrid plants and fix the hybrid vigour. Somaclonal variation provides another source of genetic variability. Regeneration via Somatic embryogenesis has advantages for lettuces.

Keywords: Lettuce, Somatic embryogenesis, Haploidization, Shoot organogenesis, Somaclonal variation, Somatic hybridization

INTRODUCTION

Lettuce (*Lactuca sativa* L.), a fresh leaf vegetable, is a prominent vegetable for consuming and harvesting. They are a self-fertilising species that can be produced yearly, with cultivation being possible all over the world. While the beginnings of lettuce can be traced to the Middle East and south-west Asia, today they are mainly produced and consumed in Europe and the United States (Ryder, 1986). Different regions can have different preferences in colours, shapes, sizes, and flavours. In 2016, Turkey produced 233 662 tons of butter-head lettuces, 179 712 tons of normal lettuces, and 65 068 tons of icebergs (head salad) (Anonymus, 2017).

Due to the high nutrition level found in lettuce and the health benefits resulting from them, especially when eaten in freshly made salads, their production rate continues to increase daily. However, different varieties that are adapted to various growing conditions and seasons may be needed (Siddiqui, 2014). Thus, for the successful cultivation of lettuce (*Lactuca sativa* L.), from the germplasm of their field-grown versions, they must be assessed, selected, and rescued in a short amount of time. For this purpose using tissue culturing methods have been shown to result in efficient rescuing of the lettuce genotypes that were chosen and

consequently developing seeds in environments free from disease (Jenni et al. 2006). Because of the significance of lettuce, breeders have utilised various tissue cultures (Pink et al. 1987; Ampomah-Dwamena et al. 1997) and genetic manipulation techniques (Kim et al. 2004) with every technique needing a certain amount of totipotency for a favourable outcome. To develop better crops by manipulating novel characteristics, both *in vivo* and *in vitro* techniques are involved. For decreasing the long times of breeding programmes, which is a limitation of *in vivo* techniques, *in vitro* techniques like anther and cell suspension cultures from callus, tissue culture, shoot organogenesis, somatic hybridization by protoplast fusion, and somatic embryogenesis can be applied. This is because the *in vivo* techniques use up a lot of time and has the problem of pre and post-zygotic sexual incompatibility between species (Matsumoto, 1987). In this paper, we will summarize the tissue culture methods used in lettuce.

Somatic Hybridization Via Protoplast Fusion for Lettuce

In 1982, field testing and selection for desirable characteristics in head lettuce plants derived from protoplasts was done for the first time Engler and Grogan, 1982). For an efficient method to remove the difficulties associated with interspecific crossing, somatic hybridization by protoplast fusion can be used. This technique has recently been successfully implemented for raising new traits in new varieties that were a demand in the market for the *Lactuca* species (Siddiqui, 2014). Polyethylene glycol and electric methods can both be used to obtain lettuce protoplast fusion easily (Taniguchi, 1990). Somatic hybrids between *L. sativa* and *L. serriola* were acquired (Matsumoto, 1987). From lettuce, *Lactuca sativa* L., developed in greenhouses and growth chambers, and from shoots, roots, and cotyledons of seedlings developed *in vitro*, protoplasts can be obtained (Berry,1982). Between Evola and Red Leaf Amboni lettuce cultivars, green and red respectively, somatic hybridization was conducted so that the investigation on the culture could be carried out in four media types by polyethylene glycol (PEG) and electro fusion. While other treatments were observed to damage the protoplast, it was shown that chemical and electro- fusion of both micro and macro colonies (where in petri dishes there were 5 to 73 average micro colonies) resulted in significant outcomes for fused protoplasts when treated with the T4 treatment for each replication. Additionally, electro fusion was shown to result in protoplast fusion of 40.51% frequency over PEG (Siddiqui, 2014).

By utilizing universal hybridizers containing both dominant and recessive characters, it has become much easier for selecting somatic hybrids from some model plants. The development of backcross progenies with *L. sativa* is ongoing for female fertile plants. Due to various desirable traits like virus, fungi (*Bremia lactucae*), and bacteria resistance have been identified in wild *Lactuca* species, it now seems that using somatic hybridization in breeding programmes is an efficient possibility (Chupeau et al. 1994).

For obtaining germplasm that are exotic and sexually incompatible, protoplast fusion has been employed. It was recorded by (Mazier, 1999). That hybrids between *Lactuca sativa* and two wild *Lactuca* species, *L. tatarica* and *L. perennis*, were acquired via the protoplast technique. However, there was a significant limit in the development of useful plant material due to the regrown plants having very low fertility even when numerous backcross generations were produced. In addition, hybridization of *L. sativa* and *L. virosa* somatically was produced but with all the developed plants showing sterility (Matsumoto, 1991). Although the development of offspring of the other wild species that were investigated, like *L. perennis*, *L. viminea*, *L. juncea* and *L. tatarica*, was not found to be successful, even with many attempts of pollination via different breeders using numerous lettuce lines and different

wild specie accessions. *In vitro* rescue of immature embryos obtained from interspesific hybridization between *L. sativa* and *L. virosa* was reported to be successful when performed under tissue culture conditions. For obtaining vigorous hybrid plants, hybridizaton of *L. sativa* and seven accessions of *L. virosa* were performed. The regeneration of somatic hybrids between *L. sativa* and either *L. tatarica* or *L. perennis* was performed through protoplast fusion and as final outcome of *L. sativa* and *L. tatarica* hybrids were backcrossed to *L. sativa* (Maisonneuve et al. 1995).

Somatic Embryogenesis for Lettuce

One of the useful ways for large-scale propagation of plant material is propagating by somatic embryogenesis *in vitro*. However, for the production of lettuce, there is still no advance in a full protocol development for somatic embryogenesis. Two explant sources (sectioned and whole cotyledons) were developed so that somatic embryogenesis could be initiated. All induction, proliferation, maturation, and conversion of the somatic embryos were satisfactory, particularly in liquid systems, for the mass production of the Paris White lettuce genotype with regards to potential commercial applications (Pinheiro, 2012). Both juvenile and mature tissues could be used as well as explants taken from a wide range of plant species to develop somatic embryos (Seabrook and Douglass, 2000).

A two-step protocol was reported (Seabrook and Douglass, 2000) for the redevelopment of somatic embryos for a wide range of potato (*Solanum tuberosum* L.) genotypes, ploidy and tissues, *in vitro*. Seven cultivars of lettuce were used to redevelop somatic embryos, using these protocols.

For the redevelopment of the somatic embryos, excisions of stem, petiole, and leaf tissues were utilized. Even though stem-internode sections were mainly more productive, the lettuce explant (stem-internode, leaf, and petiole) seedlings from all the cultivars showed redevelopment. While, leaf and petiole explants was the most productive for redevelopment from mature lettuce tissues (Seabrook and Douglass, 2000).

An effective method for using three commercial lettuce cultivars (*Lactuca sativa* L. cv. Great Lakes 659-700, Salad Bowl, and Prize Head) from which cell suspensions were obtained directly and shoots were regenerated, was reported by Teng et al. Among the factors investigated for effecting cell growth and differentiation of the suspension culture (which consisted of callus quality, light intensity, carbohydrate type and concentration, auxins, and cytokinins), it was found that callus quality and carbohydrates were the most important. SH (Schenk and Hilderbrandt) basal medium with 1000 mg myo-inositol/L, 1.5% glucose, 0.44 μM BA, and 0.54 μM NAA was found to be the best medium for the regeneration of shoots in the suspension culture with a 5.8 pH. With these conditions, it was observed that from cell aggregates of 50 to 55 mg (dry weight), hundreds of shoots were developed within two weeks (Teng et al. 1992).

Haploidization for Lettuce

More productive breeding tools are needed for programmes for the improvement of plants. For the development of pure lines haploidization is of great importance amidst these (Piosik et al. 2016).

For the development of embryos to be induced with *L. sativa* maternal genome, the distant pollination technique was applied from the various haploidization methods that have been known to be successful in other species. Pollen grains from 25 different species were utilized for encouraging the process of parthenogenesis in lettuce to begin. The crosses between the *H. annuus* and *H. tuberosum* species pollen were found to be the most productive among these, and they were also used for the ensuing experiments (Piosik, 2013).

For deducing an effective method for haploidization in lettuce (*Lactuca sativa*), chemical treatment of pistils or wide crossing of lettuce with 25 species (*Asteraceae* family mostly) were carried out to start the development of haploid embryos. Crossing with *Helianthus annuus* (16%) or *H. tuberosum* (19%) resulted in the highest embryo frequencies. With all the embryos that showed globular or heart stage development, it was observed that they were haploid (n=9) (Łukasz, 2014; Mazier et al. 2003).

As there was no further development observed in the haploid pro-embryos after pollination, even with cellular endosperms being present, distant pollination using *Helianthus annuus* L. or *H. tuberosus* L. fresh pollen grains were carried out *in vivo*. This resulted in the regeneration of 23 haploid *L. sativa* plants (Piosik et al. 2016).

In Vitro Evaluation Of Disease Resistance In In Vitro Cultivated Lettuce

By examining *Lettuce Mosaic Virus* (*LMV*) infections on either newly regenerated plantlets or *in vitro* cultivated seedlings *in vitro*, the possibility of developing a new inoculation and propagation method for *LMV* infection of lettuce (*Lactuca sativa* L.) was examined (Mazier et al. 1999). They found that inoculating lettuce plants *in vitro*, under sterile conditions, with *LMV* was both possible and not difficult to do (Mazier et al. 2003). It was also shown in another study that, tolerance to downy mildew, *LMV*, and beet western yellows virus could be transferred to cultivated lettuce (*Lactuca sativa* L.) from *L. saligna* and *L. virosa* (Maisonneuve, 2003) Koyama et al. developed a universal method for lettuce tipburn susceptibility testing, *in vitro*. For verifying the dependability of the *in vitro* results for hydroponic experiments, two cultivars were chosen (Koyama, 2012).

Interactions of Genotype And Culture Medium Affecting Shoot/Root Organogenesis

Both plant growth regulators and genotype together highly effects the regeneration of shoots in lettuce (Doerschug and Miller, 1967). were the first researchers to report the successful regeneration of shoots from cotyledon explants which were cultivated in a medium with 5 mgl^{-1} IAA and 0.5 mgl^{-1} kinetin. In another study, the effects of different concentrations of NAA and BAP on the induction of callus, average number of shoot regeneration per leafy explant, and shoot-producing explant percentage were studied. It was observed that under low NAA and BAP concentrations, lettuce explants resulted in low callus formation and direct shoot regeneration increased (Latif et al. 2014).

Lettuce plants developed in fields, which were chosen for seed production, were used for breeding healthy plants by constructing a tissue culture method in which Murashige and Skoog's (MS) medium was used. For the successful development of shoot growth from axillary bud explants (2-3 mm long), a medium consisting of MS + 1.0 or 2.0 mgl^{-1} kinetin and 6.4 mgl^{-1} IAA was used. Although, kinetin of 0.5 and 4.0 mgl^{-1} concentrations resulted in poor shoot growth. After transferring the cultures form MS + 1.0 mgl^{-1} kinetin to MS + 6.4 mgl^{-1} IAA and from MS + 2.0 mgl^{-1} kinetin to MS + 4.8 mgl^{-1} IAA, successful rooting was

observed after 3 to 4 weeks. Additionally, 3.2 and 8.0 mgl^{-1} IAA concentrations resulted in poor initiation of roots. It was also observed that for the cultures developed at 40 Wm^{-2} of light there were more root initiation than those in 5 Wm^{-2} of light. Once the rooted cultures were planted and formed in compost with a success rate of 90-95%, the regenerated plants flowered after 18 weeks [5]. Due to explants that are incubated under light resulting in the development of more shoots, light is an important factor for shoot regeneration (Webb et al 1984).

For the identification of genotypes, especially those that are susceptible to genetic manipulation at the cellular and molecular level, screening of lettuce cultivars comprising of a large variety that represent the four main morphological types has occurred. [30] and [6] researched how a media with 0.1 mgl^{-1} IAA, 0.5 mgl^{-1} kinetin and 0.05 mgl^{-1} zeatin effected the genotypes of lettuce for the regeneration of shoots from cotyledon explants. Regenerating plant genotypes in tissue cultures is the key to success for these methods involving genetic manipulations. It was also stated by Vanjildorj et al. that using cotyledon explants of lettuce to result in shoot regeneration successfully in media containing 0.5 mgl^{-1} kinetin and 0.05 mgl^{-1} NAA was also possible (Vanjildorj, 2005).

Additionally, it was reported that by using media with 0.54 μM NAA and 0.44 μM BA for culturing isolated cotyledon explants, the percentage of explants developing shoots and the mean shoot number per explant doubled after 3-14 days once germination occurred as opposed to other combinations of auxins ad cytokinins (1= 28.54 μM IAA, 32 μM kinetin, 0.23 μM zeatin; 2= 0.57 μM IAA, 2.32 μM kinetin; 3= 0.57 μM IAA, 0.44 μM BA) (Hunter and Burritt, 2002). While in another study, after a number of different types of media were used for studying five different genotypes, a high number of regenerations (more than 2 shoots per cotyledon explant) of shoots were observed when a medium consisting of 0.1 mgl^{-1} NAA and 0.1 mgl^{-1} BA was used (Kanamoto et al. 2006).

For the initiation of callus formation (Dias et al. 2006), after seeds were germinated for 48 hours, cultured cotyledons and placed the callus into a MS medium which had 0.1 mgl^{-1} BA and 0.1 mgl-1 IBA added to it, after which the callus, for the indirect regeneration of shoots, was then placed into MS media with 0.1 mgl^{-1}. After various combinations of NAA and BAP were studied for observing their effects on the induction of callus and the regeneration of shoots from lettuce cotyledon explants, it was detected that at low concentrations of BA, the most number of direct regeneration of shoots occurred (Mohebodini, 2011).

CONCLUSIONS

Industrial and agricultural applications have taken precedence in research conducted on tissue cultures in the past decade. Among the applications that have been successful in tissue culturing, the most important have been somaclonal and gametoclonal selection of variants to produce new varieties, utilizing androgenises routinely for programmes related to plant breeding, using genetically manipulated cells for transgenic plant regeneration, industrial compound development, and crop plant and endangered species germplasm preservation. Various factors have an effect on the responses observed by tissue cultures among experiments, with some not being measurable nor controlled (George, 1993). A diverse response amidst genotypes was indicated by the regeneration of shoots in culture. It was recently determined that for the regeneration of a large order of lettuce genotypes, an enhanced culture medium was possible (Xinrun and Connor, 1992).

Lettuce haploids supply a good foundation for the development of double-haploid (DH) lines, and the production of novel varieties of the common lettuce species can be possible in the future (Piosik et al. 2016). Additionally, from the area near cotyledon petioles, direct regeneration of shoots could help by improving characteristics of lettuce that are valuable via aiding in genetic manipulations (Mohebodini et al. 2011). For lettuce regeneration, it was observed that somatic embryogenesis was effective. For starting material employment a better stock plant should be used for clonal propagation from plant mature tissues (Seabrook and Douglass, 2000). Interspecific hybrids were developed successfully between *L. sativa* and wild *Lactuca* species by using an immature embryo *in vitro* culture and somatic hybridization (Siddiqui, 2014; Jenni, 2006, Chupeau, 1994; Maisonneuve, 1995). It can be expected that utilizing the aforementioned techniques for breeding purposes, could, in the future, assist in increasing lettuce variability.

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REFERENCES

Ampomah-Dwamena C., Conner A. J. and Fautrier A. G.1997. "Genotypic response of lettuce cotyledons to regeneration *in vitro"*, Sci Hort., 71, 137–145.

Anonymus 2017. Turkish Statistical Institute https://biruni.tuik.gov.tr/bitkiselapp/bitkisel.zul.

Berry S. F., Lu D. Y., Pental D. and Cocking E. C.1982. "Regeneration of plants from protoplasts of *Lactuca sativa* L.", Z. Pflanzenphysiol., 108, 31-38.

Chupeau M. C., Maisonneuve B., Bellec Y. and Chupeau Y. A. 1994. "*Lactuca* universal hybridizer, and its use in creation of fertile interspecific somatic hybrids", Mol. Gen. Genet., 245, 139-145.

Dias B. B. A., Cunha W. G., Morais L. S., Vianna G. R., Rech E. L., de Capdeville G. and Aragão F. J. L. 2006. "Expression of an oxalate decarboxylase gene from *Flammulina* sp. in transgenic lettuce (*Lactuca sativa* L.) plants and resistance to *Sclerotinia sclerotiorum*", Plant Pathol., 55, :187–193.

Doerschug M. R. and Miller C. O. 1967. "Chemical control of adventitious organ formation in *Lactuca sativa* explants", Amer. J Bot., 54, 410–413.

Engler D. E. and Grogan R. G.1982. "Protoplast regeneration", California Agriculture, 36 (8), 18-19.

George E. F. 1993 Plant Propagation by Tissue Culture: Part 1. The Technology. Ed. 2, Exegetics Ltd., Westbury, England, 574 pp.

Hunter D. C. and Burritt D. J. 2002." Improved adventitious shoot production from cotyledon explants of lettuce (*Lactuca sativa* L.)", Sci. Hort., 95, 269–276.

Jenni S., Loukili F. and Moghaddam B. E. 2006 "*In Vitro* culture response of apical and axillary shoot-tips excised from crisphead lettuce cores depends on head maturity, not storage time", *In Vitro* Cell. Dev. Biol.-Plant, 42, 274–277.

Kanamoto H., Yamashita A., Asa H., Okumura S., Takase H., Hattori M., Yokota A. and Tomizawa K. I. 2006. "Efficient and stable transformation of *Lactuca sativa* L. cv. Cisco (lettuce) plastids", Trans. Res., 15, 205–217.

Kim J. H. and Botella J. R. 2004 "Etr1-1 gene expression alters regeneration patterns in transgenic lettuce stimulating root formation", Plant Cell Tiss. Organ Cult., 78, 69–73.

Koyama R., Sanada M., Itoh H., Kanechi M., Inagaki N. and Uno Y. 2012 "*In vitro* evaluation of tipburn resistance in lettuce (*Lactuca sativa* L.)", Plant Cell Tiss. Organ Cult., 108, 221–227.

Latif B., Javaran M. J., Alizadeh H., Memari H. R. and Mohammadi R. 2014. "Interactions of genotype and plant growth regulators affecting direct shoot regeneration of lettuce (*Lactuca sativa* L.)", Int. J. Biosci., 5 (1), 315-322.

Łukasz P. 2013. Haploid embryos of lettuce (*Lactuca sativa*) induced by alien pollen or chemical factors, African Journal of Biotechnology Vol. 12(4), pp. 345-352, DOI: 10.5897/AJB12.1526, 2013.

Łukasz P., Maciej Z. and Elżbieta Z. 2014. "Induction and development of haploid embryos and plants of *Lactuca sativa* after intergeneric crosses and chemical treatment", Acta Biol. Cracov. Series Botanica, 1 (56), 42.

Mohebodini M., Javaran M. J., Mahboudi F. and Alizadeh H. 2011 "Effects of genotype, explant age and growth regulators on callus induction and direct shoot regeneration of Lettuce (*Lactuca sativa* L.)", Australian J Crop Sci., 5(1), 92-95.

Maisonneuve B., Chupeau M. C., Bellec Y. and Chupeau Y. 1995. "Sexual and somatic hybridization in the genus *Lactuca"*, Euphytica, 85, 281-285.

Maisonneuve B.2003. "*Lactuca virosa*, a source of disease resistance genes for lettuce breeding: results and difficulties for gene introgression", in: Eucarpia Leafy Vegetables, Centre for Genetic Resources, Wageningen, the Netherlands, pp. 61-67.

Matsumoto E.1991. "Interspecific hybridization between lettuce (*Lacruca sativa*) and wild species *L. Virosa"*, Plant Cell Rep., 9, 531-534.

Matsumoto E.1987. "Production of somatic hybrids between *Lactuca sativa* and *L. serriola* by cell fusion", Japanese J. Breed., 37, 134-135.

Mazier M., Maisonneuve B., Bellec Y., Chupeau M. C., Souche S. and Chupeau Y. 1999. "Interest of protoplasts for lettuce breeding", in: *Eucarpia Leafy Vegetables '99*, A. Lebeda, and E. Krístková, ed., Proceedings of the Eucarpia Meeting on Leafy Vegetables Genetics and Breeding, Olomouc, the Czech Republic, 8-11 June, 1999, Palacky University Olomouc, Olomouc, pp. 239-244.

Mazier M., German-Retana S., Flamain F., Dubois F., Botton E., Sarnette V., Gall O. L., Candresse T., and Maisonneu and B. 2003 "Simple and efficient method for testing *Lettuce Mosaic Virus* resistance in *in vitro* cultivated lettuce", Journal of Virological Methods, 116, 123–131.

Ryder E. J. 1986. Lettuce breeding, In: Basset MJ, ed. Breeding vegetable crop. CT, USA: AVI Publishing Inc., 433-474 p.

Pink D. A. and Carter P. J.1987. "Propagation of lettuce (*Lactuca sativa*) breeding material by tissue culture", Ann. Appl. Biol., 110, 611-616.

Siddiqui M. R. 2014 "Somatic hybridization via protoplasts fusion ın *Lactuca sativa* (Lettuce) and it's fused product response to culture media". J. Agric. Res., 52(1), 1-9.

Taniguchi T., Sato T., Maeda K. and Maeda E.1990. "Microscopic observations of fusion process of rice and lettuce protoplasts", Current Plant Science and Biotechnology in Agriculture, 8, 281-298

Pinheiro M. V. M., Ribeiro da Silva T.C., Maia C., Lima B. V. and Motoike S. Y.2012. "*In vitro* propagation of lettuce genotypes via somatic embryogenesis", Ciencia Rural, Santa Maria, 42 (l l), 1947-1953.

Piosik Ł. 2013. Haploid embryos of lettuce (*Lactuca sativa*) induced by alien pollen or chemical factors, Afr J Biotechnol 12(4):345–352.

Piosik Ł., Zenkteler E. and Zenkteler M. 2016. "Development of haploid embryos and plants of *Lactuca sativa* induced by distant pollination with *Helianthus annuus* and *H. tuberosus"*, Euphytica, 208, 439–451.

Seabrook J. E.A. and Douglass L. K. 2000. "Regeneration of somatic embryos from plant tissues", U.S. Patent # 6,071,746. Filed 02/02/98. Allowed June 6.

Seabrook J. E.A. and Douglass L. K.2003 "Somatic embryogenesis of lettuce from mature tissues", Proc. XXVI IHC – Biotechnology in Hort. Crop Improvement, Eds. F.A. Hammerschlag, and P. Saxena, Acta Hort. 625, ISHS.

Teng W. L., Liu Y.J. and Soong T. S. 1992. "Rapid regeneration of lettuce from suspension culture", Hortscience, 27(9), 1030-1032.

Vanjildorj E., Bae T. W., Riu K. Z., Kim S. Y. and Lee H. Y. 2005. "Overexpression of Arabidopsis ABF3 gene enhances tolerance to drought and cold in transgenic lettuce (*Lactuca sativa*)", Plant Cell Tiss. Org. Cult., 83, 41-50.

Webb D. T., Torres L. D. and Fobert P. 1984. "Interactions of growth regulators, explant age and culture environment controlling organogenesis from lettuce cotyledons *in vitro",* Can. J. Bot., 62, 586-590.

Xinrun Z. and Connor A. J. 1992. "Genotypic effects on tissue culture response of lettuce cotyledons", J. Genet. Breeding, 46, 287-290.

EURASIAN JOURNAL OF AGRICULTURAL RESEARCH

Determination of Effective Mutagen Dose for Lettuce (*Lactuca sativa* var. *longifolia* cv. Cervantes) Seeds

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Abstract

In plant breeding strategies induced mutagenesis has become an effective way of supplementing the existing germplasm and improving new varieties. Mutation can be induced by chemical and physical mutagens or by combination. The commercial importance and production of lettuce, which is the most popular of the local salad crops, is increasing in Turkey. Lettuce is an important vegetable commodity and in demand by the local markets throughout the year. This study was carried out to get database for mutation breeding studies on lettuce cv. Cervantes. For this aim, 0, 50, 100, 200, 300, 400, 500 and 600 Gray (Gy) doses of Co^{60} (gamma-rays) were treated on lettuce seeds as a physical mutagen. 30 seeds were used for each dose. Thirty days after treatment, germination and shoot developing of cloves were determined. The Effective Mutagen Dose (EMD_{50}) calculated by linear regression analyses. According to results, 372.66 Gy dose was found as EMD_{50}.

Keywords: Lettuce, mutation breeding, Co^{60}, gamma ray, EMD_{50}, *Lactuca sativa*

INTRODUCTION

Lettuce (*Lactuca sativa* L.) is a major fresh vegetable and its leaves are commonly found in salad mixtures and sandwiches. In some eastern countries like China and Egypt, stems instead of leaves of lettuce are consumed, either cooked, raw, pickled, dried, or as a sauce. Some less common uses for lettuce include a cigarette without nicotine made from lettuce leaves, edible oil extracted from seeds of a primitive lettuce (Mou, 2008) Salads and lettuce leaves, which are among the vitamins and minerals and appetizing vegetables that are consumed in our table, contain 94-95% water. It is easy to grow in all regions because it is a cool climate vegetable. Gradually increased marketing of ready to use salad mixtures and different leaf colors, shapes like diversity point out the increased demand of upcoming period in this product group. Approximately two-thirds of the total production in the world is carried out by Asian countries.

China is the largest lettuce producer country, meeting nearly half of world production. Production rate of Turkey was 233 662 tons for cos lettuce, 179 712 tons for leaf lettuce and 65 068 tons for iceberg (head salad) in 2016 (Anonymus, 2016).

Turkey lettuce seed production was 12.965 tons in 2015. In the case for seeds of plants from the salad group, we are dependent on foreign countries, and it is an important fact that this results in losses due to foreign exchange rates every year. Annually 15 000 kg of foreign

variety vegetable seeds for salads are purchased from abroad and approximately $ 3.6 million USD is paid. The production rate is increasing day by day as vegetables, especially when freshly consumed from salads, have a positive effect on human health due to their high nutritional values.

When the breeding studies are examined to develop new varieties in the world, it is seen that many different techniques are used alone or in combination. There are some studies in the breeding studies conducted from the past to the present day like early flowering and head deformations besides yield criterion, resistance to diseases (especially Downy Mildew), and development of miniature head type (Waycott et al. 1995), tolerance to herbicides and early harvesting in the salad group, which has a prescription for human health and nutrition (Mou, 2011). In addition to the studies starting with classical hybridization, new varieties are being developed by utilizing in vitro tissue culture techniques such as hypocotyl and leaf culture Grube et al. 2003; Ohki et al. 2012).

In addition to the discovery of the efficacy of recombinant DNA technology, studies on the use of biotechnological methods in the last 30 years continue to work on disease-resistant, high-yield transgenic (GMO) varieties (Dayton et al. 2012). Studies carried out to obtain transgenic plants, especially in the salad group, have shown that hypocotyl and leaf parts give the best results and the regeneration capacity of these parts is very high (Okubara et al. 1994).

However, especially due to the adverse effects that GMOs that are rapidly spreading in the market can create in human health in the future, researchers are expanding the existing genetic pools and creating new variations from which high-quality F_1 hybrid parental candidates are obtained by using nuclear techniques (Masuda et al. 2004).

When Nuclear-based studies are compared with the studies on obtaining genetically modified plants which are very popular today, this technique requires a lower cost than the transgenic plant line which also created many disputes and arguments all around the World, doesn't create any disadvantages in terms of human health, and makes it possible to reach a definitive result in a shorter time. The mutation breeding technique provides a significant advantage in the development of characters Anonymus, 1977; Sağel et al. 2002; Waycott et al.) that are managed by a single gene and exhibit simple inheritance, especially in self-fertilized plants, in studies conducted predominantly during the last 50 years.

The frequency of the mutation that occurs as a result of chemical mutagenesis in the physical compartment is 10^3 times higher than naturally occurring mutations. Lettuce breeding studies are focused on leaf-shaped, tight head, presence or absence of anthocyanins, resistance to diseases and insects, good quality in stress conditions, short growth period, yield, adaptation to different regions and environmental conditions (De Vries, 1997; Mou, 2011)

As a result of the mutation breeding trials in the salad group species, according to the records of the International Atomic Energy Agency (IAEA), the "Giantgreen" mutant variety was registered in 1966, following it "Evergreen" which is late-flowered, "Novogodnii" which gives a high yield in low light intensity and is rich in vitamin C, "Ice Cube", "Blush" and "Mini Green" varieties which have miniature head features, "Satilo" which has different leaf types. Very important data was obtained involving important deletions caused by ethyl methane sulfonate (EMS) on C/G pairings and T/A pairings resulting from the susceptibility

of salad group varieties to mutations caused by both natural or physical (fast neutron, gamma rays) and chemical mutagen applications (Mou, 2011).

To obtain successful results, it is important to know the susceptibility of the selected variety to mutations and, by determining the "Effective Mutation Dose" (EMD_{50}), to start the studies with the correct irradiation dose for the genotype to be studied. In the first phase of the work we have planned to create a new variation in the Cervantes variety with the method of mutation breeding; Effective Mutation Dose (EMD_{50}) was determined by determining the effects of different gamma ray doses applied to the Cervantes variety on seed germination and plant growth.

MATERIALS and METHODS

Genetically a homogene seed of *L. sativa cv*. Cervantes containing 4.60% moisture, which has valuable biological and economic traits in the Mediterranean region, was used as the starting material.

After the amount of moisture in the seeds to be used in the experiment is determined, seeds were irradiated with a gamma irradiation device which is used in experimental irradiation with the Isotope brand, the Ob-Servo Sanguis Co-60 Research Irradiator model (dose rate: 407 Gy / h); at Turkish Atomic Energy Authority, Sarayköy Nuclear Research and Training Center, Department of Technology. Different irradiation doses (0, 50, 100, 200, 300, 400, 500 and 600) by ^{60}Co gamma rays radiator were used for seed irradiation to determine the effects on seed germination and shoot development.

The irradiated material were planted in a greenhouse belonging to the Turkish Atomic Energy Authority, Sarayköy Nuclear Research and Training Center, Unit of Agriculture, in plastic pots containing :1:1 (soil:manure:peat) ratios of soil mixture. The experiment was arranged in 10 seeds / pot, with three replications per treatment.

Measurements were made to determine seedling height, root length, fresh weight, dry weight and seed germination ratio to determine the effects of different gamma ray doses on plant development at 30 days after planting (Figure 1). The obtained data were subjected to linear regression analysis to determine the dosage of $EMD_{50,}$ defined as the dose, which reduces the seedling growth and mean rooting height of control plants by 50%.

Figure 1. Germination of gamma-ray treated plants after 30 days

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RESULTS and DISCUSSION

After irradiation at 8 different doses with Co^{60} gamma ray source, 80% germination occurred in the control at the end of the counts made 30 days after sowing in sowing seeds, 90% at 50 Gy dose, 76.67% at 100 Gy dose, 86.67% at 200 Gy dose, 43.35% at 300 Gy dose, 76.67% at 400 Gy dose, 83.33% at 500 Gy dose and 83.30% at 600 Gy. The germination rate of 90% of the 50 Gy dose is an expected effect of a low dose application which has been caused by the stimulating effect of germination (Anonymous 1977). During the measurements made, only root formation was observed in the seeds from the 500 dose. It has been observed that at a dose of 400 Gy or more, where no shoot development other than hypocotyl development was provided, shoot development appeared at a lower rate and the shoots germinated from the seeds germinated in the 30 days following planting have decreased due to the increased radiation dose (Figure 2). The obtained data were shown to be in parallel with the research (Mou, 2011) conducted to produce variability in the Evergreen variety treated with 420 Gy dose.

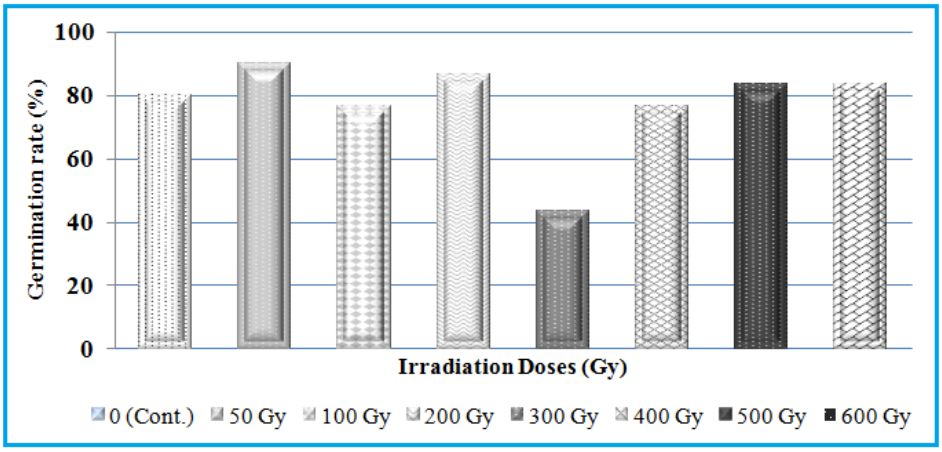

Figure 2. Relative germination rate of seeds treated with different gamma-ray doses.

As can be seen from Table 1 as a result of the measurements made on the 30th day after irradiation, significant reductions in seedling height and root length depending on the increasing irradiation dose was observed. According to results there was a negative correlation between seedling height and irradiation doses. The root length was 3.86 cm in the control, 3.05 cm in the 50 Gy dose, 3.72 cm in the 100 Gy application, 3.38 cm in the 200 Gy application, 2.96 cm in the 300 Gy application, 2.13 in the 400 Gy application, while it was 1.69-1.77 cm in the 500 and Gy 600 applications respectively.

Table 1. Seedling height, root length, fresh weight, dry weight, germination values in the plants obtained from seeds irradiated at different doses (seedling size = 13,705 +(-0,0203) x dose, R^2= 1)

Irradiation Dose (Gy)	Seedling Height (cm)	Root Length (cm)	Fresh Weight (g)	Dry Weight (g)	% Germination
0 (Control)	12.28	3.86	7.15	0.31	80.00
50	11.18	3.05	4.14	0.18	90.00
100	13.29	3.72	9.23	0.35	76.67
200	11.18	3.38	3.76	0.15	86.67
300	9.36	2.96	1.29	0.07	43.35
400	4.88	2.13	0.48	0.03	76.67
500	2.20	1.69	0.21	0.02	83.33
600	1.53	1.77	0.14	0.02	83.33
Regression Rate According to Mean Seedling Height: 372.66 Gy					

In the same way, mean seedling height was determined as 12.28 cm in control and 11.18 cm in 50 Gy. While average seedling height was found to be very low in measurements made after the 400 Gy dose was applied on the 30th day depending on increasing doses (Table 1, Figure 3). It has been reported in a study that 150 and 300 Gy dosing applications caused chromosomal degradation in irradiated lettuce seeds while no significant effects of dose applications between 0-75 Gy were observed (Franco et al. 2015).

As a result of the research, it was determined that 372.66 Gy was an effective mutation dose due to the regression analyses made from the 8 different doses applied to the seeds, and that the seeds irradiated at this dose could form plants with a survival rate of 50%.

Based on the data obtained, EMD_{50}, and 10% lower and upper values of this dose (330-410 Gy), may be used as an effective dose in mutation breeding studies for the Cervantes variety in order to create variability depending on the source power to be used in irradiation and the amount of moisture contained in the seeds.

Figure 3. Appearance of seedlings obtained from lettuce seeds being irradiated in different dose on the 30th day

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REFERENCES

Anonymus 1977. "Manual on Mutation Breeding". International Atomic Energy Agency, Technical Report Series No:119, Vienna. 290p.

Anonymus 2016. Turkish Statistical Institute, https://biruni.tuik.gov.tr/bitkiselapp/bitkisel.zul.

Anonymus, 1977. "Manual on Mutation Breeding". International Atomic Energy Agency, Technical Report Series No:119, Vienna. 290p,

Dayton Wilde H., Chen Y., Jiang P. and Bhattacharya A. 2012. "Targeted mutation breeding of horticultural plants", Emir. J. Food Agric. 24 (1): 31-41.

De Vries I. M.1997. "Origin and domestication of *Lactuca sativa* L. genetic resources and crop evolution", 44, 165–174.

Franco C. H., Santos H.M., Silva L. P., Arthur V. and Silva R. G. M. 2015. "Mutagenic Potential of Lettuce Grown from Irradiated Seeds", Scientia Horticulturae 182, 27–30.

Grube R. C., Brennan E. B. and Ryder E. J. 2003. "Characterization and genetic analysis of a lettuce (*Lactuca sativa* L.) mutant, weary, that exhibits reduced gravitropic response in hypocotyls and inflorescence stems", Journal of Experimental Botany, 54: 385, 1259-1268.

Masuda M., Agong S., Tanaka A., Shikazono N. and Hase Y. 2004. "Mutation spectrum of tomato seed induced by radiation with helium ion beams and coal", Acta Hort. 637, 257-262.

Mou, B., 2011. "Mutations in Lettuce Improvement", International Journal of Plant Genomics, 2011(3): 723518.

Mou B. 2008. Lettuce. Handbook of Plant Breeding, Vegetables I, Asteraceae, Brassicaceae, Chenopodicaceae and Cucurbitaceae, Page: 85-126.

Ohki S. and Hatashita M. 2012. "Mutation breeding by ion beam in lettuce (*Lactuca sativa* L.) using an *in vitro* regeneration", Research and Development Department Proc, 7th ISHS on In Vitro Culture and Horticultural Breeding (Ed.: D. Geelen) Acta Hort. 961, 285-290.

Okubara P. A., Anderson P. A., Ochoa O. E. and Michelmore R. W. 1994. "Mutants of downy mildew resistance in *Lactuca sativa* (lettuce)", Genetics, 137: 3, 867–874.

Sagel Z., Peskircioglu H., Tutluer I., Uslu N., Senay A., Taner K.Y., Kunter B., Sekerci S. and Yalcin S. 2002. "Bitki Islahında Mutasyon ve Doku Kültürü Teknikleri", III. Ulusal Mutasyon Kursu Kurs Notları, TAEK, ANTHAM Nükleer Tarım Radyobiyoloji Bölümü, Ankara.

Waycott W., Fort S. B. T and Ryder E. J. 1995, "Inheritance of dwarfing genes in *Lactuca sativa* L.", Journal of Heredity, 86:1, 39–44.

EURASIAN JOURNAL OF AGRICULTURAL RESEARCH

The Analysis of Problems in the Certification Application in State Forestry Administration in Turkey

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Abstract

The use of natural sources and increase in environmental damage around the world have come to a state in which it threatens the existence and functionality of forest resources as well as other natural resources'. The idea that economic development can only be achieved through the mentality of sustainable forest management supported by community involvement has ensured the improvement in certification systems of forestry and forest product. Therefore, in this study, the opinions of directors of state forestry administration in Turkey concerning the difficulties encountered or hardships which are possible to encounter in forestry and forest products certification are addressed. In this context, a questionnaire based on the face-to-face interview method has been carried out on 147 participants in manager position in 71 different State Forestry Management. While 11 of the forestry managements, on which the questionnaire is conducted, have FSC forest management certificates, 60 are non-certified businesses. At the end of this study, that bureaucratic procedures will increase within the management and that malfunctions will be experienced with respect to the operation, low level of certification awareness in Turkey, the inadequacy of collaboration between stakeholders and the incomplete forest cadastre all are determined as major obstacles to the certification. On the other hand, it has been detected that there are noteworthy differences in opinions between employees in certified companies and workers in non-certified businesses in respect to worker's health and safety, and stakeholder collaboration. In addition, it is conducted that there are significant differences between the working hours of participants and the participants' opinions concerning the problems encountered in the forest products certification.

Keywords: Forest management, Forestry and forest products, Certification, state forestry administration

INTRODUCTION

In recent years, while there is a rapid increase in the human population across the world, greater problems have occurred concerning environmental problems and natural resource use towards meeting the needs.

The consumption rate exceeding the tolerance of natural resources' renewal has become to an extent where it threatens the sustainability of natural sources as well as the sustainability of economic recovery (Baykal & Baykal, 2008; United Nations, 2015).

Since 1980s, it has been widely acknowledged that perpetual continuation of the existence and functional features of the ecosystem and natural resource depends on economic recovery and keeping the development process inside the ecological boundary (Ruckelshaus, 1989).

In the United Nations Conference on Environment held in Rio in 1992, it was stated that every single country needs to form its own sustainable recovery act plan by indicating that countries themselves cannot provide sustainable recovery and that environmental damage could not be decreased (Toprak, 2006). However, processes developed in following years made obvious that public services alone would not be successful in that terms and it should be supported with social participation (Özmehmet, 2012). This process promoted the development of forestry and forest products certification systems which include the comprehension of social responsibility towards development of sustainable management of forest resources (Kiker & Putz, 1997).

Forestry and forest products certification systems rely on the basis of creating a relationship which will lead to improvement of sustainable forest management between producers and consumers with a high environment consciousness (Durusoy & Türker, 2005; Chen & Innes, 2013).

These systems secure that raw material sources are managed according to international sustainable forest management principles and the whole production processes beginning from raw material source are based on the international criteria and in a transparent structure.

In the global level, the Canadian Standards Association (CSA, Sustainable Forest Initiative (SFI), Programme for the Endorsement of Forest Certification (PEFC) and Forest Stewardship Council (FSC) certifications systems make forest management certification (Baharuddin, 1995). Among these certification systems, CSA stands out as the only certification system in Canada, SFI stands out as operating in Canada and USA, FSC and PEFC stand out as operating worldwide and having the widest usage area. Since 2015, the forest land taken into the scope of forest management certification around the world has reached to %10.9 of whole forest land (UNECE/FAO, 2015).

In Turkey since 1999, the legislative alignment practices have started in the forestry alongside other domains with the adaptation process to the Europe Union (Dölarslan, 2007). Within this context, the national sustainable forest management criteria's and indicators were generated. The General Directorate of Forestry (GDF) has adopted FSC forest management certification and started certification practices in 2010 (FSC, 2015). These certification operations are dealt at level of State Forest Management Directorate (SFM) and Forest Management Chieftaincy (GMC) in the provincial organisation.

This study aims to analyse challenges which are encountered or likely to be encountered by the forest management certification system, which is put into practice by general directorate of forestry provincial organisation units at the level of technical workers and several variables and aims to develop suggestions for a solution.

MATERIAL and METHOD

Material

This study handles countrywide State Forest Management (SFM) units of GDF which holds about %99 of Turkey forest land ownership on behalf of the public, and organizes forest activities. 243 SFMs connected with 28 Regional Directorate of Forestry (RDF) operate throughout Turkey (OGM, 2016). Within the concept of FSC Forest Management Certification, total of 32 SFMs and 1 GMC from 6 different RDF have been certificated since 2015. 9 of these units take place in Mugla, 4 of them take place in Bolu, 3 of them take place in Bursa, 2 of them take place in Zonguldak, 3 of them take place in Istanbul, 11 of them take place in Kastamonu RDF and 1 GMC takes place in Bolu RDF. The total certified area has become 2530976.33 ha in these mentioned units. In Turkey, there are units with FSC forest

certificate in 6 RDF under GDF. In total, there are 32 SFM and 1 GMC which have FSC Forest Management Certificate (FSC, 2015).

Method

The survey used for the study was prepared according to 5 likert scale and it was applied to management director, management assistant principle and workers in a chieftaincy position who work activel. In these surveys, 18 statements were used in general, 12 of them were difficulties likely to be encountered and 6 of them were about solution suggestions. The surveys were conducted through face to face interaction.

Within the scope of the research, the survey was conducted on total 147 personnel in 71 SFMs throughout Turkey. The reliability of the surveys was calculated as 0.852 by using Cronbach Alfa method. This value indicates that the scale is highly reliable. The validity of the data was calculated as 0.794 by using Kaiser-Meyer-Olkin (KMO) test method. The measured KMO value points out to a high data validity in the surveys.

This work aims to determine views and solution suggestions regarding the already existing and difficulties likely to be encountered in FSC, which was put into practice by GDF country organisation units and the study also includes the ideas of SFM technical workers. IBM SPSS (20.0) package program was used in analysing the gained data. According to the One-Sample Kolmogorov-Smirnov Test results, it was seen that the data did not show normal distribution. Based on that non-parametric tests were used in order to analyse whether there is a difference between the ideas of technical workers at the level of different variations. In this context for the analyses with 3 or more independent statements Kruskal-Wallis tests were used and for the analyses with 2 independent statements, Mann-Whitney U tests were used (Tavşancıl, 2014). In addition, data frequency, the ratio and arithmetic means were calculated by the use of Microsoft Office Excel 2007 program.

RESULTS and DISCUSSION

The distribution of the participants of the survey under the scope of this study according to the SFM they work in and some of their demographic features are given in Table 1. In this study, while the highest level of participation occurs in the Black Sea Region, the lowest level of participation comes from the Southeastern Anatolia region. While the participation level from SFMs that don't have FSC certificates is 77%, the participation level from SFMs with the certificate is 23%. Considering the demographic features of participants, it is concluded that they mostly participate in 5 to 10 year working periods, undergraduate studies and the chief position of management groups.

Table 1. Distribution of the participants according to the SFMs and demographic features.

Variables		Frequency	Rate (%)
SFMs Certificate Status	Uncertified	113	77
	Certified	34	23
	Total	147	100
Educational Status of Participants	Undergraduate	121	82
	Graduate	26	18
	Total	147	100
Task Status of Participants	Managing Director	21	14
	Assistant Manager	22	15
	Chief Operating Officer	91	62
	Other	13	9
	Total	147	100
Participants' Working Time	1-5 Year	37	25
	5-10 Year	47	32
	10-15 Year	28	19
	15-20 Year	11	8
	> 20Year	23	16
	Total	147	100

Difficulties that are formed or foreseen by the factors inside the management

Participants' views about the difficulties that are created/can be created by internal factors of FSC Forest Management Certification are presented in Table 2. According to this, it is understood that participants consider certification causing to the staff recruitment necessity inside the management as the most important issue. It is seen that the participants strongly agree with the theories which say that the number of bureaucratic procedures would increase and there might be malfunctions in the current system. On the other hand, the inspection of management activities by independent institutions is understood to be seen as an insignificant problem by the participants. The opinion that the certification is believed to have strict organisation constructions and high level bureaucratic properties (Türker *et al*, 2009) and to cause an increase in workload (Genç, 2014) can be evaluated as there would be problems during the adaptation of the certification.

Table 2. Difficulties that are anticipated and formed by the factors inside the management.

Factors		I do not agree at all	I slightly agree	I neither agree nor disagree	I agree	I strongly agree	Total
It causes the documentation procedures to increase inside the management	Frequency	3	15	44	54	31	147
	Ratio	2%	10%	30%	37%	21%	100%
The need of additional personnel employment for certification works occurs	Frequency	2	13	41	65	26	147
	Ratio	1%	9%	28%	44%	18%	100%
There may be some trouble with the operation in the education process of the workers about the matter	Frequency	6	20	50	54	17	147
	Ratio	4%	14%	34%	37%	12%	100%
In terms of management privacy, it is not fair for the management to be inspected by an independent foundation	Frequency	14	44	39	30	20	147
	Ratio	10%	30%	27%	20%	14%	100%

Difficulties that are formed and foreseen by the factors outside the management

The views of the participants about the difficulties resulting from external factors of FSC Forest Management Certification are presented in Table 3. By looking at this, it is understood that the certification awareness level of forest products organisation is not sufficient enough, there is the lack in terms of cooperation which is required by certification, the issue with cadastral has not been solved yet and the problems that are probable with country people pose a crucial matter. On the other hand, it seems that the participants, in general, are uncertain about the adaptation between forestry regulations and certification standards, infrastructures of workers' health and work security, and providing shareholder participation.

Table 3. Difficulties that are anticipated and formed by the factors outside the management.

Factors		I do not agree at all	I slightly agree	I neither agree nor	I agree	I strongly agree	Total
The certification awareness level of the forest products industry sector is not enough	Frequency	4	18	43	53	29	147
	Ratio	3%	12%	29%	36%	20%	100%
The rise in the estimated prices depending on certification costs ends up with customer loss	Frequency	11	42	52	31	11	147
	Ratio	7%	29%	35%	21%	7%	100%
Matching forestry regulations with international certification standards is hard.	Frequency	10	29	49	46	13	147
	Ratio	7%	20%	33%	31%	9%	100%
Substructure of health, work safety, social security and education in our country is not suitable for the certification	Frequency	15	33	30	39	30	147
	Ratio	10%	22%	20%	27%	20%	100%
The cooperation of forestry and forest products industry sector in our country is not as developed as the certification program needs	Frequency	7	24	45	51	20	147
	Ratio	5%	16%	31%	35%	14%	100%
It is not possible to enable the participation of all shareholders during all the deciding processes of the forestry organization	Frequency	4	28	56	43	16	147
	Ratio	3%	19%	38%	29%	11%	100%
The fact that the Operations of forest cadaster are not completed makes the application of the certification difficult	Frequency	9	30	41	42	25	147
	Ratio	6%	20%	28%	29%	17%	100%
Deficiencies in the area of applying the legal legislations to country people make the application of the certification difficult	Frequency	6	27	41	46	27	147
	Ratio	4%	18%	28%	31%	18%	100%

The opinion differences on certification difficulties

The fact that there is not any significant difference between the executives and technical workers of SFMs that have the FSC certificate about difficulties resulting from external factors of managements the SFMs that do not have this certificate ($p>0.05$) can be seen in Table 4.

Table 4. The results of Mann-Whitney U Test about the opinion differences of internal factors for having the certificate.

Difficulties	Certification State	Number (N)	Mean Rank	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
It causes the documentation procedures to increase inside the management	Certificated	112	74.67				
	Uncertificated	35	71.86	1885.0	2515.0	-0.357	0.721
	Total	147					
The need of additional personnel employment for certification works occurs	Certificated	112	75.72				
	Uncertificated	35	68.50	1767.5	2397.5	-0.930	0.352
	Total	147					
There may be some trouble with the operation in the education process of the workers about the matter	Certificated	112	76.00				
	Uncertificated	35	67.60	1736.0	2366.0	-1.070	0.285
	Total	147					
In terms of management privacy, it is not fair for the management to be inspected by an independent foundation	Certificated	112	73.94				
	Uncertificated	35	74.20	1953.0	8281.0	-0.033	0.974
	Total	147					

In Table 5, there are the opinions differences of the executives and technical workers of SFMs, which have the FSC certificate, about difficulties resulted from external factors of managements the SFMs that do not have this certificate. According to this, it is seen that there is a difference between the workers of SFMs with certificates and the workers of SFMs without certificates in terms of the fact that the infrastructure of health, education and social security in Turkey forms an obstacle ($p<0.05$). Although this issue is a fundamental obstacle for the workers of SFMs with certificates, it is regarded as an insignificant topic for the workers of SFMs without certificates. Similarly, lack of cooperation between the forestry and the industry of forest products is seen as a big problem by the workers of SFMs with certificates while it is not considered as an important issue for the workers of SFMs without certificates.

In researches conducted in the literature (Owari *et al*, 2006), it is indicated that there are significant opinions differences between the workers of managements with certificates and the workers of managements without certificates. But this research showed that the workers of SFMs with certificates think that the certification program would face more problems compared with the workers of non-certified SFMs. It could be understood as the workers of certificated SFMs observe the difficulties encountered better by working actively in certificated managements.

In addition to that, the fact that the certification increases the burden of the workers especially who work as engineers can be said to strengthen the negative opinions of the workers of managements with certificates (Genç, 2014).

Table 5. The results of Mann-Whitney U Test about the opinion differences of external factors for having the certificate.

Difficulties	Certification State	Number (N)	Mean Rank	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
The certification awareness level of the forest products industry sector is not enough	Certificated	112	74.13				
	Uncertificated	35	73.60	1946.0	2576.0	-0.066	0.947
	Total	147					
The rise in the estimated prices depending on certification costs ends up with customer loss.	Certificated	112	76.18				
	Uncertificated	35	67.01	1715.5	2345.5	-1.158	0.247
	Total	147					
Matching forestry regulations with international certification standards is hard	Certificated	112	72.65				
	Uncertificated	35	78.33	1808.5	8136.5	-0.717	0.473
	Total	147					
Substructure of health, work safety, social security and education in our country is not suitable for the certification.	Certificated	112	79.72				
	Uncertificated	35	55.70	1319.5	1949.5	-2.986	0.003*
	Total	147					
The cooperation of forestry and forest products industry sector in our country is not as developed as the certification program needs.	Certificated	112	79.00				
	Uncertificated	35	58.01	1400.5	2030.5	-2.649	0.008*
	Total	147					
It is not possible to enable the participation of all shareholders during all the deciding processes of the forestry organization.	Certificated	112	77.23				
	Uncertificated	35	63.66	1598.0	2228.0	-1.724	0.085
	Total	147					
The fact that the Operations of forest cadaster are not completed makes the application of the certification difficult	Certificated	112	74.75				
	Uncertificated	35	71.60	1876.0	2506.0	-0.394	0.694
	Total	147					
Deficiencies in the area of applying the legal legislations to country people make the application of the certification difficult.	Certificated	112	75.47				
	Uncertificated	35	69.29	1795.0	2425.0	-0.776	0.438
	Total	147					

*$p<0.05$

Views on solution suggestions

Solution offers of the participants on the difficulties encountered in the certification of forestry and forest products are given in Table 6. According to this table, the highest average exits on the view that society's environment awareness should be improved by oral and visual media promotion while the lowest average takes place on the view that green label should be obligatory in purchase contracts in public institutions. It can be said that the ones who are aware of this certificate are sensitive to the environment because of the fact that advertising and informing actions are their priorities (Thompson *et al*, 2010). On the other hand, increasing the awareness in the public and in forestry organizations is regarded as an important stage to overcome the difficulties in the area of certification systems of forestry (Schepers, 2010).

Table 6. The solution offers of the participants.

Suggestion		I do not agree at all	I slightly agree	I neither agree nor disagree	I agree	I strongly agree	Total
The Green label should be obligatory in purchase contracts in public institutions.	Frequency	7	8	54	60	18	147
	Ratio	5%	5%	37%	41%	12%	100%
Discount should be made to certified managements	Frequency	3	8	45	68	23	147
	Ratio	2%	5%	31%	46%	16%	100%
There should be works towards awareness raising of the whole community by education foundations	Frequency	3	5	28	75	36	147
	Ratio	2%	3%	19%	51%	24%	100%
Uncertificated forest products should not be allowed to enter the country by importation	Frequency	6	10	26	66	39	147
	Ratio	4%	7%	18%	45%	27%	100%
Society's environment awareness should be improved by oral and visual media promotion	Frequency	3	1	28	63	52	147
	Ratio	2%	1%	19%	43%	35%	100%
In order to improve the country men and forestry organizations, there should be a public relations institution in forest management directorship	Frequency	2	4	35	58	48	147
	Ratio	1%	3%	24%	39%	33%	100%

CONCLUSIONS

In this study, the difficulties encountered and difficulties likely to be encountered during the application process of the forestry and forest products certification are evaluated by SFM directors and technical workers. In the survey, it is benefited from surveys conducted on SFM directors and technical workers in GDF field service operating throughout Turkey.

According to the evaluation of the survey, it is stated that during the application of certification there would be problems of the current internal running of the management, the workload would increase and the need of personnel employment would emerge. On the other hand, for participants, it is inevitable that this new situation which comes with the certification would affect country people negatively. Despite emphasizing the necessity of improving forestry and forest products certification, it was seen that the biggest obstacle in that matter was the insufficient certification awareness of the consumers of the forest products sector.

In this work, it is concluded that the infrastructures of workers' health and work security and education in our country are not enough to extend the certification of forestry and forest products and the cooperation of the shareholders in the sector is needed. The most important factor for the development of the certification is regarded as the increase of social environment consciousness.

In this regard, there is a need for studies among SFM workers and all segments to increase the awareness of certification. Within this scope, advertising activities can be conducted under the cooperation of GDF and nongovernmental organisations and GDF workers can be trained accordingly. Specialisation can be provided by employing additional personnel and by decreasing the workload of the SFM directors and technical workers. With establishing public relations departments in SFMs can improve the cooperation of the shareholders.

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REFERENCES

Baharuddin H. G. 1995. Timber Certification: An Overview, *Unasylva*, 46(183), 18-24.

Baykal H. & Baykal T. 2008. Environmental Problems in the Globalizing World, *Mustafa Kemal University Journal of Social Sciences Institute*, 5(9), 2-17.

Chen J. & Innes J. L. 2013. The Implications of New Forest Tenure Reforms and Forestry Property Markets for Sustainable Forest Management and Forest Certification in China, *Journal of Environmental Management*, 129, 206-215.

Dölarslan E. Ş. 2007. Conservation of Forests in Europe Conference of Ministers Conference on Sustainable Forest Management, *Süleyman Demirel University Journal of Forestry*, A(2), 159-174.

Durusoy I. & Türker M. F. 2005. Sustainable Forest Resources Management and Certification, 1st Environment and Forestry Forum, Antalya, Turkey.

FSC, 2015. Forest Stewardship Council website. http://info.fsc.org/index.php#result. (accessed 18 December 2015)

Genç A. 2014. *Problems Encountered in Implementation of Forest Management Certificate and Suggestions for Solution (Kastamonu Forest Regional Directorate)*, Masters Thesis, Kastamonu University Graduate School of Natural and Applied Sciences Department of Forest Engineering, Kastamonu, Turkey.

Kiker C. F. & Putz F. E. 1997. Methodological and Ideological Options, Ecolocical Certification of Forest Products: Economic Challenges, *Ecological Economics*, 20(1997), 37-51.

OGM, 2016. T.C. Ministry of Forestry and Water website. http://www.ogm.gov.tr/Documents/Kurulusumuz/TeskilatSema.pdf (accessed 15 January 2016)

Owari T., Juslin H., Rummukainen A. & Yoshimura T. 2006. Strategies, Functions and Benefits of Forest Certification in Wood Products Marketing: Perspectives of Finnish Suppliers, *Forest Policy and Economics*, 9(2006), 380-390.

Özmehmet E. 2012. Sustainable Development Approaches in the World and Turkey, *Yaşar University Journal*, 3(12), 1853-1876.

Ruckelshaus W. D. 1989. Toward a Sustainable World, *Scientific Amerikan*, 261(3), 166-175.

Schepers D. H. 2010. Challenges to Legitimacy at the Forest Stewardship Council, *Journal of Business Ethics*, 92, 279–290.

UNECE/FAO, 2015. Forest Products Annual Market Review 2014-2015. United Nations Publications, http://dx.doi.org/10.18356/4f5cd0dd-en. (accessed 22 December 2015)

United Nations, 2015. Report of the World Commission on Environment and Development: Our Common Future. Transmitted to the General Assembly as an Annex to document A/42/427. http://www.un-documents.net/ocf-ov.htm (accessed 20 December 2015)

Tavşancıl E. 2014. *Attitude Measurement and Data Analysis with SPSS*, 5th Edition, Nobel Publications, Ankara, Turkey.

Thompson D. W., Anderson R. C., Hansen E. N., & Kahle L. R. 2010. Green Segmentation and Environmental Certification: Insights from Forest Products, *Business Strategy and the Environment*, 19, 319–334.

Toprak D. 2006. Environmental Policies and Financial Instruments in the Framework of Sustainable Development, *Süleyman Demirel University Journal of Social Sciences Institute*, 2(4), 146-169.

Türker M. F., Barlı Ö., & Ayyıldız H. 2009. A Research on Determining Business Culture in Turkish Forestry Organization. 1nd ed., Publication of the Forestry and Nature Conservation Foundation, Ankara, Turkey.

EURASIAN JOURNAL OF AGRICULTURAL RESEARCH

Identification of Ecological Connectivity for Brown Bears: Example of Malatya Province

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Abstract

Increasing population, industrialization and use of agricultural land in the world results in devastation and fragmentation of natural areas, and thus the wild life is threatened. Especially big carnivorous animals are influenced heavily by this situation. They are vulnerable due to the need for wide areas for habitation, low reproduction rates, huge body size and the fact that they are perceived as threats by people because of their predatory characteristics. Therefore, these species should be considered as a priority in protection strategies.
Connectivity is one of the tools used for preventing the mentioned devastation created by human activities and enabling protection of the habitats of mentioned species. An umbrella species, big carnivorous brown bear (*Ursus arctos* L) is tackled in the study which is found in the natural landscape of Malatya province. The purpose of the study is to identify their habitats via Geographical Information Systems and ensure ecological connectivity among habitats. Similar studies are examined as examples within the applied model in this context and they are transferred to the field. The mobility among reproduction and population areas of the brown bears is provided by the to-be-established ecological networks, while they are protected from isolation and spatial losses.

Keywords: Brown bear (*Ursus arctos* L), ecological connectivity, habitat model, Malatya, Turkey

INTRODUCTION

Within densely populated landscapes, human activities generally deprived wild animals and plants of their natural habitats while restricting the carnivore (for instance; the bears) to reach their habitats (Posillico et al. 2004). In addition to this, the carnivores have a vulnerable structure due to their need for a bigger living space, their low fertility rate and ravenousness (Fernández, 2014). For the last two centuries large carnivore populations became widely extinct largely depending on increasing human population (Fernández, 2014). The disappearance of the predators is generally considered worrisome, since majority of the ecosystems are controlled top-down (Dorresteijn, 2013).

For this reason, habitats of the large carnivore should first be identified so that the so called extinction could be prevented by finding connections among separated habitats. The bears tackled in this study are one of the most varied groups of the large mammals. Their habitats include a large area extending to the Ecuadorian rainforest, desert steppe, poles and meadows (Figure 1). They feed on various resources such as plant roots and leaves, fruits, insects, larva, eggs and fish (Servheen, 1998). The Bear are generalist and opportunistic species which have a bigger adaptation to different habitat types and to human activities (Favilli, 2013).

Figure 1 *General distribution of bear species throughout the World (Servheen, 1998)*

Protection of the bears with a wide range of habitats and food sources will also pave the way for the protection of many other species. The bears no matter where they exist are a significant sign for the ecosystem health. Therefore, the bears can be at the center of ecosystem protection (Servheen, 1998). Connectivity is one of the tools used for preventing deteriorations in the ecological systems (Favilli, 2013). It should be handled as species focused and determined as per each animal species (Merriam, 1991). For this reason, brown bear was selected as the study subject due to its higher ecologic tolerance and top level of the food pyramid convenient for a top down control in line with the data obtained from IUCN 2016. The aim of this study is to identify the habitats of the brown bear (*Ursus arctos L)* and to specify the possible connectivity routs among these habitats.

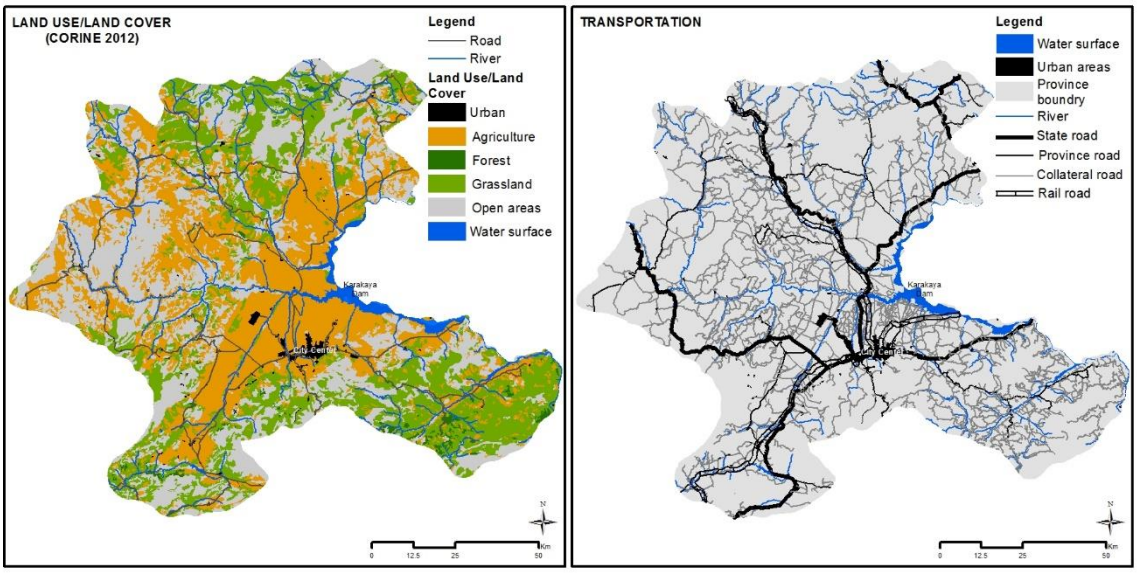
MATERIALS and METHODS

The main material of this study is Malatya province. Malatya is positioned in the Eastern Anatolia Region between 35 54' - 39 03' North latitudes and 38 45' - 39 08' East longitudes (Anonymous, 2011). It is surrounded by Elazığ and Diyarbakır on the East, by Adıyaman on the South, by Kahramanmaraş on the West, by Sivas and Erzincan on the North (Figure 2) (Kaymaz, 2014).

Figure 2 *Location map*

In this study, CORINE land use/land cover data prepared by the European Commission in 2012 was used (http://land.copernicus.eu, 2016). The transportation and topographic maps used in this study are obtained from various government agencies as part of PEYZAJ-44 project (Şahin, 2013). The transportation collected from this so called project was obtained from Directorate General of Highways while the topographic maps were taken from General Command of Cartography.

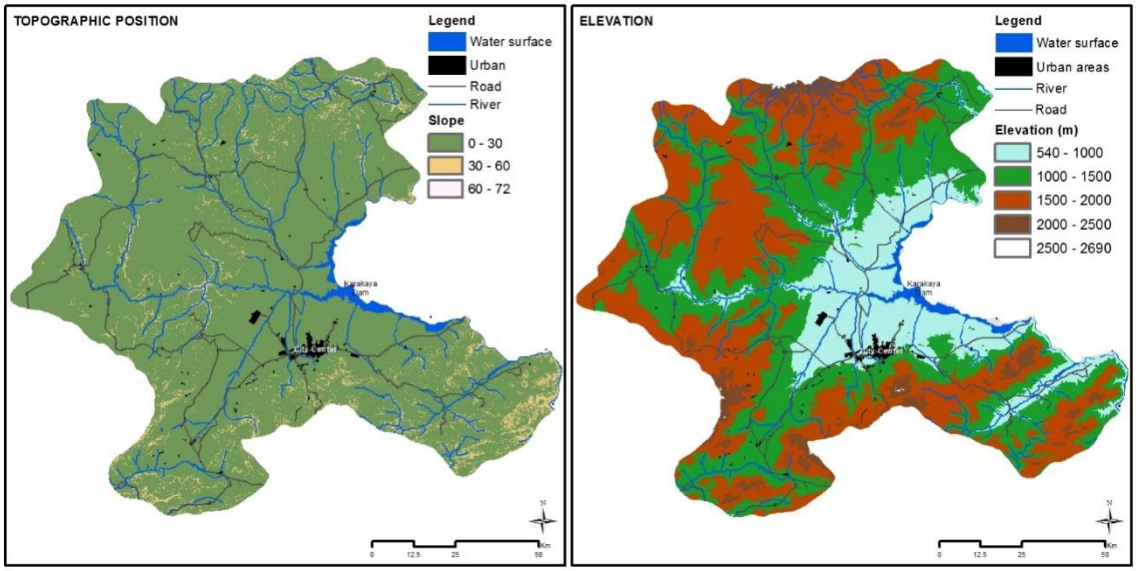
Agricultural lands are placed densely in the distance between the city center and Karakaya Damn. The forests cover a small portion of the province and the general outlook includes grassland and open areas (Figure 3a). There are two significant transportation lines placed in the land of study. First one is the highway numbered 300-23 connecting East with the West. The second one is the railway starting from Sivas. This line is separated into two at the center of Malatya as one line reaches to Adıyaman and the other line ends in Karakaya Dam Lake. Railway transportation generally shows similarity with the highway transportation (Şahin, 2013) (Figure 3b)



a *b*

Figure 3 *Land use/land cover (Kaymaz, 2014) and tranportaton (Şahin, 2013)*

The gradient ranges between 0-30 degrees on the study area (Figure 4a). The height ranges between 540-2690 m. The height of the land between Karakaya damn and city center changes between 540-1000 m and the elevation increases as we go to the west of the province (Figure 4b)



a *b*

Figure 4 *Topographic position and elevation*

The study which aims to find some ecological connections regarding the brown bear consists of two phases. In the first phase, the database give in table 1 and conformity ratios were used in order to find species specific lands by identifying the appropriate habitats via Corridor Designer tool. In the second phase the affiliated lines between specified habitats were identified by Linkage Mapper tool (Figure 5).

In this study the appropriate habitats for the brown bear (*Ursus arctos* L) were identified by making use of the study called BioREGIO Carpathians Advanced Tools and Methodologies Adopted GIS Model Design For Deriving Ecological Corridors (2013). In this study the umbrella types were specified and the data regarding CORINE land use/land cover, distance to roads weight, topographic posıtıon, elevation, and distance to human impact facilities were used in order to identify appropriate living spaces for these species. For finding habitat lands CorridorDesigner tool was used. The data regarding identification of habitats for the brown bear (*Ursus arctos* L) was availed from the so called study.

Table 1 *Data, weight and scores (Favilli, 2013).*

	Classes	**Weight**	**Summer Scores (% suitability)**	**Winter Scores (% suitability)**
Land Cover	Forest	30%	100	75
	Grassland		50	50
	Open areas		50	50
	Water bodies		25	25
	Agriculture		25	25
	Urban		0	0
Topographic Posıtıon	Bottom-gentle (0-30)	30%	50	75
	Steep (30-60)		100	50
	Ridge top (60-90)		25	0
Distance to Human Impact Facilities	0-100 m	10%	0	0
	100-500 m		50	50
	500-1000 m		100	100
	> 1000 m		100	100
Elevation	0-500	10%	50	50
	500-1000		75	75
	1000-1500		100	100
	1500-2000		100	50
	2000-2500		100	0
	>2500		50	0
Distance to Roads Weight	0-50 m	20%	0	25
	50-200 m		50	50
	>200 m		100	100

In this study, Linkage Mapper (McRae and Kavanagh 2016) tool was used for identifying possible ecologically connected routes among the habitats found with the help of CorridorDesigner tool. The tool creates the connected routes by using self-space and resistance surface. The resistance surface should be evaluated by the consumed energy, hardship or risk of death (Favilli, 2013; McRae and Kavanagh 2016). The habitats determined as mentioned above, are handled as self-spaces. The resistance surface is specified by the method taken from (Favilli, 2013). The human foot prints effect (Woolmer, 2008) and hemeroby degrees (Walz and Stein 2014) were used to calculate resistance values in this method (Favilli, 2013)

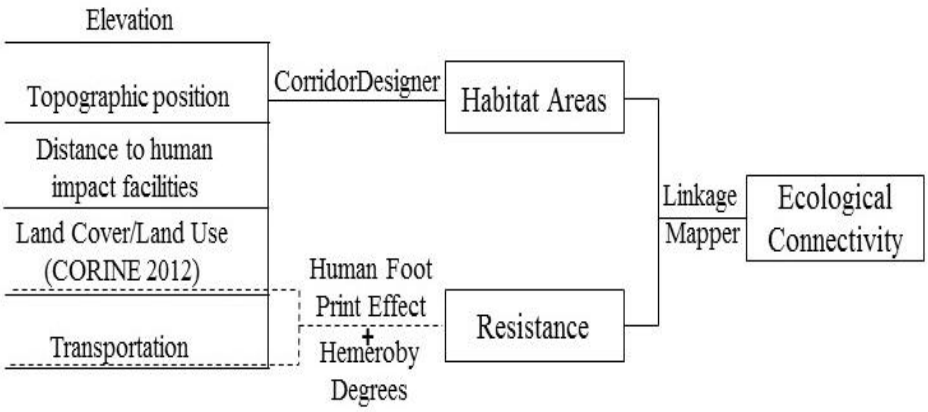
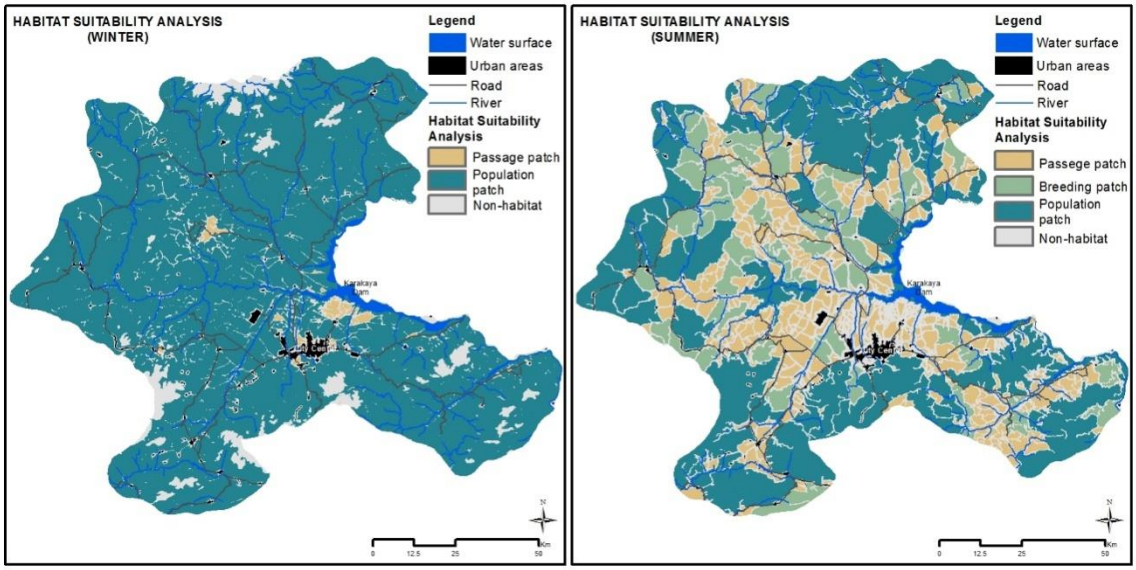


Figure 5 *Flow chart*

RESULTS and DISCUSSION

The habitats of summer and winter seasons were studied separately. However, the analysis of the winter season (figure 6a) fragmentation was not identified in population habitats. Therefore, only summer season (figure 6b) was included. In the light of the data displayed on Table 1, the species specific habitats found by the method taken from (Favilli, 2013). The areas found on the study area are transitional areas feeding and population areas. (Figure 6a, Figure 6b).

As a result of the analysis made feeding and population areas have a fragmented nature. Particularly, the agricultural lands and human impact facilities are candidate for being transitional habitats.



a *b*

Figure 6 *Habitat suitabilty analysis (Favilli, 2013)*

In this study, the resistance value of the area must be known so that the possible ecological connectivity routes between self-spaces can be identified. In this regard, the method taken from (Doğan, 2016) was applied to learn the resistance degree of the land. The resistance values determined by this method ranged between 1 and 100. As the value closes to 100, the resistance increases (Favilli, 2013) (Figure 7). The resistance value is the highest particularly around highways, settlements and their surroundings while the lowest in natural lands (Favilli, 2013).

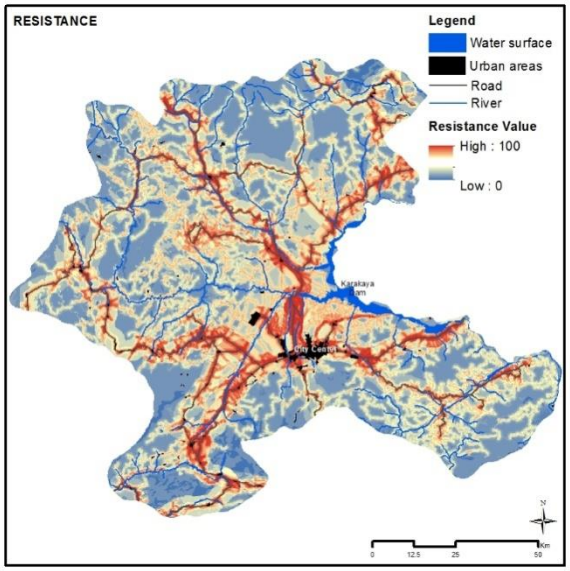


Figure 7 *Resistance layer*

In this study, the possible connectivity routes were identified with the help of Linkage Mapper tool by using the specified habitats (self-spaces) and resistance value (Figure 8). The broadness of the routes is one of the most important topics while idetifiying connectivity routes in ecological protection focused studies. According to the studies and the models, large corridors show the direct movement of the animals among the stains and their rate of movement increase (Hennings and Soll 2010). The broadness changes from species to species. The minimum broadness of corridor for the brown bear is 2-5 km (Favilli, 2013). Most of the possible connectivity routes mentioned in this study pass through agricultural lands. For this reason, the broadness is specified as 2 km.

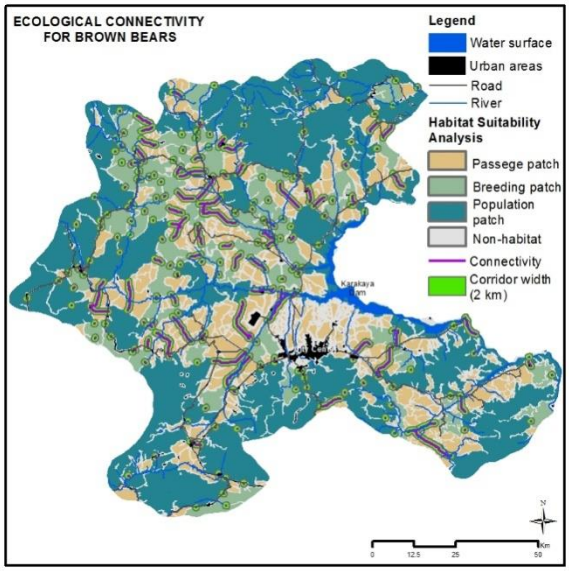


Figure 8 *Ecological Connectivity for Brown Bears*

CONCLUSION

Ecological connectivity is a crucial element for sustainability of the ecological processes and systems. Particularly in high scale and species focused studies, we must be able to specify habitats by means of models. This depends on the integration of ecological data with the modeling process (Fernández, 2012). The model used as part of this study is actually the result of such process. It is important to determine connectivity according to species in ecological connectivity studies. However, it is not that easy to determine connectivity routes for every species and to apply this to the site. Therefore, indicator species are designated for such studies and connectivity routes are specified as to these species. The indicator species are selected among primary consumer as well as among large predators positioned on top of the food pyramid.In this study, brown bear was used as an indicator species due to the high habitat diversity as well as high tolerance, because protection of the bears and their habitats will also provide protection for the habitats of many other species (Servheen, 1998).

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REFERENCES

Anonymous 2011. Malatya Valiliği İl Çevre ve Şehircilik Müdürlüğü Malatya İl Çevre Durum Raporu.

Doğan D. 2016 Peyzaj Bağlantılılığının Saptanması ve Değerlendirilmesi: Malatya Kenti Ve Yakın Çevresi Örneği. Doktora Tezi. Ankara Üniversitesi Fen Bilimleri Enstitüsü Peyzaj Mimarlığı Anabilim Dalı. Ankara

Dorresteijn I. 2013 The Future of the European Brown Bear (Ursus arctos) in Transylvania, Romania. Final report

Favilli F, Ravazzoli E., Hoffmann C, and Streifeneder T. 2013 The Carpathian Ecological Network GIS approach to detect the landscape permeability for particular umbrella species 5th Symposium Conference Volume for Research in Protected Areas pages 177 – 183 10 to 12 June 2013, Mittersill

Fernández N, Selva N, Yuste C, Okarma H, and Jakubiec Z (2012) Brown bears at the edge: Modeling habitat constrains at the periphery of the Carpathian population. Biological Conservation 153(0):134-142

Hennings L. ve Soll J. 2010. Wildlife corridors and permeability A literature review http://land.copernicus.eu/pan-european/corine-land-cover/clc 2012 Erişim tarihi: 26.08.2016

Kaymaz İ. H. 2014 Malatya Şehri'nin Mekânsal Gelişimi T.C. Kahramanmaraş Sütçü İmam Üniversitesi Sosyal Bilimler Enstitüsü Coğrafya Ana Bilim Dalı. Yüksek Lisans Tezi

McRae B. and Kavanagh D. 2016 Linkage Mapper User Guide Version 1.1—Updated August

Merriam, G. 1991. Corridors and connectivity: Animal populations in heterogenous environments. In Nature conservation, 2. The role of corridors, ed. D.A. Saunders & R.J. Hobbs. Surrey Beatty & Sons, Chipping Norton, pp. 133-42.

Posıllıco, M., A. Merıggı, E. Pagnın, S. Lovarı, and L. Russo. 2004. A habitat model for brown bear conservation and land use planning in the central Apennines. Biological Conservation 118:141–150

Servheen, C., Herrero, S., and Peyton, B. (compilers). (1998) Bears. Status Survey and Conservation Action Plan. IUCN/SSC Bear and Polar Bear Specialist Groups. IUCN, Gland, Switzerland and Cambridge, UK. x + 309 pp.

Şahin, Ş., Perçin, H., Kurum, E., Uzun, O., Bilgili, B.C., Tezcan, L., Çiçek, İ., Müftüoğlu, V., Çorbacı, Ö.L., Sütünç, S., Doğan, D., Koç, Ö., Ateş, E., Tarım, B., Kurdoğlu, G. ve Kaşko, Y. 2013. PEYZAJ-44: İl Ölçeğinde Peyzaj Karakter Analizi ve Turizm/Rekreasyon Açısından Değerlendirilmesi. 109G074 Nolu TÜBİTAK KAMAG Projesi Raporu.

Walz U. and Stein C. 2014 Indicators of hemeroby for the monitoring of landscapes in Germany Leibniz Institute of Ecological Urban and Regional Development, Weberplatz 1, 01217 Dresden, Germany Journal for Nature Conservation 22 (279–289)

Woolmer, G., Trombulak, S.C., Ray, J.C., Doran, P.J., Anderson, M.G., Baldwin, R.F., Morgan, A., Sanderson, E.W., 2008. Rescaling the Human Footprint: a tool for conservation

EURASIAN JOURNAL OF AGRICULTURAL RESEARCH

The Perception Analysis of Forest Products Certification in the Wood and Wood Products Sector in Turkey

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Abstract

Industrialisation has improved a manufacturing-oriented comprehension in the forest industry along with the entire industry sector. The forestry and forest products certification, which has been developed to ensure a sustainable development and to reduce the pressure of this comprehension on the forest resources, is gradually gaining importance. In this research, it is aimed to carry out a perception analysis of the wood and wood products sector in Turkey towards the forestry and forest products certification. Therefore, a face-to-face survey has been conducted in 131 managements operating in the wood and wood products sector throughout the country. In the survey, the problems, which are expected to be encountered with the effect of certification on sector employees, forestry activities, and forest products market, are addressed to the participants in such a way that includes the sub-propositions. As a result of the analysis conducted, a significant diversity is observed concerning the opinions of executives on certification and environmental certificate possession status of managements. It is confirmed that there are noteworthy differences in opinions of executives about certification in regard to target market status of the businesses. In addition to this, the location and activity area of businesses creates significant diversity in views of business executives towards the certification. On the other hand, it is understood that the operating period, number of employees and annual sales revenue of businesses don't influence on the certification perception of business managers. As a consequence, it has been determined that forestry and forest products certification perception of the wood and wood products sector needs to be improved.

Keywords: Certification, Wood and wood products sector, Sustainable forest management

INTRODUCTION

The interaction of humankind with natural resources has become more controversial in recent years than ever with the over-exploitation of these resources and the beginning of negative externalities destroying the ecological balance. In addition to population growth, the continuous production tools developed to meet the increasing and diversifying needs have led to a further increase in the pressure on natural resources (Türker *et al*, 2001).

Forests that are one of the most important natural resources have also been affected significantly by these negative developments. As from the 1960s, considerations has begun to develop in the direction that this situation has threatened the continuity of improvement and the increase in production should be planned together with environmental and social influences (Urungu, 2010).

The United Nations Conference on Environment and Development in 1992 played an important role in the development of certification process, which is based on forest resource conservation, effective management and stakeholder engagement, of the forest and forest product (Bozloğan, 2005; Urungu, 2010; Özmehmet, 2012). The forestry product certification, which is developed in this process, is emerged as a system monitoring and ensuring that the entire production chain process is in accordance with international standards starting from the forest as a raw material source. This system is stated as licensing that a product has less damage to the environment among alternative products according to regulated lifecycle information of a product (Durusoy, 2002).

Forest product certification systems will increase the preferability of environmentally-conscious products among alternatives in conjunction with the increase in consumer awareness (Varangis *et al*, 1995). At the same time, these systems make environmental management, which keeps environmental damage to a minimal level in meeting consumer demands, an important element that can be used for the development of the management (Hansen, 1997).Worldwide, organisations that commonly certify forest products are the Forest Stewardship Council (FSC) and The Program for the Endorsement of Forest Certification (PEFC) (Durusoy, 2002). Product certifications issued by these organisations are known as the Chain of Custody (CoC) (Türkoğlu & Tolunay, 2013). The number of firms with CoC product certification worldwide has reached to 39 609 by year of 2015 (UNECE/FAO, 2015).

Certification of forest products in Turkey has started to develop since 2008. In Turkey, the number of enterprises with FSC CoC certificates is 213 and the number of enterprises with PEFC CoC certificates is 213 in 31 different business areas, as of 2016 (FSC, 2016; PEFC, 2016).

In this study, it is attempted to determine the certification perception of forestry and forest products certification by analysing the opinions of the business executives in the sub-sector of wood and wood products of forest products industry.

MATERIAL and METHOD

The research area of the study constitutes of the firms in the wood and wood products sector among the sub-sectors of the forest products industry in Turkey. In the field of manufacturing of wood and wood products, there are 11 022 workplaces in our country according to the distribution of business establishments covered by SGK 4/a according to the activity branches and business size (SGK, 2015). In this field of activity, there are companies which make tree mowing and planing, wood plated panel and tree based panel manufacturing, production of plywood, MDF (medium density fiberboard), plywood etc. panels from compressed fiber, and parquet flooring manufacturing.

In the study, a survey structured according to five point likert scale was conducted to managers (general manager, business manager, production manager, marketing manager, manager assistants etc.) of businesses in the wood and wood products sector of Turkey Forestry Products Industry (FPI) and other employees (marketing and other unit chiefs). In the questionnaire, 25 propositions were used under four main headings, which include general ideas about the effects of forestry and forest products certification on sector workers, forestry practices and forest resources, forest products market and certification. Questionnaires which were used as data collection tools were applied with face to face interview technique.

In the study, since the number of elements in the population is known, the following formula has been used for determining the sample size (Özdamar, 2013).

$$n= [N.t^2.p.q]/[d^2.(N-1)+t^2.p.q] \quad (1)$$

N: Number of individuals in the population,

n: Number of individuals to be sampled,

p: the frequency of occurrence of the event to be investigated (probability),

q: the frequency of non-occurrence of events to be examined (1-p),

t: The theoretical value in the "t" table at a determined degree of freedom and at the specified error level,

d: It is shown as the desired deviation according to the frequency of occurrence of the event.

According to the formula above, although the number of samples is determined at least 96, in the study questionnaire was conducted to a total of 131 FPI business managers and other employees which were distributed in different geographical regions of Turkey, 31 of which were certified and 100 were non-certified. The Cronbach Alfa reliability coefficient was calculated as 0.894 based on the answers given to 25 propositions in the questionnaires. On the other hand, the data validity coefficient was found as 0.805 using the Kaiser-Meyer-Olkin (KMO) test. These calculated values show that the validity and reliability of the data are at a high level.This study, which aims to analyse the perceptions of the forestry and forest products certification of the wood and wood products sub-sector of FPI in Turkey and to reveal the differences of opinions, includes views of the managers and other employees in the previously mentioned firms. IBM SPSS (20.0) package program was used on analysis of collected data. Kuskal-Wallis was used in comparisons involving three or more independent sampled analyses and Mann-Whitney U tests were used in comparisons involving two independent sample analyses (Tavşancıl, 2014). Microsoft Office Excel 2007 program was utilised in the calculation of frequencies, ratios and arithmetic averages in the study.

RESULTS and DISCUSSION

As part of the study, the distribution of FPI firms, of which executives and other empolyees were conducted in the survey, according to some variables is given in Table 1. While the highest level of participation at the geographical region level was achieved in the Black Sea Region, the ratio of the surveyed production firms to the grand total was 92%. While seventy-six percent of the FPI firms enlisting had no environmental certifications, 24% were FSC or PEFC certified managements. Whereas the share of the companies operating in only domestic market was 48%, the share of the companies operating in both domestic and foreign markets was 52%.

Table 1. The distribution of the surveyed FPI firms according to some variables.

Variables		Frequency	Rate (%)
Certificate Status	Uncertified	100	76
	Certified	31	24
	Total	131	100
Target Market	Domestic	63	48
	Abroad	68	52
	Total	131	100
Activity Area	Production	120	92
	Marketing	11	8
	Total	131	100
Geographical Region	Marmara	36	28
	Black Sea	39	30
	Aegean	9	7
	Mediterranean	15	11
	Central Anatolia	28	21
	Eastern Anatolia	4	3
	Total	131	100

Differences of opinions according to owner's certificate ownership

The presence of significant differences ($p < 0.05$) on proposition groups between FPI firms in terms of certificate holders and opinions of management on the certification in evaluations concerning forest ownership and management, forest products market and general acceptance can be seen in Table 2. Accordingly, it is understood that the certified FPI business managers think that the certification will have a big positive effect in other areas apart from company employees.

The results showing that the certification system of enterprises will similarly provide great benefits to sustainable forest management have also been obtained in different studies on the certification of timber products (Koomson, 2000; Murray & Abt, 2001) were reached. On the other hand, it is reported as an important factor that enterprises producing wood products can use monitoring and documentation systems to increase their market share (Owari *et al*, 2006).

Table 2. Mann-Whitney U test results towards differences on participants' opinion according to FPI management certificate ownership.

Assessment with respect to certification	**Certificate Status**	**Number (N)**	**Mean Rank**	**Mann-Whitney U**	**Wilcoxon W**	**Z**	**Asymp. Sig. (2-tailed)**
The effects on company employees	Uncertified	100	68.77	1273.5	1769.50	-1.503	0.133
	Certified	31	57.08				
	Total	131					
Effects on forest existence and management	Uncertified	100	59.03	853.0	5903.0	-3.786	0.000*
	Certified	31	88.48				
	Total	131					
Impacts on forest products market	Uncertified	100	61.46	1096.0	6146.0	-2.467	0.014*
	Certified	31	80.65				
	Total	131					
Evaluations concerning general acceptance	Uncertified	100	57.19	669.0	5719.0	-4.800	0.000*
	Certified	31	94.42				
	Total	131					

*p<0.05

Disagreements according to the target market situation of the operator

It is understood from Table 3 that there are significant differences ($p<0.05$) in the opinions of the target markets and the managers of the FPI firms concerning the effects of the forest and forest product certification on forest existence and management. Accordingly, it can be said that the firms operating in the foreign market think that the certification has much

more positive effects on the forest existence and the sustainable forest management in comparison with the firms operating in the internal market.

It has been reported that forestry and forest products certification is an important factor in improving access especially to foreign markets (Marx, 2010) and the certification awareness of businesses, especially those trading in western countries, is higher (Durusoy *et al*, 2003). The fact that nearly half of our forest products trade is done with EU countries (TOBB, 2012) supports the positive views of companies working towards foreign markets on certification.

Table 3. Mann-Whitney U test results towards participants' opinion differences according to the target market of FPI firm.

Assessment with respect to certification	Target Market	Number (N)	Mean Rank	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
The effects on company employees	Domestic	63	71.87	1772.0	4118.0	-1.711	0.087
	Abroad	68	60.56				
	Total	131					
Effects on forest existence and management	Domestic	63	56.95	1572.0	3588.0	-2.634	0.008*
	Abroad	68	74.38				
	Total	131					
Impacts on forest products market	Domestic	63	60.17	1774.5	3790.5	-1.699	0.089
	Abroad	68	71.40				
	Total	131					
Evaluations concerning general acceptance	Domestic	63	60.70	1808.0	3824.0	-1.548	0.122
	Abroad	68	70.91				
	Total	131					

*p<0.05

Disagreements according to the operator's field of activity

There were significant differences (p <0.05) between the opinions of the FPI managements that produced the products and the managers of the firms marketing these products and the opinions of the other employees regarding the general acceptance propositions of the certification (Table 4). Accordingly, it can be said that executives and other employees of businesses engaged in marketing have more positive attitudes about certification compared to the production firms.

It has been reported that companies producing do not yet have the substructure on some issues such as quality management systems required by certification (Trishkin *et al*, 2014) and they are hesitant to take economic risks due to insufficient funding (Büyükkeklik *et al*, 2010). On the other hand, the low cost of additional certifications for marketing firms and direct the consumer can be said to be a sign of positive ideas of managers in this group about the certification.

Table 4. Mann-Whitney U test results towards participants' opinion differences according to the activity area of FPI firm.

Assessment with respect to certification	Activity Area	Number (N)	Mean Rank	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
The effects on company employees	Production	120	66.55	594.0	660.0	-0.550	0.583
	Marketing	11	60.00				
	Total	131					
Effects on forest existence and management	Production	120	64.20	443.5	7703.5	-1.802	0.720
	Marketing	11	85.68				
	Total	131					
Impacts on forest products market	Production	120	65.03	543.5	7803.5	-0.970	0.332
	Marketing	11	76.59				
	Total	131					
Evaluations concerning general acceptance	Production	120	63.89	406.5	7666.5	-2.116	0.034*
	Marketing	11	89.05				
	Total	131					

*p<0.05

Disagreements according to the geographical area where the firm is located

It is understood from Table 5 that there are significant differences (p<0.05) between the opinions of business executives and other employees on the effects of the certification on the business employees and general acceptance propositions according to the geographical region where the FPI firms are located.

Whereas Eastern Anatolia Region FPI business executives and other employees agreed at the highest level with that the certification would have a positive effect on the employees, participation in the discussions on this issue involved at the lowest level in the Marmara Region where the industrial facilities and the hardcore firms were located. On the other hand, among the general acceptance proposals regarding the certification, the FPI management employees in the Marmara Region have shown the highest level of positive opinion. In a survey done on environmental certification systems, it was reported that the certification motivation depends on consumer satisfaction and it may vary according to the sectoral activity areas and the geographical area in which the operator is located, which supports the findings o this study (Tuppura *et al*, 2015).

Table 5. Kruskal-Wallis test results for differences in opinion of participants according to the geographical area where FPI operation is located.

Assessment with respect to certification	Geographical Region	Number (N)	Mean Rank	Chi-Square	df	Asymp. Sig.
The effects on company employees	Marmara	36	51.67	14.495	5	0.013*
	Black Sea	39	80.33			
	Aegean	9	70.61			
	Mediterranean	15	56.73			
	Central Anatolia	28	63.61			
	Eastern Anatolia	4	96.38			
	Total	131				
Effects on forest existence and management	Marmara	36	82.99	10.634	5	0.059
	Black Sea	39	59.55			
	Aegean	9	64.83			
	Mediterranean	15	53.53			
	Central Anatolia	28	61.41			
	Eastern Anatolia	4	57.50			
	Total	131				
Impacts on forest products market	Marmara	36	74.07	6.867	5	0.231
	Black Sea	39	66.19			
	Aegean	9	56.22			
	Mediterranean	15	57.10			
	Central Anatolia	28	58.77			
	Eastern Anatolia	4	97.50			
	Total	131				
Evaluations concerning general acceptance	Marmara	36	83.94	25.153	5	0.000*
	Black Sea	39	74.79			
	Aegean	9	54.61			
	Mediterranean	15	47.27			
	Central Anatolia	28	43.23			
	Eastern Anatolia	4	74.00			
	Total	131				

* $p<0.05$

On the other hand, in analyses made to determine the effects of the business's operating duration, number of employees and annual sales income on the certification perception of business managers, it was seen that these factors did not cause significant differences in opinion on the certification perception of firm management and other employees of FPI.

CONCLUSIONS

In this study, the forestry and forest products industry is evaluated in terms of differences in opinion by taking into account the different variables of forest and forest product certification perceptions of managers and other employees of firms in the sub-sector of wood and wood products. The survey was conducted towards the managers and technical staff of FPI companies operating across Turkey.

According to the evaluation results of the data obtained in the study, the certification awareness of the participants in FPI firms uncertified remains lower than the certified firms. On the other hand, it has been understood that certification are likely to have limited positive effects on the employees because of their concerns that the certification would increase the workload on the employees.

In the study, it is determined that business managers, who open to international markets where forestry and forest product certification is widely used, think that certification will provide significant contributions to forest resources and sustainable forest management. Accordingly, it can be said that the certification awareness in the wood and wood products sector in Turkey, which can create environmental sensitivity on the enterprises, has not yet reached sufficient level. Results reveal that the forestry and forest product certification awareness of manufacturing companies is lower than the marketing businesses. Comparisons

results at the regional level have shown that the FPI business executives in the regions, where industrial facilities are dense, find that certification is acceptable as a general understanding but they think that its effects on employees will be negative. As a result, it is clear that the certification perception in the wood and wood products sector needs to be improved. In addition to efforts to improve the environmental sensitivities of end consumers, it is also important that actions towards FPI business managers are not neglected. In studies made in this context, the costs of forestry and forest product certification and the additional workload that will be brought to the employees should be analysed and the results achieved should be shared with the sector enterprises.

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REFERENCES

Bozlağan R. 2005. Historical Background of the Sustainable Development Thought, *Journal of Social Political Conferences*, 50th Book, 1011-1028.

Büyükkeklik A., Toksarı M. & Bülbül H. 2010. A Research on Environmental Sensitivity and Innovation, *Süleyman Demirel University Journal of Faculty of Economics and Administrative Sciences*, 15(3), 373-393.

Durusoy İ. 2002. *Certification and Assessment of Potential Bottlenecks and Opportunities to be Encountered in the Process of Possibility, Implementation and Application in Turkey Forestry*, Master Thesis, KTÜ Institute of Science and Technology, Trabzon, Turkey.

Durusoy İ., Türker M. F. & Başkent E. Z. 2003. Forest Certification: Turkish Forestry Sector Perspective, XII World Forestry Congress, Congress Proceedings, A-Forests For People, Quebec City, Canada.

FSC, 2016. Forest Stewardship Council website. http://info.fsc.org/index.php#result. (accessed 11 April 2016)

Hansen E. 1997. Forest Certification and its Role in Marketing Strategy, *Forest Product Journal*, 47(3), 15-24.

Koomson T. A. 2000. *Implications of International Timber Certification for Ghanaian Timber Exports and Sustainable Forest Management*, Ph.D. Thesis, Fletcher School of Law and Diplomacy (Tufts University), Massachusetts, United States.

Marx A. 2010. Forest Certification as a Global Environmental Governance Tool: What is the Macro-Effectiveness of the Forest Stewardship Council?, *Regulation & Governance Journal*, 4(2010), 408-434.

Murray B. C. & Abt R. C. 2001. Estimating Price Compensation Requirements for Eco-Certified, *Ecological Economics*, 36 (2001), 149-163.

Owari T., Juslin H., Rummukainen A. & Yoshimura T. 2006. Strategies, Functions and Benefits of Forest Certification in Wood Products Marketing: Perspectives of Finnish Suppliers, *Forest Policy and Economics*, 9(2006), 380-391.

Özdamar K. 2013. *Modern Scientific Research Methods*, 1nd ed., Kaan Bookstore, Eskisehir, Turkey.

Özmehmet E. 2012. Sustainable Development Approaches in the World and Turkey, *Yaşar University Journal*, 3(12), 1853-1876.

PEFC, 2016. The Program for the Endorsement of Forest Certification website. http://register.pefc.cz/search2.asp. (accessed 11 April 2016)

SGK, 2015. Social Security Institution. Monthly Statistical Bulletins. Insured Statistics Month 2013. http://www.sgk.gov.tr/wps/portal/tr/company/statistics/aylik_ statistik_ information. (accessed 10 December 2015)

Tavşancıl E. 2014. Attitude Measurement and Data Analysis with SPSS. 5th Edition, Nobel Publications, Ankara, Turkey.

TOBB, 2012. Turkish Forest Products Council Sector Report, TOBB Publication No: 2012/172, Ankara, Turkey.

Tuppura A., Puumalainen K. & Toppinen A. 2015. Forest Certification and ISO 14001: Current State and Motivation in Forest Companies, *Business Strategy and the Environment*, (2015), 355-368.

Türker M. F., Öztürk A. & Pak M. 2001. Investigation of the Concept of Externality in Terms of Forest Resources and Forest Management in Turkey, I. National Forestry Congress, Turkish Forestry Society Publication, Congress Series No: 1, pp. 154-170.

Türkoğlu T. & Tolunay A. 2013. Opinions of Turkish Forest Products Importer Businesses on Certified Forest Products, *SDU Faculty of Forestry Journal*, 14, 95-101.

Trishkin M., Lopatin E. & Karjalainen T. 2014. Assessment of Motivation and Attitudes of Forest Industry Companies Toward Forest Certification in Northwestern Russia, *Scandinavian Journal of Forest Research*, 29(3), 283- 293.

UNECE/FAO, 2015. Forest Products Annual Market Review 2014-2015. United Nations Publications, http://dx.doi.org/10.18356/4f5cd0dd-en. (accessed 22 December 2015)

Urungu A. 2010. Sustainable Development: Action Area of Applied Anthropology, *Journal of Anthropology*, 24, 133-164.

Varangis P. N., Crossley R. & Primo Braga C. A. 1995. Is there a Commercial Case for Tropical Timber Certification?, The World Bank, International Economics Department, Commodity Pollicy and Analysis Unit, Policy Research Working Paper 1479, Washington, USA.

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Evaluation of Some Wheat Cultivars as Roughage

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Abstract

This study was carried out during the growing season of 2015-2016 to determine the roughage value of some wheat cultivars. In the study, 3 bread wheat (Pehlivan, Aras, Cham-6) and 5 durum wheat (Eminbey, Bakrajo-1, Ovanto, Simito and Acsad-65) cultivars were used as plant material. Experiments were conducted in randomized complete blocks design with three replications. Plant height, green herbage yield, dry herbage yield, crude protein ratio, protein yield, acid detergent fiber, neutral detergent fiber, calcium, magnesium, phosphor and potassium ratios were investigated. Plant heights between 70.3 and 81.8 cm, green herbage yields between 694.0 and 2560.0 kg da^{-1}, dry herbage yields between 237.4 and 824.9 kg da^{-1}, crude protein ratios between 10.60 and 12.85%, protein yields between 29.6 and 98.5 kg da^{-1}, acid detergent fiber ratios between 30.78 and 34.92%, neutral detergent fiber ratios between 51.86 and 57.26%, calcium ratios between 0.36 and 0.47%, magnesium ratios between 0.11 and 0.17%, phosphor ratios between 0.35 and 0.38% and potassium ratios between 1.61 and 2.22% have changed. In the study, Aras and Acsad-65 cultivars for high green herbage, dry herbage and protein yields; Simito and Bakrajo-1 cultivars for low acid detergent fiber, neutral detergent fiber ratios and high calcium and magnesium contents were better results as roughage at wheat cultivars.

Keywords: ADF, herbage yield, NDF, nutrient content, wheat

INTRODUCTION

Our country has the deficit of roughage. Even if the rate of forage crops cultivation has reached to 8-9% among field crops in result of the supports in recent years, it is obvious that this level is not sufficient to meet the deficit. Therefore, new sources are required to meet the roughage deficit in Turkey.Small grain cereals such as wheat, barley, oat, rye and triticale can be harvested as herbage and utilized as roughage in addition to be cultivated for its grains and be used as human food. In our country like in the entire world, the utilization of cereals as fodder is widespread. The herbage derived from cereals is fed animals in green, dry and silage forms (Tan and Serin, 1997).

In dry regions, cereals can be cultivated for dry herbage production. Although all cereals can be used for that purpose, barley, oat, and wheat are preferred. The hays of cereals which are harvested in the proper period and dried are considered as good forage for ruminant animals. It is proposed to harvest cereals for herbage at the milk dough stage. Cereals should be harvested to produce good herbage at heading stage. Hays can be yielded from cereals

between 500 kg and 1500 kg per hectare depending on land fertility and maintenance (Acikgoz, 2013).

Cereals are so delicious and nutritious in the vegetative period for animals and include crude protein of 15-35%. Digestibility rate of nutrients is at 80%. It has a high carotin amount and low rate of cellulose, is rich in B vitamins and minerals. Cereals are quietly proper at the vegetative period for young animals and dairy cattles (Acikgoz, 2001). Cereals have a crucial potential to feed animals as a forage source with regards to yield, quality and mineral contents (Yolcu, 2008).

In Anatolia where cereal cultivation has been carried out throughout the history, it is considered that utilization of cereals as roughage source would contribute to meet the roughage deficit. For this reason, this study aims to unfold forage potential of certain wheat species by investigating yield and forage quality in the latter.

MATERIAL and METHODS

Material

This study has been conducted at the Bingol University Research and Practice Area during 2015-2016 growing season. The wheat cultivars used as study materials in the research and the institutions that have provided the cultivars are given in Table 1. The figures related to Bingol climate conditions are given in Table 2.

Table 1. The wheat cultivars used in the study and the providing institutions

No	Variety Name		Institutions and Organizations
1	Pehlivan	Bread wheat	GAP International Agricultural Research and Training Centre
2	Aras	Bread wheat	Sulaymaniyah Agricultural Research Institute / Iraq
3	Cham-6	Bread wheat	Sulaymaniyah Agricultural Research Institute / Iraq
4	Eminbey	Durum wheat	GAP International Agricultural Research and Training Centre
5	Bakrajo-1	Durum wheat	Sulaymaniyah Agricultural Research Institute / Iraq
6	Ovanto	Durum wheat	Sulaymaniyah Agricultural Research Institute / Iraq
7	Simito	Durum wheat	Sulaymaniyah Agricultural Research Institute / Iraq
8	Acsad-65	Durum wheat	Sulaymaniyah Agricultural Research Institute / Iraq

Table 2. Monthly average climate figures of Bingol for long years (2000-2015) and first half of 2016

Months	Average Temperature (°C)			Total Precipitation (mm)			Relative Humidity (%)		
	Long Years	2015	2016	Long Years	2015	2016	Long Years	2015	2016
January	-2.5	1.8	-2.8	154.0	147.2	257.8	73.3	75.1	75.4
February	-0.9	1.9	2.5	137.7	119.8	95.3	72.2	74.4	73.3
March	4.9	5.5	7.0	124.1	155.3	131.0	64.2	66.9	60.2
April	10.9	10.7	14.0	103.8	66.7	46.8	61.2	60.1	43.4
May	16.2	16.4	16.3	66.8	21.2	66.2	55.8	53.9	57.4
June	22.6	22.6	22.3	18.4	8.1	34.4	42.5	38.4	43.5
July	27.0	27.4	26.9	7.3	0.1	7.0	36.7	28.1	43.3
August	26.8	27.1	-	5.4	0.6	-	36.8	30.8	-
September	21.3	23.6	-	16.4	0.4	-	42.2	30.0	-
October	14.2	14.4	-	70.3	18.9	-	58.9	68.6	-
November	6.5	14.4	-	91.8	46.2	-	64.7	56.4	-
December	0.2	1.3	-	121.8	219.1	-	70.7	58.6	-
Total/Ave.	12.3	13.9	12.3	917.8	803.6	638.5	56.6	53.4	56.6

Source: General Directorate of Meteorology (Bingol)

As seen in the table, the long year's temperature average of Bingol is 12.3 °C. Accordingly in 2015, when the study was conducted, the annual average temperature was 13.9 °C. We can say that 2015 was a warm year for Bingol compared to previous years. Until the month of July, when the harvest took place, 2016 average temperature was 12.3 °C. During the first half of 2016 the figures were similar to those of long years' averages.

It has been determined that 2015 total precipitation level is lower than the total precipitation level of previous years. But during the first half of 2016, the amount of precipitation was higher than the previous years. In terms of relative humidity values, the average figure for the long years was 56.6% but in 2015 this figure became 53.4% and during the first half of 2016 it was 56.6%. It has been observed that the figures acquired for relative humidity were close to the previous year's average.

In conclusion, we can say that in Bingol, 2015 and the first half of 2016 was warmer, with less precipitation and similar moisture levels when compared to long years'.Soil samples have been taken from ten different points of the study area, from a depth of 0-30 cm, and then the samples were mixed. The analysis of the resulting sample took place at the Bingol University Faculty of Agriculture Department of Soil Science and Plant Nutrition Laboratories. Results of the analysis have been assessed by taking the limit values defined by Sezen (1995) and Karaman (2012) as a basis. Results of the analysis are given in Table 3.

Table 3. Soil texture, saturation, pH, salinity, lime content, organic matter content, phosphor and potassium amounts of the study area

Texture	Saturation (%)	pH	Salinity (%)	$CaCO_3$ (%)	Organic Matter (%)	P_2O_5 (kg da^{-1})	K (kg da^{-1})
Loamy	43.31	6.37	0.0066	0.15	1.26	7.91	24.45

As seen in Table 3, the soil texture of the study area was "loamy", with "mildly acidic" pH, no "salinity", "low" levels of lime, organic matter ratio was "low", phosphor ratio was "average" and potassium ratio was "sufficient".

Method

The trial has been established on 16 October 2015 over a randomized complete block experimental design with 3 repetitions. Planting was made where parcels lengths were 5 m, row spacing was 20 cm and each parcel had 6 rows. 500 seeds have been used per square meter during planting. Right before planting, 4 kg nitrogen (N), 8 kg phosphor (P_2O_5) fertilizer was applied over pure matter per decare. Then during the bolting period of the plans, 4 kg nitrogen (N) fertilizer was applied over pure matter per decare to increase the nitrogen (N) quantity to 8 kg da^{-1}. The trial was conducted under dry conditions. Harvesting of the plants took place on 12 May 2016.

Plant height, randomly selected from each parcel, 10 plants have been measured from soil surface to the top, including the awn, in cm and the average has been taken. The harvested herbage from each plot was weighed to get green herbage yields. Then, plot herbage yields were converted into yields per decare. From each green herbage harvest, 0.5 kg was dried at 70 ^{0}C for 48 hours (Anonymous, 2016). Dried samples were weighed to get dry herbage yields of the plots. Then, these values were also converted into dry herbage yields per decare.

Crude protein, ADF (Acid Detergent Fiber), NDF (Neutral Detergent Fiber), calcium, magnesium, phosphor and potassium analyses were performed at laboratories of Dicle University Scientific and Technological Research Center with NIRS (Near Infrared Spectroscopy - Foss Model 6500) analysis device.

Statistical Model and Assessment Method

The gathered data has been analysed by the help of JUMP statistics package program (software of SAS program) in accordance with randomized complete block experimental design with three repetitions. The factor averages that were statistically significant according to the variance analysis results have been compared to LSD test (Kalayci, 2005).

RESULTS and DISCUSSION

The plant height, green herbage yield and dry herbage yield averages observed in wheat cultivars are given in Table 4.

Table 4. Plant height, green herbage yield and dry herbage yield averages determined in wheat cultivars

		Plant Height (cm)	Green Herbage Yield (kg da^{-1})	Dry Herbage Yield (kg da^{-1})
1	Pehlivan	70.8 bc*	2237.1 b**	671.0 b**
2	Aras	78.8 ab	2560.0 a	801.8 a
3	Cham-6	81.8 a	1595.0 d	526.5 cd
4	Eminbey	70.3 c	1872.4 c	611.6 bc
5	Bakrajo-1	79.6 a	999.0 f	327.8 ef
6	Ovanto	80.6 a	1352.7 e	422.6 de
7	Simito	74.8 abc	694.0 g	237.4 f
8	Acsad-65	81.2 a	2454.0 ab	824.9 a
	Average	77.2	1720.5	552.9
	CV (%)	5.97	7.95	11.24

*) statistically significant at a level P≤0.05, **) statistically significant at a level P≤0.01

Different wheat cultivars are statistically significant at a level of 5% in terms of plant height and of the 1% in terms of green herbage and dry herbage yields.

Plant Height (cm)

The highest plant height has been obtained from Cham-6 cultivar by 81.8 cm, Acsad-65 cultivar by 81.2 cm, Ovanto cultivar by 80.6 cm and Bakrajo-1 cultivar by 79.6 cm and it was respectively followed Aras (78.8 cm) and Simito (74.8 cm) cultivars, statistically in the same group. The lowest plant height has been obtained from Eminbey cultivar by 70.3 cm.

The plant height average of the cultivars has been defined as 77.2 cm. Our findings are parallel to those obtained under Turkey conditions by Kaya (2004) 86.5 cm, by Mut et al. (2005) 66.9-98.8 cm, by Gumustas (2014) 79.4 cm.

Green Herbage Yield (kg da^{-1})

The highest green herbage yield has been obtained from Aras cultivar by 2560.0 kg da^{-1} and it was followed Acsad-65 cultivar by 2454.0 kg da^{-1}. The lowest green herbage yield has been obtained from Simito cultivar by 694.0 kg da^{-1}. The green herbage yield average of the cultivars has been defined as 1720.5 kg da^{-1}. The green herbage yield of wheat was determined to be 336.75 kg da^{-1} by Yolcu (2008).

Dry Herbage Yield (kg da^{-1})

The highest dry herbage yield has been obtained from Acsad-65 cultivar by 824.9 kg da^{-1} and Aras cultivar by 801.8 kg da^{-1}. The lowest dry herbage yield has been obtained from Simito cultivar by 237.4 kg da^{-1}. The dry herbage yield average of the wheat cultivars has been defined as 552.9 kg da^{-1}. The dry herbage yield of wheat was determined to be 175.54 kg da^{-1} by Yolcu (2008) and 65.1-477.5 kg da^{-1} by Tolu et al. (2013). The crude protein ratio, protein yield, acid detergent fiber and neutral detergent fiber averages observed in wheat cultivars are given in Table 5.

Table 5. The crude protein, protein yield, acid detergent fiber and neutral detergent fiber averages determined in wheat cultivars

		Crude Protein (%)	Protein Yield (kg da^{-1})	ADF (%)	NDF (%)
1	Pehlivan	11.22	75.1 b**	34.92 a**	56.90 ab**
2	Aras	12.27	98.5 a	34.25 ab	57.04 ab
3	Cham-6	10.60	55.8 cd	34.48 ab	56.69 ab
4	Eminbey	11.16	68.1 bc	33.52 ab	56.49 ab
5	Bakrajo-1	12.01	39.3 e	30.78 c	51.86 d
6	Ovanto	12.85	53.4 d	32.72 bc	54.54 bc
7	Simito	12.19	29.6 e	31.02 c	52.40 cd
8	Acsad-65	11.42	94.2 a	34.02 ab	57.26 a
	Average	11.71	64.2	33.21	55.40
	CV (%)	8.89	12.13	3.59	2.66

*) statistically significant at a level P≤0.05, **) statistically significant at a level P≤0.01

Different wheat cultivars are statistically significant at a level of 1% in terms of protein yield, acid detergent fiber and neutral detergent fiber.

Crude Protein Ratio (%)

Wheat cultivars are statistically insignificant in terms of crude protein contents. The crude protein content of the wheat cultivars to range from 10.60 to 12.85%. The crude protein average of the wheat cultivars has been defined as 11.71%. The crude protein content we have obtained were similar to those reported by Yolcu (2008) 13.11% and by Tolu et al. (2013) 4.0-14.0%.

Protein Yield (kg da^{-1})

The highest protein yield has been obtained from Aras cultivar by 98.5 kg da^{-1} and Acsad-65 cultivar by 94.2 kg da^{-1}. The lowest protein yield has been obtained from Bakrajo-1 cultivar by 39.3 kg da^{-1} and Simito cultivar by 29.6 kg da^{-1}. The protein yield average of the wheat cultivars has been defined as 64.2 kg da^{-1}. The protein yield was determined to be 21.26 kg da^{-1} by Yolcu (2008).

Acid Detergent Fiber (%)

The lowest acid detergent fiber has been obtained from Simito cultivar by 31.02% and from Bakrajo-1 cultivar by 30.78%. The highest acid detergent fiber has been obtained from Pehlivan (34.92%), Cham-6 (34.48%), Aras (34.25%), Acsad-65 (34.02%) and Eminbey (33.52%) cultivars. The acid detergent fiber average of the wheat cultivars has been defined as 33.21%. The acid detergent fiber was determined to be 34.21% by Yolcu (2008), 38.4-48.5% by Tolu et al. (2013) and 27.6% by Canbolat (2012).

Neutral Detergent Fiber (%)

The lowest neutral detergent fiber has been obtained from Bakrajo-1 cultivar by 51.86% and from Simito cultivar by 52.40%. The highest acid detergent fiber has been obtained from Acsad-65 (57.26%), Aras (57.04%), Pehlivan (56.90%), Cham-6 (56.69%) and

Eminbey (56.49%) cultivars. The acid detergent fiber average of the wheat cultivars has been defined as 55.40%. The acid detergent fiber was determined to be 58.64% by Yolcu (2008), 49.2-60.8 by Tolu et al. (2013) and 49.9% by Canbolat (2012). The calcium, magnesium, phosphor and potassium averages observed in wheat cultivars are given in Table 6.

Table 6. The calcium, magnesium, phosphor and potassium averages determined in wheat cultivars

		Calcium (%)	Magnesium (%)	Phosphor (%)	Potassium (%)
1	Pehlivan	0.40 cd*	0.12 cd**	0.36	2.01
2	Aras	0.36 d	0.11 d	0.36	1.83
3	Cham-6	0.39 cd	0.14 b	0.36	1.90
4	Eminbey	0.38 cd	0.13 bc	0.36	1.99
5	Bakrajo-1	0.46 ab	0.14 b	0.38	1.96
6	Ovanto	0.43 abc	0.11 d	0.38	2.22
7	Simito	0.47 a	0.17 a	0.36	1.61
8	Acsad-65	0.40 bcd	0.13 bcd	0.35	1.83
	Average	0.41	0.13	0.36	1.92
	CV (%)	8.29	7.48	3.53	10.04

*) statistically significant at a level P≤0.05, **) statistically significant at a level P≤0.01

Different wheat cultivars are statistically significant at a level of 5% in terms of calcium and of the 1% in terms of magnesium.

Calcium (%)

The highest calcium content has been obtained from Simito cultivar by 0.47%. It was respectively followed Bakrajo-1 (0.46%) and Ovanto (0.43) cultivars, in the same statistically group. The lowest calcium content has been obtained from Aras cultivar by 0.36%. The calcium content average of the wheat cultivars has been defined as 0.41%. The calcium ratio was determined to be 0.57% by Yolcu (2008).

Magnesium (%)

The highest magnesium content has been obtained from Simito cultivar by 0.17%. The lowest magnesium content has been obtained from Aras and Ovanto cultivars by 0.11%. The magnesium content average of the wheat cultivars has been defined as 0.13%. The magnesium ratio was determined to be 0.27% by Yolcu (2008).

Phosphor (%)

Wheat cultivars are statistically insignificant in terms of phosphor content. The phosphor content of the wheat cultivars to range from 0.35 to 0.38%. The phosphor content average of the wheat cultivars has been defined as 0.36%. The phosphor ratio was determined to be 0.35% by Yolcu (2008).

Potassium (%)

Wheat cultivars are statistically insignificant in terms of potassium content. The potassium content of the wheat cultivars to range from 1.61 to 2.22%. The potassium content

average of the wheat cultivars has been defined as 1.92%. The potassium ratio was determined to be 1.44% by Yolcu (2008).

CONCLUSIONS

The highest plant height has been obtained from Cham-6, Acsad-65, Ovanto and Bakrajo-1 cultivars; the highest green herbage yield has been obtained from Aras cultivar; the highest dry herbage yield has been obtained from Acsad-65 and Aras cultivars; the highest protein yield has been obtained from Aras and Acsad-65 cultivars; the lowest acid detergent fiber and neutral detergent fiber has been obtained from Simito and Bakrajo-1 cultivars; the highest calcium and magnesium content has been obtained from Simito and Bakrajo-1 cultivars. However, wheat cultivars are statistically insignificant in terms of crude protein ratio, phosphor and potassium content. Based on these results; Aras and Acsad-65 cultivars with high green herbage, dry herbage and protein yields, Simito and Bakrajo-1 cultivars with low acid detergent fiber and neutral detergent fiber ratios and high calcium and magnesium content were recommended for wheat hay as roughage.

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REFERENCES

Acikgoz E. 2001. Forage Crops. Uludag University Strengthening Foundation Publication No: 82.

Acikgoz E. 2013. Forage Crops Breeding. Dairy Livestock Training Center Publications No:8, s.56.

Anonymous 2016. Experiments on Measuring Agricultural Values Technical Instruction. Ministry of Food, Agriculture and Livestock, Directorate of Seed Registration and Certification Center, Ankara.

Canbolat O. 2012. Comparison of in vitro Gas Production, Organic Matter Digestibility, Relative Feed Value and Metabolizable Energy Contents of Some Cereal Forage. Kafkas Univ Vet Fak. Derg, 18(4), 571-577.

Gumustas R. 2014. Analysing the Yield and Yield Factors of Some Milling Wheat Varieties Under Bingöl Conditions, Bingöl University Institute of Science Department of Field Crops, Master Thesis, 2014.

Kalayci M. 2005. Use JUMP with Examples and Anova Models for Agricultural Research. Anatolia Agricultural Research Institute Directorate Publications No:21.

Karaman M.R. 2012. Plant Nutrition. Gubretas Guide Books Series: 2. Editor: Zengin M, Basic Principles in Interpreting Soil and Plant Analysis Results (Section 12), Page: 874.

Kaya M. 2004. A Study on the Yield and Yield Elements of Some Milling Wheat (Triticum aestivum L.) Varieties, Anadolu, J. of A ARI, 14(1), 41-61.

Sezen Y. 1995. Fertilizers and Fertilizing. Atatürk University Paplications No:679, Agriculture Faculty Paplications No:303, s.15, Erzurum.

Mut Z., Aydın N., Özcan H. & Bayramoğlu H.O. 2005. Determining the Yield and Some Quality Characteristics of Milling Wheat (Triticum aestivum L.) Genotypes in Central Black Sea Region, Journal of Agricultural Faculty of Gaziosmanpasa University, 22(2),

85-93.
Tan M. & Serin Y. 1997. The Nutrition Values of Small Grain Cereals as Hay. Atatürk Üniv. Ziraat Fak. Derg, 28(1), 130-137.
Tolu C., Savaş T., Yurtman İ.Y., Hakyemez B.H. & Gokkus A. 2013. The Effect of Wheat and Natural Pastures and of Different Grazing Intensities on Some Behavioral Traits of Lactating Goats. Journal of Tekirdag Agricultural Faculty, 10(3), 37-45.
Yolcu 2008. The Effect of Farmyard Manure Application on Morphological, Yield and Quality Properties of Barley and Wheat Cultivars Used as Roughage. J. of Fac. of Agric OMU, 23(3): 137-144.