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Araştırma Makalesi/*Research Article*

Research on the Effects of NPK (Chemical fertilizer) and Organic Fertilizers Used for Some Cotton Species (*Gossypium hirsutum* L.) Grown In Semi-arid Climate Conditions on Growing Crops, Growing Crop Elements and Sustainable Agriculture[a]

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Abstract: Organic agriculture is a controlled and conditional system that protects the humankind, the environment and the whole ecosystem by preventing sentetic pesticides that cause serious illnesses and contaminate the soil, the air, the water and our food. In order to popularize organic agriculture this study was carried out by using ST-468 and BA-119 cotton varieties at NPK (Chemical fertilizer), Cattle manure, Pigeon manure, and control parcels at Akçakale Vocational High School of Harran University of Organic Agriculture conditions in 2013 and 2014. It is found that according to used organic and chemical fertilizers, plant height varies between 105,46 cm (control) and 116,48 cm (pigeon manure); boll number per plant^{-1} varies between 19,10 (control) and 31,03 (NPK); average boll weight varies between 5,43 g (control) and 6,18 g (Cattle manure); average seed cotton boll weight varies between 4.33 g (control) and 4,82 g (Cattle manure); seed cotton yield varies between 3240,26 kg ha^{-1} (control) and 4420,45 kg ha^{-1} (NPK fertilizer); monopodial branch number varies between 3,51 (pigeon manure) per plant^{-1} and 4,16 per plant^{-1} (Cattle manure); number plant^{-1} boll number per plant^{-1} varies between 12.13 (control) and 15.12 (NPK); First sympodial branch node number varies between 6,96 (Cattle manure) and 9.60 (Pigeon manure) number plant^{-1} ginning ratio varies between 40,88% (control) and 42,99 % (pigeon manure); 100 seed weight varies between 9,93 g (control)and 10,41 g (NPK). It is confirmed that the use of organic and NPK (chemical fertilizers) has dramatic effects and statistical differences on plant height, boll number, boll weight and yield.

Keywords: Organic cotton, organic fertilizer, chemical fertilizer.

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Yarı Kurak İklim Koşullarında Üretilen Bazı Pamuk (*Gossypium hirsutum* L.) Çeşitlerinde Kullanılan NPK ve Organik Gübrelerin Verim, Verim Unsurları ve Sürdürülebilir Tarıma Etkisinin Araştırılması

Öz: Organik tarım günümüzde insan bünyesinde önemli hastalıklara neden olan, toprağı, havayı, besinlerimizi ve suyu kirleten sentetik ilaçlara maruz kalmamıza engel olarak insanı, çevreyi ve bütün ekosistemi koruyan kontrollü ve kayıtlı bir sistemdir. Organik pamuk üretimi yapmak, yaşadığımız yer kürenin geleceği hakkında olumlu düşünmek anlamına gelmektedir. Ülkemizde ve bölgemizde organik tarımı yaygınlaştırmak amacıyla bu çalışma 2013-2014 yıllarında, Harran Üniversitesi Akçakale Meslek Yüksekokulu Organik Tarım koşullarında ST-468 ve BA-119 pamuk çeşitleri kullanılarak; NPK, Biofarm ve Güvercin gübreleri ile gübre kullanılmayan kontrol parsellerinde yürütülmüştür. Kullanılan organik ve kimyasal gübrelere göre bitki boyunun 105.46 cm (kontrol) ile 116.48 cm (Güvercin Gübresi); bitki başına koza sayısının 19.10 adet bitki^{-1} (kontrol) ile 31.03 adet bitki^{-1} (NPK); ortalama koza ağırlığının 5.43 g (kontrol) ile 6.18 g (Biofarm Gübresi); ortalama koza kütlü ağırlığının 4.33 g (Kontrol) ile 4.82 g (Biofarm Gübresi); kütlü pamuk veriminin 3240.26 kg ha^{-1} (Kontrol) ile 4420.45 kg ha^{-1} (NPK Gübresi); odun dalı sayısının 3.51 adet bitki^{-1} (Güvercin Gübresi) ile 4.16 adet bitki^{-1} (Biofarm Gübresi); meyve dalı sayısının 12.13 adet bitki^{-1} (Kontrol) ile 15.12 adet bitki^{-1} (NPK Gübresi); ilk meyve dalı boğum sayısının 6.96 adet bitki^{-1} (Biofarm Gübresi) ile 9.60 adet bitki^{-1} (Güvercin Gübresi); çırçır randımanının %40.88 (Kontrol) ile %42.99 (Güvercin Gübresi); 100 tohum ağırlığının 9.93 g (Kontrol) ile 10.41 g (NPK Gübresi) arasında değiştiği saptanmıştır. Çalışmada kullanılan organik ve kimyasal gübre uygulamalarının bitki boyu, koza sayısı, koza ağırlığı ve verim gibi incelen incelenen karakterler üzerine istatistiksel önem düzeyinde farklılıklar oluşturduğu saptanmıştır.

Anahtar Kelimeler: Organik pamuk, organik gübre, kimyasal gübre.

Introduction

Organic Agriculture is a farming process that is certificated and every step between production and consumption is controlled without using chemical input. The purpose of organic agriculture is to maintain sustainable agriculture, to prevent contamination of nature and to protect ecological system. Organic agriculture dates back 20th century when ozone layer thinning and future dangers for nature started to draw attention (Anonymous, 2016).

Cotton plant is one of the most chemical input used products in farming. Moreover, 16% of the world's pesticide production is used for cotton farming. Cotton farming has 3% production share in the world's agricultural production, but during its production process, a great amount of chemical fertilizers and pesticides are used. As a result, cotton plant is the most chemical used industrial plant compared to the other products. These chemicals aim at harmful insects, however they give harm to beneficial insect population as well as harmful insects. Furthermore, pesticides that are used excessively are absorbed by soil and they contaminate the groundwater and the air. There harmful chemicals accumulate in the soil and they affect the cultivation of plants negatively after cotton production that results in contamination of beneficial parts of the plants. As a result of contamination, human health gets harmed. Using organic cotton means considering our health and the future of the earth that we live on. Agricultural practices that have been applied for many years, dangerous pesticides and fertilizers and the production of genetically modified products can be replaced by organic agriculture practices.

Turkey is one of the leading countries in the organic cotton production. In Turkey, 258 farmers produced 20.127 tonnes of unginned cotton and 7958 tonnes of fibre cotton on 4140 ha production field in 2013 and 2014 growing seasons and in this way Turkey has 6.80% share of organic fibre cotton production in the world. In the organic cotton production ranking in the world; India is the first, China is the second, Turkey is the third, Africa is the fourth, Tanzania is the fifth and the USA is the sixth in 2013-2014 production season. In 2013-2014 production season organic cotton production was more or less 116.974 tonnes. In 2014, world organic cotton sale volume increased to about 10 billion dollars (Anonymous, 2015 a). Turkey is one of the rare countries that have fertile lands to produce organic textile products and industry and technology to process these products. Especially with GAP (Southeastern Project) and increasing organic cotton production, organic textile production has started to increase. The most important potential countries for organic textile products are the USA in particular and Sweden, Germany, England, France, Switzerland, Japan, Italy and Netherland. Turkey has great advantages for both processing of organic cotton that is produced in GAP region and marketing the product to the nearby countries. In the some researches and studies, we see that a great number studies have been done on the cotton production in the world and in Turkey.

Gençer & Oğlakçı (1983) pointed out that nitrogen dosages are effective to ginning yield (%), fruiting branch number, and unginned cotton yield but they are not effective to monopodial branch number, boll number, boll weight, unginned boll weight, fibre index, fibre lenght, ultimate tensile stress of fibre and fibre fineness in their study that they proceeded to determine the effect of different order distance and nitrogen fertilizing to the quality and yield elements of cotton plant (*Gossypium hirsutum* L.). Bondada et al (1996), stated that appropriate nitrogen dosages increase plant's leaf number and size, plant height, boll weight and boll size and as a result, they provide yield increase. Ohlendorf & Rude (1996) pointed out that approximately 70% of the product is taken from the first position of the fruiting branches, 20% from the second position, 5% from third position and the later positions and 15% from the secondary fruiting branches grow on the monopodial branches in the cotton production system. In his study on the effect of different nitrogen dosages (0, 80, 160 ve 240 kg ha^{-1} N) on blooming of cotton, fruiting brach number, yield and yield elements, Haliloğlu (1999) stated that the most yield of unginned cotton was obtained from 160 kg ha^{-1} pure nitrogen application. In the same study, stated that nitrogen dramatically increased the plant height, monopodial branch number, fruiting branch number, blooming day number, the first fruiting branch node number, average ripeness period, daily yield index and earliness index. Anlağan (2001) stated that the economical nitrogen dosage is 160 kg ha^{-1} and nitrogen increases plant height, fruiting branch number and boll number in his study to determine the effects of different nitrogen dosages to agricultural and technological elements of the cotton (*Gossypium hirsutum* L.)

Bozdoğan (2006), in his study that he carried out with two cotton varieties (*Gossypium hirsutum* L.) in 2004 and 2005, pointed out that there are significant difference at statistical level between the two Genovarieties as regards duration of flowering, boll opening day number, ginning yield, 100 seed weight, fibre length and unginned cotton weight. He also pointed out that plant height, monopodial branch number, fruiting branch number, boll weight and unginned yield differ statistically in years and he stated it is possible that it may happen as a result of climate and the cultural practices. According to Bozdoğan, unginned yield is a quantitative element that is conducted by a great number of different genes and these elements may be affected by environmental conditions.

Khaliq et al (2006) searched the effects of organic and inorganic fertilizer resources and effective microorganisms on cotton yield and yield elements in Pakistan in 1999 and 2000. In their study, they applied Inspection(control), Organic materials (OM), Effective Microorganisms (MO), minerals (NPK) and different combinations of these. They stated the results of their study as that when organic materials and effective microorganisms were used solely they failed to increase the cotton yield and yield componenets. However, when they were applied as combined, they increased the yield and yield components as 44% compared to inspection and as a result of addition of NPK fertilizer (1700:850:600 kg ha^{-1}) to organic fertilizer and effective microorganisms, the highest unginned cotton yield (2470 kg ha^{-1}) was acquired.

In their study that they researched for the effects of chemical fertilizers, organic farm fertilizer and micro plant nutrition materials on cotton yield features, fibre quality features and economy in 2004 and 2005, Kumari et al (2006) stated that the application of nitrogen, phosphorous, potassium with 25% or 50% organic farm fertilizer increased the plant height, fruiting branch number and boll number and the fibre parameters of 2005 were 2.5% higher than the previous season. In their study “Research on Organic Cotton Farming Potentials” between 2002 and 2006 Kısakürek et al (2007) stated that verticillium dahlia occured less in organic farming parcels than inspection and traditional production systems; with the effect of fertilizing Variety earliness occured in organic farming parcels and with the effect of acides exposed as a result of decomposition of the farm fertilizer, the plant could benefit from Fe, Mn and P_2O_5 more efficiently. They also stated that in parcels in which traditional farming systems were applied pests occured more than organic and inspection systems, and cotton leaf hairiness affected the density of pests and they pointed out that traditional farming provided higher yield than organic farming parcels.

Ali et al (2009) in their study which consisted of farm manure, chicken manure, chemical fertilizer and inspection parcels that are used in cotton farming in 2006 and 2007 stated that farm fertilizer and chicken manure application increased the leaf size, plant height, distance between the nodes, fruiting branch number, root dry weight and fibre yield. Gunjal et al (2009) in their study that they carried out by applying six different fertilizer combinations in India in 2006 stated that, parcels in which poultry manure with phosphor and potassium addition were used provided similar unginned cotton yield compared to other parcels in cotton fibre yield and yield components, but in the parcels where poultry and farm fertilizer were used together the results were plant height as 102.76 cm, fruiting branch number 24.50 per plant, monopodial branch 3.87 per plant, and boll number 34.30 per plant, boll weight 3.93 g and unginned yield 2112 kg ha^{-1}. Ahmed et al (2013) carried out a study that they applied 0,8 and 16 tonnes ha^{-1} cattle manure in organic farming conditions. As a result of 8 tonnes ha^{-1} dosage of fertilizing boll number was 22 per plant, average boll weight was 3.01 g, cotton fibre yield was 1278.2 tonnes ha^{-1}, ginning yield was 34.72%. They stated that when dosage of fertilizing raised to 16 tonnes ha^{-1}, boll number was 29.33 per $plant^{-1}$ and fibre yield was 1307 kg ha^{-1}. Akyol (2013) in his study on usability of liquid cattle manure as main fertilizer in cotton farming and determining appropriate dosage stated that liquid cattle manure as main fertilizer could be applied in cotton farming and as a result of its usage, it had positive effects especially on unginned cotton yield and the other elements such as ginning yield, plant height, fruiting branch number and monopodial branch number. Channagounda et al (2014), in their study in which they searched the effect of microbial bacterias on cotton plant in 2011 and 2012 stated that a great amount of beneficial bacterias, fungus, actinomycetes occured in the 50% compost and 50% vermicompost application, N_2–Fixers and enzyme activities, phosphatase, deshydrogenase activities increased the soil's respiration speed and affected the plant growth positively. Lopez et al (2014) carried out a study in which they applied 0-40-80-120 tonnes of cattle manure and 120-60-0 plant ha^{-1} nitrogen to two diffrent plant density 120.000 plant ha^{-1} in the process of organic cotton production. According to the study they pointed out that the highest unginned cotton yield was obtained with 120.000 plant ha^{-1} plant density and 8 tonnes of cattle manure dosage. Yang et al (2014), in their study on searching the effects of root bacterias on verticillium dahliae, stated that 49.9 % plant growth was observed in the cotton parcels that root bacterias were fertilized in the greenhouse conditions compared to inspection parcels. Moreover, they stated that bacteria application decreased the verticillium dahliae 76.0 %, increased the cotton yield 13.7%. They pointed out that infusion of bacteria to the soil developed the yield and uniformity index, increased the organic material in the soil and regulated the percentages of Nitrogen, Phosphor and Potassium. Chavda et al (2015) said that they produced cotton by applying 5 tonnes of vermicompost per hectar in India between 2012 and 2013. According to Chavda et al (2015), unginned yield was 3500 kg ha^{-1} in the parcels that were applied vermicompost. They obtained 3040 kg ha^{-1} of unginned cotton yield from control parcels. They pointed out that vermicompost application provided higher yield increase than chemical fertilizer application when all elements were taken into consideration.

Material and Method

This study was planned and carried out as three replications and with split plot randomized blocks experiement design at Harran University Akçakale Vocational High School, organic agriculture conditions in 2013 and 2014. The main plots were formed by ST-468 and BA-119 commercial varieties which are compitable with the ecology of the region, the sub-parcels were NPK(Chemical fertilizer), Cattle manure, Pigeon manure and control (no fertilizer) parcels. In the study, the lenght of the parcels was 12 meters, the width of the parcels was 2.8 meters and there was 3 meters gap among the parcels for fertilizer isolation. Planting was done on 30th April 2013 and on 5th May 2014.

In the experiment ST-468 and BA-119 cotton varieties were used. ST-468 is a semi-early Variety. It has a great adaptation capability and it has perfect yield results. It has hairy leaves. It is convenient for mechanical harvesting. BA-119 has earliness and it has medium height. It is adapted to the region and convenient for the mechanical harvesting. The soil of the experiement area was clayish and loamy with average of two years 1.26 % of salt, 25.7 % of lime ($CaCo_3$), 32.2 kg ha^{-1} phosphorus, 1298.0 kg ha^{-1} potasium, 1.275 % organic material and 7.48 PH of soil reaction. The samples of soil of experiment area's analyses were made according to Tüzüner (1990), methods at laboratoy of GAP TAEM (GAP Agricultural Research Enstitute) in Şanlıurfa Province. The analysis of soil results was taken at Table 1. The studies had been carried out as fixed trial format for two years. The soil was plowed 25 centimeters depth after November and the second plow was done by cultivator in March. When the soil was ready, gobble disk array was constructed and soon after Cattle manure and pigeon manure were mixed with the soil. Cattle manure was applied as 2.000 kg ha^{-1}, pigeon manure was applied as 1.000 kg ha^{-1} and NPK fertilizer was applied as 200 kg ha^{-1} 15-15-15 compound fertilizer as the base fertilizer before planting. Urea fertilizer was applied as 240 kg ha^{-1} stage of flowering and boll development manure had produced by fermentation method of cattle manure and vegetable protein sources. It is a fertilizer that improves the physical structure of the soil, enriches the soil plant nutrients and humus. Cattle manure and pigeon manure was made analysis in GAP Agricultural Research Institute in Şanlıurfa Province. According to the analyzes; cattle manure was consists 2% P_2O_5, 2% water-soluble potassium (K_2O), 20% maximum moisture, C / N 9-12, 2 % organic nitrogen (N), pH range is around 7. 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 (K_2O). Pigeon manure and cattle manure after naturelly burned was applied as dried. Organic fertilizers and NPK fertilizer applications were applied in different parcels and different places with isolation distance at the same climate conditions. Hoeing was done six times against weed by manual and mechanic hoe. Drip irrigation was used in the trial and it was done seven times in total. The mixture of soft soap (3 kg per 100 lt $water^{-1}$) and spirit (600 g 100 lt $water^{-1}$) was applied against aphid, thrips, white fly and red spider mite. Neemazal is an organic certified pecticide with a trade name. In addition to this application, Neemazal that is produced from Neem tree was applied with the dosage of 300 cc 100 lt $water^{-1}$ at the chilly times of the day by covering all the plant's surface according to density of pests three times in total (Cevheri and Yılmaz, 2016). One meter was taken out from both sides of the parcels with different organic and NPK fertilizers and two lines in the middle were harvested two times manually in the third week of September and in the middle of October. It is seen that between April and October, known as cotton planting season, the average temperature values of July, September and October in 2014 (0.7, 2.3 ve 1.8 °C) were relatively higher than 2013 values according to comparison of temperature values of 2013, 2014 and average temperature values. Variance analysis of the data of the yield and the yield elements that were acquired from the experiment were processed according to JUMP statistical programme and significant level of them were classified according to LSD test.

Table 1. Soil Analysis Results for the Trial Area

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	66	1.26	7.66	26.0	27.8	1442.0	1.20
2014	66	0.78	7.30	25.4	36.7	1154.0	1.35
average	66	1.02	7.48	25.7	32.2	1298.0	1.275

Anonimous, 2015b.

Results and Discussion

Plant Height (cm)

According to two years average values out of Table 2, it is understood that plant height varies between 110.32 cm (ST-468) and 112.86 cm (BA-119), BA-119 variety has a higher value as 112.86 cm. As a result of fertilizer applications, average plant height varies between 105.46 cm (control) and 116.48 cm (pigeon manure) and the highest plant height was obtained from pigeon manure application. According to variety x fertilizer interaction values, it is seen that the lowest plant height value was obtained from BA- 119 x control (100.06 cm) interaction and the highest plant height was obtained from BA-119 x Pigeon manure interaction (116.48 cm). Neither any difference occurred between the varieties in the level of statistical importance nor the fertilizer applications had a significant effect on plant height. It is seen that there wasn't any difference on plant height among the NPK (chemical fertilizer) parcels, organic fertilizer parcels and control (non-fertilizer) parcels (Table 2).

Our findings are coherent with Khaliq et al (2006), Reddy et al (2007), Gunjal et al (2009), Kıvılcım et al (2010) who stated that when organic materials and effective microorganisms are used solely, they do not increase the cotton yield and the yield components, however organic materials, effective microorganisms mineral NPK (chemical fertilizer) and different combinations of these increase the yield and the yield components. In the examined literature, Bondada et al (1996), Phipps et al (1997), Haliloğlu (1999), Anlağan (2001), Ali et al (2009), Yolcu (2009), Shah et al (2012) stated that appropriate nitrogen dosages increase the leaf number and size, plant height, boll weight and seed size. This statement that is not entirely coherent with our findings possibly resulted from different genotypical structure of the Varieties which used in the experiments, different environmental conditions and different cultural applications. Thus, Albayrak (2014) pointed out that any kind of diseases and pest that would cause a significant decrease of

Table 2. Average Values of Features that are Analyzed According to Cotton and Fertilizer Variety used in the Experiement and Interactions of the Variety-Fertilizer

R.F.	Fertilizer Applications	Varieties			R.F	Fertilizer Applications	Varieties		
		ST-468	BA-119	Average			ST-468	BA-119	Average
1	1.C.M	111.23	116.46	113.85	6	1.C.M	4.20	4.13	4.16
	2. P.M.	111.70	121.26	116.48		2. P.M.	3.83	3.20	3.51
	3.NPK	107.50	113.66	110.58		3.NPK	3.56	3.50	3.53
	4. control	110.86	100.06	105.46		4. control	3.70	3.36	3.53
	Average	110.32	112.86	111.59		Average	3.82	3.54	3.68
	CV(%):8.53 LSD(Variety): N.S. LSD(Fertilizer): n.s. LSD(Variety*Fertilizer): n.s.					CV(%):15.07 LSD(Variety): n.s. LSD(Fertilizer): n.s. LSD(Variety*Fertilizer): n.s.			
2	1.C.M	29.06a	27.53a	28.30a	7	1.C.M	13.66	11.23	12.45b
	2. P.M.	25.30a	30.50a	27.90a		2. P.M.	15.56	11.03	13.30ab
	3.NPK	30.46a	31.60a	31.03a		3.NPK	17.46	12.76	15.12a
	4. control	25.03a	13.16b	19.10b		4. control	15.06	9.20	12.13b
	Average	27.46	25.70	26.58		Average	15.43	11.05	13.25
	CV(%):14.96 LSD(Variety): n.s. LSD(Fertilizer): 5.00** LSD(Variety*Fertilizer): 7.07*					CV(%):11.23 LSD(Variety): n.s. LSD(Fertilizer): 1.87* LSD(Variety*Fertilizer): n.s.			
3	1.C.M	5.90	6.46	6.18a	8	1.C.M	6.83b	7.10a	6.96b
	2. P.M.	5.80	6.16	5.98a		2. P.M.	11.26a	7.93a	9.60a
	3.NPK	5.86	5.75	5.81ab		3.NPK	6.86b	7.90a	7.38b
	4. control	5.43	5.43	5.43b		4. control	12.40a	6.76b	9.58a
	Average	5.75	5.95	5.85		Average	9.33	7.42	8.38
	CV(%):7.05 LSD(Variety): n.s. LSD(Fertilizer): 0.51* LSD(Variety*Fertilizer): n.s.					CV(%):13.30 LSD(Variety):n.s. LSD(Fertilizer): 1.4** LSD(Variety*Fertilizer): 1.98**			
4	1.C.M	4.56	5.08	4.82	9	1.C.M	42.10	41.86	41.98ab
	2. P.M.	4.43	4.63	4.53		2. P.M.	42.72	43.27	42.99a
	3.NPK	4.76	4.71	4.74		3.NPK	40.99	41.19	41.09b
	4. control	4.30	4.36	4.33		4. control	41.51	40.25	40.88b
	Average	4.51	4.70	4.60		Ortalama	41.83	41.64	41.74
	CV(%):7.38 LSD(Variety): n.s. LSD(Fertilizer): n.s. LSD(Variety*Fertilizer): n.s.					CV(%):2.19 LSD(Variety): n.s. LSD(Fertilizer): 1.15** LSD(Variety*Fertilizer): n.s.			
5	1.C.M	3220.33	3510.66	3370.00bc	10	1.C.M	10.20	9.83	10.01
	2. P.M.	3320.52	3930.00	3620.76b		2. P.M.	10.26	10.25	10.25
	3.NPK	4410.25	4430.66	4420.45a		3.NPK	10.30	10.53	10.41
	4. control	3410.85	3060.66	3240.26c		4. control	10.40	9.47	9.93
	Average	3590.48	3730.74	3340.68		Average	10.29	10.02	10.15
	CV(%):8.16 LSD(Variety): n.s. LSD(Fertilizer): 37.67** LSD(Variety*Fertilizer): n.s.					CV(%):4.12 LSD(Variety): n.s. LSD(Fertilizer): n.s. LSD(Variety*Fertilizer): n.s.			

R.F. : Researched Features. (*):Significant at 5% statistical level; (**):Significant at 1% statistical level C.M. :Cattle manure, P.M.: Pigeon manure

1.Plant Height (cm), 2.Boll Number Per Plant (number plant^{-1}), 3.Boll Weight (g), 4. Seed Cotton Boll Weight (g), 5.Seed cotton yield (kg ha^{-1}), 6. Monopodial Branch Number (number plant $^{-1}$), 7.Sympodial Branch number (number plant^{-1}), 8. First Sympodial Branch Node Number (number plant^{-1}), 9.Ginning Yield (%), 10.100 Seed Weight (g).

Yield in cotton farming province-wide were not recorded in Aydın in 2012 but he also stated that because of early high temperatures and excessive dense planting there occurred quality and yield decrease. Along with that, values of plant height of our study were at normal levels.

Boll Number Per Plant (number plant^{-1})

According to average values of two years obtained from Table 2; boll number of the Varieties per plant varies between 27.46 number plant^{-1} (ST-468) and 25.70 number plant^{-1} (BA-119), ST-468 variety has a higher boll number value as 27.46. Moreover, as result of fertilizer applications, boll number per plant varies between 19.10 (Inspection) and 31.03 NPK (chemical fertilizer) number plant^{-1}. The highest boll number was obtained from NPK (chemical fertilizer) application, however Cattle manure and pigeon manure applications had effects similar to NPK (chemical fertilizer). In addition; according to variety x fertilizer interaction values, the least boll number per plant was obtained from BA-119 x control (13.16 number plant $^{-1}$) the most boll number per plant was obtained from BA-119 x NPK (31.60 number plant $^{-1}$). However, except from BA-119 x control interaction, the other Variety x fertilizer interactions statistically stayed within the same group. Any difference did not occur in the way of boll number per plant among the Varieties, moreover, fertilizer applications had an insignificant effect on boll number per plant. It can be said that fertilizer applications increased the boll number per plant compared to control and there wasn't any difference between NPK (chemical fertilizer) and organic (Cattle manure and pigeon manure) fertilizer applications (Table 2). Our findings are partially or totally coherent with Khaliq et al (2006), Kumari et al (2006), Attia et al (2008), Gunjal et al (2009), Yolcu (2009), Shah et al (2012), Ahmed et al (2013) that stated organic materials and effective microorganisms, when used alone, did not increase the cotton yield and the yield components however when organic materials, effective microorganisms, minerals (NPK) and different combinations of these are used, they increase the cotton yield and the yield components. Results of Kıvılcım et al (2010) which indicate organic fertilizer parcels and conventional fertilizer parcels are in the same group as yield and the other features are taken into consideration are in favor of our findings.

Boll Weight (g)

It can be understood from the Table 2 that average boll weight varies between 5.75 g (ST-468) and 5.95 g (BA-119), BA-119 has a higher weight value as 5.95 g. Moreover, as a result of fertilizer applications the average boll weight varies between 5.43 (control) and 6.18 (Cattle manure). In addition, the highest boll weight value was obtained from Cattle manure application. However, pigeon manure application had a similar effect as Cattle manure. According to variety x fertilizer interaction values, the lowest boll weight was obtained from the control parcels with no fertilizer and the highest boll weight was obtained from BA-119 x Cattle manure (6.46 g) interaction. However, it is seen that Variety x fertilizer interactions are not statistically significant. Any kind of difference did not develop among the Varieties in statistical importance level according to boll weight in variety x fertilizer interactions but fertilizer applications increased the boll weight compared to control. While applied fertilizers increased the boll weight compared to control, any significant difference was found between chemical fertilizer applications and organic fertilizer applications (Table 2). Our findings are partly or totally in coherence with findings of Gençer & Oğlakçı (1983), Khaliq et al (2006), Gunjal et al (2009), Ahmed et al (2013) about boll weight.

Seed Cotton Boll Weight (g)

According to average values of two years in Table 2, unginned boll weight of Varieties varies between 4.51 g (ST-468) and 4.70 g (BA-119). It is understood that BA-119 has a higher weight value as 4.70 g. As a consequence of fertilizer applications, average unginned boll weight varies between 4.33 g (control) and 4.82 g (Cattle manure); the highest unginned boll weight was obtained from Cattle manure application. Moreover, according to variety x fertilizer interaction values, the lowest unginned boll weight was obtained from the control parcels where any of fertilizers weren't used and the highest unginned boll weight was obtained from the interaction of BA-119 x Cattle manure (5.08 g). Any kind of difference at the level of statistical importance didn't develop among the Varieties according to unginned boll weight but fertilizer applications and variety x fertilizer interactions also did not have a significant effect on unginned boll weight (Table 2). The results of Gunjal et al (2009), Shah et al (2012), Attia et al (2008)' which stated that a higher cotton fibre yield and yield components were obtained from parcels where poultry manure together with phosphor and potassium as subsidiary effect were used and applications did not any significant effect on these characteristics respectively support our own results.

Seed cotton yield (kg ha^{-1})

According to average values of two years in Table 2, it is seen that seed cotton yield of varieties varies between 3590.48 kg ha^{-1} (ST-468) and 3730.74 kg ha^{-1} (BA-119), BA-119 has a higher value with 3730.74 kg ha^{-1}. In addition, as a result of fertilizer applications, seed cotton yield varies between 3240.26 kg ha^{-1} (control) and 4420.45 kg ha^{-1} NPK (chemical fertilizer), the highest unginned cotton yield was obtained from NPK (chemical fertilizer) application. According to variety x fertilizer interaction values, the lowest unginned cotton yield value was obtained from BA-119 x control interaction (3060.66 kg ha^{-1}) and the highest seed cotton yield value was obtained from BA-119 x NPK (chemical fertilizer) interaction (4430.66 kg ha^{1}). Any kind of difference at the level of statistical importance didn't develop among the varieties according to seed cotton yield but variety x fertilizer interactions also did not have a significant effect on unginned cotton yield (kg ha^{-1}) (Table 2). Fertilizer applications affected the seed cotton yield that the highest seed cotton yield was obtained from chemical NPK (chemical fertilizer) application. According to values, chemical fertilizer is followed by pigeon and Cattle manure respectively. Our findings are more or less in coherence with Bozdoğan (2006) who stated boll yield may be affected by a great number of genes and environmental conditions; Kumari et al (2006) who stated NPK (chemical fertilizer) and organic fertilizer has a great effect on yield component of cotton; Kısakürek et al (2007) who stated conventional farming conditions provide more product increasement than organic production; Aydemir (1982) who stated nitrogen increase the boll number, seed size and fibre yield; Gençer & Oğlakçı (1983) who stated that nitrogen increase unginned cotton yield; Bondada (1996) who stated appropriate nitrogen dosages increase the plant's leaf number and size, plant height, boll weight, seed size and unginned yield; Phipps et al (1997) who stated that nitrogen fertilizing increase the fibre yield; Anlağan(2001) who stated nitrogen is effective on plant yield components and Shah et al (2012) who stated that the highest yield was obtained from the trial in which 50%

NPK and 50% organic farm fertilizer were used. Similar results were stated by Haliloğlu (1999), Çakmakçı (2005), Kumari et al (2006), Kısakürek et al (2007), Ahmed et al (2013), Akyol (2013), Channagounda et al (2014), Lopez et al (2014), Yang et al (2014) ve Chavda et al (2015).

Monopodial Branch Number (number plant $^{-1}$)

According to average values of two years in Table 2; it is seen that monopodial branch numbers of the varieties vary between 3.82 number plant^{-1}(ST-468) and 3.54 (BA-119) number plant^{-1}, ST-468 has a higher value with 3.82 number plant^{-1}; a result of fertilizer applications, monopodial branch numbers vary between 3.51 number plant^{-1} (pigeon manure) 4.16 number plant^{-1} (Cattle manure); the highest monopodial branch number was obtained from Cattle manure application. In addition, according to variety x fertilizer interaction values, the lowest monopodial branch number was obtained from BA-119 x pigeon manure (3.20 number plant^{-1}) and the highest monopodial branch number was obtained from ST-468 x Cattle manure (4.20 number plant^{-1}). Interaction of Variety x fertilizer was considered as statistically insignificant. Any kind of difference at the level of statistical importance didn't develop among the Varieties according to monopodial branch number but fertilizer applications also did not have a significant effect on monopodial branch number. Monopodial branch number did not differ in parcels where NPK (chemical fertilizer), organic (Cattle manure and pigeon manure) fertilizer applications were applied and the parcel where no fertilizers were used (Table 2). Thus, Gençer & Oğlakçı (1983) stated that nitrogen dosages were not effective on monopodial branch number, Anlağan (2001) stated that when organic materials and effective microorganism are used alone, they do not increase the yield and the yield components. Moreover, Khaliq et al (2006) stated that when they are used as combined they increase the yield and the yield components with 44% compared to control and Kıvılcım et al (2010) stated that Nazilli-84 variety was produced organically and parcels with organic fertilizers and parcels with conventional fertilizers stayed in the same group according to yield and the other examined features. The result of Haliloğlu (1999) that nitrogen dosage increase the monopodial branch number contrasts our findings. This situation may be caused by different plant materials, different environmental conditions and different cultural processes.

Sympodial Branch number (number plant^{-1})

According to average values of two years in Table 2; it is seen that sympodial branch numbers of the varieties vary between 15.43 number plant^{-1} (ST-468) and 11.05 number plant^{-1} (BA-119). ST-468 has a higher fruiting branch number value as 15.43 number plant^{-1}. As a result of fertilizer applications, sympodial branch numbers vary between 12.13 number plant^{-1} (control) and 15.12 number plant^{-1} NPK (chemical fertilizer) , the highest fruiting branch number value was obtained from NPK (chemical fertilizer) application. According to variety x fertilizer interaction values, the highest values were obtained from ST-468 x NPK (17.46 number plant $^{-1}$) and the lowest values were obtained from BA-119 x control (9.20 number plant^{-1}). Among the parcels in which chemical fertilizer application NPK (chemical fertilizer), organic fertilizer application (Cattle manure and pigeon manure) and none- fertilizer application were applied, a significant difference was detected (Table 2). Although a higher fruiting branch number was taken from the parcels with NPK (chemical fertilizer) application, it can be said that organic fertilizer applied parcels gave good results, too. Similar results were stated by researchers such as Gençer & Oğlakçı

(1983), Haliloğlu (1999), Anlağan (2001), Bozdoğan (2006), Kumari et al (2006), Ali et al (2009), Gunjal et al (2009), Yolcu (2009), Akyol (2013).

First Sympodial Branch Node Number (number plant^{-1})

First sympodial branch number is one the vegetal features that determine earliness. For this reason, for early çömer varieties, first sympodial branch node number is lower. According to average values of two years in Table 2; the first sympodial branch node numbers vary between 9.33 number plant^{-1} (ST-468) and 7.42 number plant^{-1} (BA-119), and ST-468 has a higher value with 9.33 number plant^{-1}. However, there are not any statistical importance level differences between the varieties. As a result of fertilizer applications, the average numbers of the first fruiting branch nodes vary between 6.96 number plant $^{-1}$ (Cattle manure) and 9.60 number plant $^{-1}$ (pigeon manure); the highest the first branch nodes number was obtained from pigeon manure application and inspection parcels gave similar high results. According to variety x fertilizer interaction values, the lowest fisrt fruiting branch nodes number were obtained from BA-119 x control interaction(6.76 number plant^{-1}), and the highest first fruiting branch node numbers were obtained from ST-468 x control interaction(12.40 number plant^{-1}). While NPK (chemical fertilizer) application had low values with ST-468, it had higher values with BA-119 and placed in the upper group (Table 2). Our findings are more or less coherent with the findings of Ohlendorf & Rude (1996), Khaliq et al (2006), Gunjal et al (2009), Yolcu (2009) and Kıvılcım et al (2010). But, according to examined resources, findings of Haliloğlu (1999) contrast our findings. It may be caused by diversity of the nitrogen resources, varieties, environmental factors and cultural applications.

Ginning Yield (%)

According to average values of two years in Table 2; ginning yield of the varieties varies between 41.83% (ST-468) and 41.64% (BA-199), ST-468 had a higher value with 41.83 % but, any significant statistical difference did not develop between the Varieties in the way of ginning yield. As a result of fertilizer applications, average ginning yield varies between 40.88 % (control) and 42.99% (pigeon manure), therefore the highest ginning yield was taken from pigeon manure application. According to Variety x fertilizer ginning yield values, it is understood that the lowest ginning yield was taken from BA-119 x control (40.25%) interaction and the highest ginning yield was taken from BA-119 x Pigeon manure (43.27%) interaction. Ginning yield (41.09%) of the parcels in which NPK (chemical fertilizer) was applied had similar value to inspection parcels ginning yield (40.88 %), ginning yield (42.99% and 441.98 % respectively) of the parcels with pigeon manure and Cattle manure had lower values (Table 2). Moreover, any important difference couldn't be detected according to Variety x fertilizer interaction values. This result is coherent with the findings of İncekara (1971), however, among the examined resources, it contrasts with the findings of Gençer & Oğlakçı (1983), Akyol (2013), Erdal et al (2013) who stated nitrogen dosages increase the ginning yield and Şahin (1994), Yolcu (2009) who stated nitrogen dosages decrease the ginning yield. We assume that it may be caused by different geno Varieties of the Varieties that used, different ecologies and different environmental interactions. Despite of this, ginning yield rate (%) of our study is normal in the Harran plain ecological conditions, moreover it stays in the borders that may be higher than normal.

100 Seed Weight (g)

According to average values of two years in Table 2; 100 seed weight of the varieties varies between 10.29 g (ST-468) and 10.02 g (BA-119), ST-468 has a higher value with 10.29 g but there aren't any significant statistical differences between the varieties in the way of 100 seed weight. As a result of fertilizer applications, 100 seed weight varies between 9.93 g (control) and 10.41g and the highest 100 seed weight was taken from NPK (chemical fertilizer) application. Both chemical and organic fertilizer applications did not affect 100 seed weight in level of statistical importance. According to Variety x fertilizer interaction values, the lowest 100 seed weight values was obtained from BA-119 x control (9.47 g) interaction and the highest 100 seed weight value was obtained from BA-119 x NPK (chemical fertilizer) interaction. Any statiscally significant difference was not detected for 100 seed weight between the varieties, varieties x fertilizer interactions and the fertilizer applications (Table 2). Researches stated that appropriate nitrogen dosages increase the seed size (Aydemir 1982, Bondada et al 1996, Yolcu 2009). From the point of our view, this may be resulted from diversity of genetypical structure of the Varieties, environmental conditions and cultural applications. In our study, it may be said that 100 seed weight (g) stayed at the normal levels according to Varieties and ecological conditions of our region.

Corelations Between the Yield and the Yield Components

Coefficient of correlation among the features which were examined were given in Table 3. From the Table 3. Some relations (corelation) were detected between the vegetative specialties and yield components specialties that were examined from the Table 3. In the study, a positive and important corelation (r=0.4245*) was detected between boll number and Sympodial branch, between average cotton seed boll weight (g) and monopodial branch(r=0.5064*), between Average cotton seed boll weight (g) and average boll weight(r=0.6386**), between ginning yield and the plant height (r=0.4739*), between ginning yield and monopodial branch(r=0.4337*), between 100 seed weight and boll number (r=0.4246). Desaleng et al (2009), in their study that they planted 15 F_1 cotton variety which was produced by diallel hybridization at Ethiopia Werer Agricultural Research Institute, stated that heredity has a great percentage in corelation of unginned and fibre quality figures. Researchers reported that there is an important and positive corelation between seed cotton boll weight and boll weight (r=0.99*), fibre yield(r=0.88**) and fibre index (r=0.96**). Moreover, they stated a positive corelation between ultimate tensile stress of fibre and fibre quality criteria, and a positive and important corelation between ultimate tensile stress of fibre and fibre lenght(r=0.64**), between fibre thinness and uniformity (r=0.61**). Additionally, they reported negative and important corelations between fibre lenght and fibre thinness (r=-0.86**); between fibre lenght and short fibre index (r=-0.85**) and between fibre lenght and monotony (r=-0.99**). Similar results were reported by researchers such as Mert et al (1998), Bilalis et al (2010), Salahuddin et al (2010), Araujo et al (2012).

Table 3. Corelations between the examined vegatative features.

	1	2	3	4	5	6	7	8	9	10
1	1,0000									
2	0,2871	1,0000								
3	-0,0295	0,1117	1,0000							
4	0,0598	0,0133	0,3206	1,0000						
5	0,3884	0,0706	**0,4245***	-0,0006	1,0000					
6	0,3675	0,2641	-0,2497	-0,2723	0,2682	1,0000				
7	0,2759	**0,5064***	-0,1779	-0,3732	0,1670	**0,6386****	1,0000			
8	**0,4739***	**0,4337***	-0,0225	0,1925	0,2828	0,3329	0,2714	1,0000		
9	0,2991	-0,1326	0,3289	0,1421	**0,4246***	-0,2990	-0,1412	0,1292	1,0000	
10	0,1259	-0,2315	0,2655	-0,1826	0,5219	0,1454	0,1778	-0,0074	0,3407	1,0000

1.Plant height(cm), **2.**Monopodial branch (number plant $^{-1}$), **3.** Sympodial branch (number plant^{-1}), **4.** First sympodial branch node number (number plant^{-1}), **5.** Boll number (number plant $^{-1}$), **6.** Average boll weight (g), **7.** Average cotton seed boll weight (g), **8.** Ginning yield (%), **9.** 100 Seed weight (g), **10.** Seed cotton weight (kg ha^{-1}). (*):Significant at 5% statistical level; (**):Significant at 1% statistical level

Conclusion

The study in which the effect of NPK and organic fertilizers, used for some cotton Varieties(*Gossypium hirsutum* L.) in semi-arid climates, on the yield, yield components and sustainable agriculture were searched resulted in a positive way. According to results of the study; it is determined that a great amount of chemical input is used in conventional conditions and this results in serious threats such as contamination of nature, destruction of natural habitat. The most important result of our study is that the highest seed cotton yield was obtained from NPK fertilizer as 4420.45 kg ha^{-1} and according to variety x fertilizer interaction, the highest seed cotton yield was obtained from BA-119 x NPK fertilizer interaction. Moreover, it is understood that the highest yield was obtained from pigeon manure among the organic fertilizer applications, and according to variety x fertilizer interaction in organic fertilizer applications, the highest seed cotton yield was obtained from BA-119 with pigeon manure application as 3930.00 kg ha^{-1}. Organic cotton farming and the usage of organic input to provide sustainable agriculture, security of nature and the ecosystem is an important matter. Therefore, in order to increase the contribution of our planters, the application of pigeon manure to BA-119 cotton Variety in organic cotton farming system can be preferred as an alternative of conventional cotton farming.

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