How to cite: Cevheri, C. İ., Yılmaz, A. 2019. The Effects of Organic and Conventional Farming Systems on Fibres Quality Properties of Some Cotton(*Gossypium Hirsutum* L.) Varieties Under Semi Arid Climatic Conditions of Turkey and Correlations Between Fibre Quality Properties, Ege Univ. Ziraat Fak. Derg., 56 (2):147-152, DOI: 10.20289/zfdergi.426003

Araştırma Makalesi
(Research Article)

Ege Üniv. Ziraat Fak. Derg.,2019, 56 (2):147-152
DOI: 10.20289/zfdergi.426003

The Effects Of Organic and Conventional Farming Systems on Fibres Quality Properties of Some Cotton(*Gossypium hirsutum* L.) Varieties Under Semi Arid Climatic Conditions of Turkey and Correlations Between Fibre Quality Properties

Türkiye'de Yarı Kurak İklim Koşullarında Organik ve Konvansiyonel Tarım Sistemlerinde Üretilen Bazı Pamuk (*Gossypium hirsutum* L.) Çeşitlerinin Lif Kalite Özellikleri ve Bu Özellikler Arasındaki Korelasyon

Cevher İlhan CEVHERİ[1a*]

Ahmet YILMAZ[2b]

[1]Harran Üniversitesi, Teknik Bilimler Meslek Yüksekokulu, Tekstil Teknolojisi Programı, Şanlıurfa

[a]**Orcid No:** 0000-0002-7070-2652

[2]Harran Üniversitesi, Ziraat Fakültesi Tarla Bitkileri Bölümü, Şanlıurfa

[b]**Orcid No:** 0000-0002-2350-1516

sorumlu yazar: icevheri@harran.edu.tr

Alınış (Received): 22.05.2018 **Kabul Tarihi** (Accepted): 07.11.2018

Keywords:

Organic manure, organic farming, conventional farming, cotton fiber

ABSTRACT

Objective: The aim of the present research was to compared differences among the organic and conventional farming system in fibres quality properties of some cotton varieties under semi arid climatic conditions of Turkey.

Material and Methods: This research was carried out by using the ST-468 and BA-119 cotton varieties in three replications, according to the randomized block split parcel trial design under organic farmland conditions in 2013-2014 growing seasons; NPK, Biofarm (cattle fertilizer) and pigeon manure and control plots (without fertilizer).

Results: It was found that the seed cotton yield varied from 3594.8 (ST-468) to 3737.4 kg ha^{-1} (BA-119) in the varieties and the highest yield was obtained from the BA-119 with 3737.4 kg ha^{-1}. It was determined that there was a statistical important difference between two varieties in terms of seed cotton yield. We think that this efficiency difference between varieties is caused by genetic and environmental factors. The result of fertilization applications was changed between 3370.0 (cattle manure) and 4424.5 kg ha^{-1} (chemical fertilization) and the highest seed cotton yield was obtained from chemical (NPK) fertilization applies.

Conclusion: According to the results of the study, it has been concluded that the cotton produced in the conventional production conditions is heavily contaminated with chemical inputs and this has negative effects on the pollution of the environment.

Anahtar Sözcükler:

Organik gübre, organik tarım, geleneksel tarım, pamuk lifi

ÖZ

Amaç: Bu araştırmanın amacı, Türkiye'nin yarı kurak iklim koşullarında organik ve konvansiyonel tarım sisteminde bazı pamuk çeşitlerinin lif kalite özellikleri arasındaki farklılıkları karşılaştırmaktır.
Materyal ve Metot: Bu araştırma, 2013-2014 büyüme mevsimlerinde organik tarım koşullarında tesadüf blokları bölünmüş parsel deneme desenine göre, ST-468 ve BA-119 pamuk çeşitleri ile üç tekerrürlü olarak gerçekleştirilmiştir. Çalışma, NPK, Biofarm (sığır gübresi), güvercin gübresi ve kontrol tarlaları (gübresiz) koşullarda yürütülmüştür.

Bulgular: Pamuğun verimi çeşitlerde 3594.8 (ST-468) ila 3737.4 kg ha^{-1} (BA-119) arasında değiştiği ve en yüksek verimin BA-119'dan 3737.4 kg ha^{-1} elde edildiği tespit edilmiştir. Pamuk verimi bakımından iki çeşit arasında istatistiksel olarak önemli bir fark olduğu tespit edilmiştir. Çeşitler arasındaki bu verimlilik farkının genetik ve çevresel faktörlerden kaynaklandığını düşünüyoruz. Gübreleme uygulamaları sonucu 3370.0 (sığır gübresi) ile 4424.5 kg ha^{-1} (kimyasal gübreleme) arasında değiştiği ve kimyasal (NPK) gübreleme uygulamasından en yüksek pamuk veriminin elde edildiği görülmüştür.

Sonuç: Organik pamuk üretimi ve organik girdilerin kullanımı sürdürülebilir tarım, çevre ve gıda güvenliğinin sağlanması açısından önemli bir konudur. Çalışmanın sonuçlarına göre, konvansiyonel üretim koşullarında üretilen pamuğun kimyasal girdilerle aşırı derecede kirlenmiş olduğu ve bunun çevre kirliliğini olumsuz yönde etkilediği sonucuna varılmıştır.

INTRODUCTION

Cotton plant is one of the plants that make the most use of chemical inputs in agriculture. Cotton production has a share of 4% in agricultural production in the world. But in cotton production, chemical fertilizers and chemical pesticides are used in high proportion. These chemicals that used in cotton cultivation play an important role in vegetative and generative growth. Chemicals used in conventional production harm to plant and human health by accumulating in soil, water and environment. Organic Agriculture is a controlled and registered system that protects people, the environment and the entire ecosystem as an harmful for human health, which is caused by significant diseases, synthetic chemicals that pollute land, air, food and water. Organic cotton is grown without the use of pesticides or other toxic chemicals and it is not exposed to chemicals after the growth process. Instead, organic cotton growers emphasize natural, biological methods which have far less impact on the environment compared to conventional cotton. These methods include crop rotation, cover crops, organic fertilizers, beneficial insects, and human labor for weed control. Organic production systems replenish and maintain soil fertility, reduce the use of toxic and persistent pesticides and fertilizers, and build biologically diverse agriculture. Organic cotton is grown in many countries, with the leading producers being China, India, and Turkey. Other large-scale organic cotton producing countries are Egypt, Peru, Senegal, Tanzania, Uganda, and the United States. (Anonymous, 2017).

Conventional cotton production accounts for nearly 25 % of the world's insecticide use while comprising only about 3% of farmland. In the U.S. alone, it takes about 33% of a pound of pesticides to grow enough conventional cotton. Conventional cotton requires intensive water irrigation and synthetic fertilizers. Conventional growing practices cause soil losses due to predominantly mono-crop culture. Furthermore, conventional cotton seeds are treated with fungicides and insecticides. Many of the seeds are of the genetically modified organism (GMO) variety. Organic cotton uses untreated, non-GMO seeds.

Conventional cotton producers use defoliants for easier and cleaner harvesting, and as a result defoliants can also pollute the environment. Harvesting machinery compacts the ground and impacts soil productivity. Organic cotton production often involves handpicking - no chemicals, defoliation, or machinery (Anonymous, 2017).

Conventional cotton growing relies on a number of potentially harmful chemicals for scouring, and soil leaching. Chemicals include chlorine, hydrogen peroxide and ethylenediamine tetra-acetate (EDTA). Organic cotton processing uses natural spinning oils, potato starch, and other natural compounds.

Cotton is essentially produced for its fibre, which is universally used as a textile raw material. It is an important commodity in the world economy and is grown in more than 100 countries. Cotton is a heavily traded agricultural commodity with over 150 countries involved in exports and imports (Anonymous, 2007). Cotton that is grown by using chemical fertilizers and pesticides is known as conventional cotton. Over the last few years, as a result of a general increase in awareness for environmental problems on production of conventional cotton, organic cotton production has experienced a disproportionately large amount of attention (Hortmeyer, 2010).

Organic refers to the way agricultural products are grown and processed. It includes a system of production, processing, distribution and sales that assures consumers that the products maintain the organic integrity that begins on the farm (Anonymous, 2010). In the study which shows that the plant quality parameters examined with increase of the farm fertilization application dose were also increased, the highest yield was obtained from the areas where farm fertilization was applied at 4 and 6 t da^{-1} doses in two trial years (Bozokalfa et al., 2017). The organic apparel market is growing every year as consumers, whose appetites have been whetted with organic foods, are seeking to expand their organic lifestyle to include apparel. Sales of products made from organic cotton, the most widely available organic fiber, have jumped to $1.07 billion in 2006 and apparel manufacturers and retailers, eager to capture a piece of this growing consumer segment, have been producing organic textiles and apparel for every budget(Lipke, 2007).

Standards for organic apparel products have been evolving over the past several decades. Organic cotton, as opposed to conventionally produced cotton, has been produced using methods that are free from most synthetic chemical inputs such as pesticides, herbicides and chemical fertilizers (Myers and Stolton, 1999).

MATERIAL and METHOD

This research was carried out by using the ST-468 and BA-119 cotton varieties in three replications, according to the randomized block split parcel trial design under organic farmland conditions in 2013-2014 growing seasons; NPK, Biofarm (cattle fertilizer) and pigeon manure and control plots (without fertilizer). In the study parcel lengths were applied as 12 meters, plot widths of 2.8 meters and 3 meters spacing between parcels. Plantings were made on April 30, 2013, and May 5, 2014. The main parcels consisted of varieties, sub-parcels were organic and chemical fertlizations and control parcels.

The ST-468 variety is medium early varieties. The adaptability is very high and the efficiency is excellent and has hairy leaves. The machine harvesting is a suitable variety. Fiber properties of ST-468 variety; fiber strength average 34,7 gr tex^{-1}, fiber length 4.2 micronaire and fiber length 30 mm. The BA-119 is an early varieties, medium-sized, adaptable to the region, and suitable for machine harvesting. When the fiber quality characteristics of the BA-119 variety are examined; It was determined that the fiber thickness was 4.4-4.6 micron, the strength was 31-33 g tex^{-1} and the fiber length was 28-30 mm.

The analysis of soil results was taken at Table 1.The soil of the experiement area was clayish and loamy with average of two years 1.04 % of salt, 25.8 % of lime ($CaCo_3$), 20.69 kg ha^{-1} phosphorus, 800.3 kg ha^{-1} potasium, 1.20 % organic material and 7.60 PH of soil reaction.

The preparation of the soil was carried out with a plow 25 cm deep after November, and a second version was made with the cultivator in March in the spring. When the soil pan came in the first week of April, the goble-disc was pulled and then mixed with soil by applying biofarm and pigeon seed. Biofarm (cattle fertilizer) fertilizer was given to soil at 2000 kg ha^{-1}, pigeon fertilizer at 1000 kg ha^{-1} and NPK (20-20-20) fertilizer at 200 kg ha^{-1}. And when the plants flowering start, 200 kg ha^{-1} urea (%46 N) was applied to traditionally plots as second fertilizer.

Cattle Manure (Biofarm manure); It was produced by fermentation of cattle manure and vegetable protein sources. It is a fertilizer that improves the physical structure of soil and enriches soil with nutrients and humus. Biofarm manure was contained 50% organic matter, 2% total nitrogen (N), 1.6% Organic Nitrogen (N), 2% phosphorus P_2O_5, 2% water soluble potassium K_2O, 20% moisture. Meanwhile C / N 9-12, pH was measured about 7-8 (Anonymous, 2018). Pigeon manure was made analysis in. According to analysis of pigeon manure consists 25 % organic material, 6.24% total nitrogen (N), 1.19 % P_2O_5, 1.61 % water-soluble potassium (K2O). Pigeon manure and cattle manure after naturelly burned was applied as dried (Anonymous, 2015).

Sufficient isolation between organic fertilizers and chemical fertilization has been maintained. A total of 6 times of weeding was applied against weeds, including hand and tractor. In the experiment, a drip irrigation system was used and watered 7 times in total. Aphids, trips, white crocodiles and red spider, Neemazal (Azadirachta indica) obtained from the Neem tree was applied according to the harmful density during the cooler hours of the day, covering the entire plant surface three times with a dose of 300 cc 100 lt^{-1} water. The two middle rows of different organic and chemical fetilizations were harvested by hand during the third week of September and mid-October.

In this study some features were determined such as yield productivity, fibre lenght, micronaire, strenght STR, elongation, short fiber index according to is used (Anonymous, 2019).

The statistical analysis of the data after the research was calculated using the JUMP 7.0.1 packed program developed by SAS Institute. In 2013 and 2014 years, data was calculated both one by one and together according to 'Randomized Block Split Parcel Trial Design' and the variance was analyzed. The most important averages on F test were grouped according to Least Significant Difference (LSD) test. Moreover the Coefficient of Variation (% CV) determined. Graphics were made on Excel program. Furthermore, in order to determine the correlation between the characteristics examined, correlation calculating program on JUMP is used (Cevheri and Yılmaz, 2016).

Table 1. Soil Analysis Results for the Trial Area

Çizelge1. *Deneme Alanına İlişkin Toprak Analiz Sonuçları.*

Years	Saturation with water (%)	Total Salt (%)	Water Saturated Soil PH	Lime (CaCo3) (%)	Available nutrients for plants (kg ha^{-1})		Organic Material (%)
					Phosphorus P_2O_5	Potasium K_2O	
2013	62	1.36	7.82	26.1	20.98	800.5	1.11
2014	67	0.72	7.38	25.5	20.40	800.2	1.30
Avera-ge	64.5	1.04	7.60	25.8	20.69	800.3	1.20

Anonimous, 2015.

RESULTS and DISCUSSION

In Table 2, It was found that the seed cotton yield varied from 3594.8 (ST-468) to 3737.4 kg ha^{-1} (BA-119) in the varieties and the highest yield was obtained from the BA-119 with 3737.4 kg ha^{-1}. It was determined that there was a statistical important difference between two varieties in terms of seed cotton yield. We think that this efficiency difference between varieties is caused by genetic and environmental factors. The result of fertilization applications was changed between 3370.0 (cattle manure) and 4424.5 kg ha^{-1} (chemical fertilization) and the highest seed cotton yield was obtained from chemical (NPK) fertilization applies. The highest cotton seed yield (4412.5 kg ha-1) was obtained (BA-119 x chemical fertilization) and 4412.5 kg ha^{-1} (ST-468 x chemical fertilization) according to the variety x fertilization interactions. There is no significant difference in the yield of cultivated cotton, in terms of variety x fertilization interactions. Our findings suggest that chemical and organic fertilization have a significant effect on the yield component of cotton (Kumari and Subbaramamma, 2006), indicating that conventional production conditions result in more product growth than organic production (Kısakürek et al., 2011), which indicates that nitrogen fertilizer yield increases (Aydemir, 1982), which indicate that nitrogen fertilizer increases fertility, indicate that nitrogen doses increase the density of cotton seed (Gençer and Oğlakçı, 1983). Who indicated that the highest yield was obtained in the experiment in which 50% chemical fertilization and 50%

Table 2. Mean values and variety-fertilization interactions obtained from Organic and Conventional Experiment.
Çizelge 2. *Organik ve Konvansiyonel Gübre Koşullarında Elde Edilen Ortalama Değerler ve Etkileşimler.*

A	Fertilizer Doses	Variety			A	Fertilizer Doses	Variety		
		ST-468	BA-119	Ort.			ST-468	BA-119	Ort.
1.Yield Productivity (kg ha^{-1})	a. Cattle manure	3223.3	3516.6	3370.0bc	4. Strength STR (g tex^{-1})	a. Cattle manure	31.91	33.53	32.72
	b. Pigeon manure	332.5.2	3930.0	3627.6b		b. Pigeon manure	34.98	36.63	35.80
	c. Chemical Fertilization	4412.5	4436.6	4424.5a		c. Chemical Fertilization	33.16	33.25	33.21
	d. Control	3418.5	3066.6	3242.6c		d. Control	32.18	33.03	32.61
	Mean	3594.8	3737.4	3346.8		Mean	33.06	34.11	33.58
	%CV:8.16 LSD(variety):n.s. LSD(fertilizer): 37.67** LSD(varietyxfertilizer): n.s.					%CV:6.02 LSD(variety):n.s. LSD(fertilizer): n.s. LSD(varietyxfertilizer): n.s.			
2. Fibre Lengtht (mm)	a. Cattle manure	28.16de	32.60a	30.38a	5. Elongation EI (%)	a. Cattle manure	10.03ab	9.17d	9.60b
	b. Pigeon manure	28.99cd	31.35b	30.17a		b. Pigeon f manure	9.91ab	10.12a	10.02a
	c. Chemical Fertilization	28.92cd	29.44c	29.18b		c. Chemical Fertilization	9.65bc	9.33cd	9.49b
	d. Control	28.81cd	27.90e	28.35c		d. Control	9.93ab	9.18d	9.55b
	Mean	28.72	30.32	29.52		Mean	9.88a	9.45b	9.66
	%CV:2.00 LSD(variety): n.s. LSD(fertilizer): 0.61** LSD(varietyxfertilizer): 0.87**					%CV:2.41 LSD(Variety): 0.27* LSD(fertilizer): 0.29** LSD(varietyxfertilizer): 0.41**			
3.Micronaire	a. Cattle manure	3.79c	4.71a	4.25a	6. Short fiber Index SFI (%)	a. Cattle manure	8.91	9.75	9.33a
	b. Pigeon manure	3.86bc	3.92bc	3.89b		b. Pigeon manure	8.45	9.41	8.93a
	c. Chemical Fertilization	3.96bc	4.21b	4.09ab		c. Chemical Fertilization	8.60	9.46	9.03a
	d. Control	3.99bc	4.22b	4.10ab		d. Control	8.18	8.33	8.25b
	Mean	3.90	4.26	4.08		Mean	8.53	9.23	8.88
	%CV:5.65 LSD(Variety): n.s. LSD(fertilizer): n.s. LSD(varietyxfertilizer): 0.41*					%CV:5.47 LSD(Variety): n.s. LSD(fertilizer): 0.61* LSD(varietyxfertilizer): n.s.			

A. Reviewed features, (LSD: least significant difference, ns: non-significant.) *Significant at p≤0.05; **significant at p≤0.01.

organic fertilizer were used findings are partially or completely in harmony (Shah et al., 2012).

There was no difference between the varieties in terms of fiber lenght. According to fertilizer applications the fiber lenght ranged from 28.35 mm (control) to 30.38 mm (cattle manure). The highest fiber length was obtained from cattle manure application. The lowest fiber length was obtained in BA-119 x control application as a 27.90 mm whereas the highest fiber lenght was determined BA-119 x cattle manure application being with the highest fiber length being highest fiber lenght 32.60 mm according to the varieties x fertilization interactions. Fiber yield has increased with farmyard manure (FYM). In addition, fiber smoothness and other fiber quality criteria have been increased by farmyard manure (FYM). It provides a healthy positive nutrient balance thanks to the nutritional substance of the farm (Blaise et al., 2005). These results as similar to the ones indicated in our findings. When we compared to the micronaire results, there was no significant differences according to variety and fertilizer applications the best results was obtained in ST-468 x catttle manure interaction as a 3.79. There is no significant difference in Strength STR (g tex^{-1}). There is a difference between the varieties in terms of elongation the highest value was obtained in ST-468 (9.88%). ST-468 was the highest at 9.88. There is a significant difference between the fertilizers applied in terms of elongation. The highest result was obtained from pigeon manure being 10.02%. There was a significant difference in short fiber index (%) in terms of fertilizer application. The lowest elongation was determined in control as 8.88%. Our findings indicated that nitrogen fertilizer is not effective on the fiber length, fiber breakage resistance and fiber fineness characteristics of cotton plant (Gencer and Oğlakçı,1983; Phipps et al., 1997) reported that nitrogen application is not effective on fiber quality. Reported that our findings did not show any statistical difference in fiber length, uniformity index, fiber breakage resistance and fiber count, and that these fiber criteria were affected by differences under genotypic characteristics, climate, environmental conditions or genotype x environment interaction (Erdal et al., 2010; Akyol, 2013).

RELATIONS BETWEEN YIELD AND YIELD COMPONENTS (CORRELATION)

The values for correlation between the component and fiber quality characteristics was presented in Table 3. In the study, there was a positive and significant correlation between micronaire and fiber length (r = 0.4224 *). A negative and significant relationship between fiber elongation (%) and micronaire (r = -0.5769 *) was obtained. In addition, a positive and significant relationship was determined between short fiber index and fiber length (r = 0.6701 **).

CONCLUSION

Organic cotton production and the use of organic inputs are an important issue in ensuring sustainable agriculture, environment and food safety. According to the results of the study, it has been concluded that the cotton produced in the conventional production conditions is heavily contaminated with chemical inputs and this has negative effects on the pollution of the environment. As an alternative to conventional cotton production in order to increase the sustainable agricultural contribution of our producers, the system of applying pigeon manure for BA-119 cotton variety in organic cotton production system has come to the conclusion. Also, it is beneficial to use the specified variety and organic fertilizers in terms of fiber quality characteristics.

Table 3. Correlations between yield and fiber quality characteristics.
Çizelge 3. *Verim ve Lif Kalite Özellikleri Arasındaki Korelasyon.*

Variable	Variable	Correlation	Severity Level	Correlation Level
1.Length(mm)	6.Yield Productivity (kg ha^{-1})	0.2028	0.3418	
2.Micronaire	6.Yield Productivity (kg ha^{-1})	0.0394	0.8551	
2.Micronaire	1.Length(mm)	0.4224*	0.0398	
3. Strength STR (g tex^{-1})	6.Yield Productivity (kg ha^{-1})	0.1043	0.6277	
3. Strength STR (g tex^{-1})	1.Length(mm)	0.3770	0.0694	
3. Strength STR (g tex^{-1})	2.Micronaire	-0.2094	0.3260	
4.Elongation (%)	6.Yield Productivity (kg ha^{-1})	-0.0337	0.8756	
4.Elongation (%)	1.Length(mm)	-0.1518	0.4789	
4.Elongation (%)	2.Micronaire	-0.5769**	0.0032	
4.Elongation (%)	3. Strength STR (g tex^{-1})	0.1548	0.4701	
5.Short fiber Index SFI (%)	6.Yield Productivity (kg ha^{-1})	0.2143	0.3146	
5.Short fiber Index SFI (%)	1.Length(mm)	0.6701**	0.0003	
5.Short fiber Index SFI (%)	2.Micronaire	0.3530	0.0906	
5.Short fiber Index SFI (%)	3. Strength STR (g tex^{-1})	0.1515	0.4798	
5.Short fiber Index SFI (%)	4.Elongation (%)	-0.2954	0.1611	

*Significant at p≤0.05; **significant at p≤0.01.

REFERENCES

Akyol, N. 2013. Sıvı hayvan gübresinin pamuk tarımında üst gübre olarak kullanılabilirliği ve uygun doz araştırması (Master's thesis, Adnan Menderes Üniversitesi, Fen Bilimleri Enstitüsü).

Anonymous 2007. International Trade Center (ITC). http://www.intracen.org/uploadedFiles/intracenorg/Content/Exporters/Sectoral_Information/Agricultural Products/Organic Products/Organic Cotton an Opportunity for Trade.pdf.

Anonymous 2010. International Cotton Advisory Committee (ICAC). International cotton advisory committee report on some specialty cottons: Organic, fair trade and cotton made in Africa. Washington, DC: ICAC. Retrieved from http://www.icac.org/delegates/sc_notices/sc_meeting_504/504_at3.pdf

Anonymous, (2015). Gap Agricultural Research Enstitute, Soil Analysis Laboratory Şanlıurfa. 2015.

Anonymous, 2017. http://www.howstuffcompares.com

Anonymous, 2018. http://www.camli.com.tr/tr/urun/biofarm-humus-organik-gubre

Anonymous,2019.https://www.uster.com/fileadmin/customer/Instruments/Fiber_Testing/HVI/en_USTER_HVI_1000_TD_112017.pdf

Aydemir, M. 1982. Pamuk Islahı, Yetiştirme Tekniği ve Lif Özellikleri. Nazilli Bölge Pamuk Araştırma Enstitüsü Müdürlüğü Yayınları.

Blaise, D., Singh, J. V., Bonde, A. N., Tekale, K. U. and C.D. Mayee. 2005. Effects of farmyard manure and fertilizers on yield, fibre quality and nutrient balance of rainfed cotton (Gossypium hirsutum L.). Bioresource Technology, 96(3), 345-349.

Bozokalfa, M. K., Aşçıoğlu, T. K., Eşiyok, D., Tepecik, M., Kayıkçıoğlu, H. H. and N.T. Barlas. 2017. Çiftlik Gübresi Uygulamalarının Lahana (Brassica oleraceae L. var. capitata) Kök Kereviz (Apium graveolens L. var. rapaceum) ve Pırasa (Allium ampeloprasum) Yetiştiriciliğinde Verim ve Kalite Özellikleri Üzerine Etkisi. Ege Üniv. Ziraat Fak. Derg., 54(2), 239-247.

Cevheri, C. İ. and A. Yılmaz. (2016). Harran Ovası Organik Tarım Koşullarında Üretimi Yapılan Bazı Pamuk (Gossypium hirsutum L.) Çeşitlerinde Farklı Organik Gübre Uygulamalarının Gün Sayısı ve Gün-Derece Değerlerine Etkisi. Harran Tarim Ve Gida Bilimleri Dergisi, 20(2), 82-93.

Erdal, Ü., Sökmen, Ö., Üner, K., Bilir, L., Göçmez, S., Okur, N. and R. Çakmak. 2010. Bağ Yetiştiriciliğinde Organik ve Konvansiyonel Tarım Uygulamalarının Verim, Kalite ve Toprak Özellikleri Üzerine Etkileri. In Organik Tarım Araştırma Sonuçları 2005-2010 (pp. 333-340). TC Tarım ve Köyişleri Bakanlığı.

Gençer, O., and Oğlakçı M., (1983). Farklı Sıra Arası Uzaklığı ve Azot Gübrelemesinin, Pamuk Bitkisinin (G. hirsutum L.) Verim ve Kalite Unsurlarına Etkisi Üzerine Araştırmalar. ÇÜ ZF Yıllığı, (3-4).. Ç.Ü.Z.F. Yıllığı, Sayı: 3-4 Adana.

Hortmeyer, E. 2010. Organic Cotton: The Challenges Ahead. Cotton: Review of the World Situation, 63(5), 6-9.

Kisakürek, M. N., Gözcü, D., Arpaci, B. B., Kiliç, C., Aslan, C., Çiçek, B. and İ. Şen. 2011. Kahramanmaraş'ta Organik Pamuk Üretim Olanaklarının Araştırılması. In Organik Tarım Araştırma Sonuçları (pp. 115-122). TC Tarım ve Köyişleri Bakanlığı, Tarımsal Araştırmalar Genel Müdürlüğü.

Kumari, S. R. and P. Subbaramamma. 2006. Effect of farm yard manure, chemical fertilizers and micronutrients on yield, economics and fibre properties of cotton. Journal of Cotton Research and Development, 20(1), 64-70.

Lipke, D. (2007), "The greening of men's wear'', DNR, 2 April, available at: www.dnrnews.com/ site/article.php?id ¼ 32 (accessed May 15, 2007).

Myers, D. and S. Stolton. (Eds.). 1999. Organic cotton: from field to final product. London: Intermediate Technology Publications.

Phipps, B. J., Stevens, W. E., Ward, J. N. and T. V. Scales. 1997. The influence of mepiquat chloride (PIX) and nitrogen rate upon the maturity and fiber quality of upland cotton. In Beltwide Cotton Conferences (USA).

Shah, M. S., Verma, N. and R. K. Rai. 2012. Effect of organic manures and bio-pesticides on cotton yield. New Agriculturist, 23(2), 145-148.

Yolcu, 2009. Pamukta (Gossypium Hirsutum L.) Farklı Azot Doz ve Uygulama Zamanlarının Verim Ve Verim Unsurları İle Bitki Büyüme ve Gelişmesini İzleme Parametrelerine Etkisi. Doktora Tezi. Şanlıurfa