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INVESTIGATION OF AGRICULTURAL PROPERTIES OF SOME COTTON GENOTYPES IN SECOND CROP CULTIVATION WITH TWO DIFFERENT TILLAGES IN ANTALYA

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ABSTRACT

The conservation agriculture system is an agricultural technique that will attract the attention of farmers, especially in terms of yield and cost, and this has been proven by many scientific studies. It is expected to be a widespread agricultural practice in future. This study was conducted in order to investigate the effects of different tillage and sowing methods of second crop cotton agriculture on the yield and yield components in the 2015-2016 production season on the trial land of Batı Akdeniz Agricultural Research Institute in Antalya. This study in which two different tillage methods (direct sowing on stubble and conventional tillage) with 5 cotton varieties and 2 cotton lines were used, was conducted according to parcels whose randomized blocks were split in a trial pattern. Genotypes showed significant differences in all examined agricultural characteristics. In terms of practices, there were significant differences in the number of nodes, number of monopodial branches, number of sympodial branches and number of seeds in agricultural observations. The year*application*genotype interaction was significant in terms of plant height, boll weight and number of seeds in the boll.

Keywords: second crop, cotton, conventional planting, stubble drilling.

INTRODUCTION

Cotton, which occupies an important place in Turkey's economy and has a variety of usages, is a plant supplying fiber in the first degree and oil in the second degree.

Considering the added value and employment opportunities it creates, it is a product of great economic importance for the agricultural countries. In Antalya, cotton is a plant which not only creates employment but has also enabled growers to make a profit for many years.

Although research studies have been conducted to determine suitable soil tillage methods for different agricultural products in various regions of our country, there is no large-scale and practical study on both first and second crop cultivation in Antalya and similar ecologies.

Fowler and Rockstorm (2001) in a study they carried out for the effective use of agricultural resources in Africa, defined protected agriculture as sustainable agriculture, which is the sum of agricultural production that protects natural and other resources, and enables water and soil conservation. They also demonstrated that this system is environmentally viable, technically feasible, economically consistent and socially acceptable.

In their study, Polat et al. (2007) stated that the success of second crop cotton production without tillage after lentils is important in terms of both preserving the soil (both by reducing the consumption of fertilizers by using legumes, and by minimizing tillage) and spreading the income distribution of the farmer throughout the year.

A result of research in Southeastern Anatolia Agricultural Research Institute in 2005 on the possibility of a second crop of cotton crops by using 6 cotton lines / varieties after ridge-sown watered wheat showed that stubbledirect second crop cotton agriculture could only be done by using very early genotypes (Ekinci et al., 2008).

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In the study of second product in cotton with different sowing methods, was ranked Direct sowing on ridge > Seedling planting in stubble > Stubbledirect sowing > Decreased soil tillage methods from high to low, respectively, in terms of yield per decare (Aşık, 2015).

Çetin et al. (2013) reported that although Antalya's cotton production comprised only 1% of Turkey's whole production, manufacturers in the region should conduct research activities by cooperating with research institutions and other organizations operating in the region for the expansion of cotton farming as a second product after harvesting wheat in winter.

The aim of this study was to compare direct sowing on wheat stubble with conventional tillage in the second crop production of cotton cultivation in the Antalya region coastline.

MATERIAL AND METHODS

Trial Area, soil properties and climate characteristics of the test area

The research was carried out in the application area of Batı Akdeniz Agricultural Research Institute Directorate Aksu Enterprise in Antalya province after the winter wheat harvest, in the second cotton growing period.

Physical and chemical properties of soil samples (from 0-30 cm soil layers) taken from the test areas where the study was carried out are given in Table 1. Monthly total precipitation, average temperature and relative humidity values of the second product growing period in which the experiments were carried out are given in Table 2 together with the long-term averages.

Table 1. Soil analysis results of the trial area

	2015 year		2016 year	
	Evaluation			
pH (1:2.5)	8.2	Light Alkaline	8.1	Light Alkaline
Lime (%)	20.7	More line	24.4	More lime
EC micromhos/cm (25°C)	167	Without salt	181	Without salt
Sand (%)	13	Silty clay	21	Clay Loam
Clay (%)	43		29	
Silt (%)	44		50	
Organic matter (%)	1.6		2.1	
P ppm (Olsen)	12		11	
K ppm	273		322	
Ca ppm	4875		5450	
Mg ppm	571		585	

Table 2. The average climatic data of the 2015-2016 year

Year	2015						
Month	June	July	August	September	October	November	December
Rains (mm)	5.0	0.0	0.0	32.0	102.0	35.0	5.0
Average relative humidity (%)	68.4	66.1	67.7	77.8	69.9	65.0	61.4
Average temperature (°C)	24.0	27.7	28.6	25.4	20.9	15.7	10.7
Maximum temperature (°C)	38.2	41.3	42.2	41.3	32.4	28.4	24.4
Minimum temperature (°C)	14.8	16.4	16.8	16.0	9.4	5.4	2.0

Year	2016						
Month	June	July	August	September	October	November	December
Rains (mm)	18.0	0.0	0.0	24.0	5.0	78.0	32.0
Average relative humidity (%)	61.4	61.8	66.0	61.6	63.4	67.3	57.6
Average temperature (°C)	26.1	29.1	26.6	24.6	21.3	14.7	19.0
Maximum temperature (°C)	42.7	41.5	41.4	40.3	31.9	24.6	19.8
Minimum temperature (°C)	14.7	18.0	18.6	12.1	11.0	3.1	-0.9

The plant materials, agricultural equipment and machinery used in the trial

Productive varieties suitable for early and second crops were preferred. As cotton seed, Özbek 105, Gloria, Lydia, Elsa, St 373 varieties and YS6 and Aksu lines were used.

A Massey Ferguson tractor, with an engine power of 80 HP, was used as tractor in the trials. As agricultural tools and machinery, moldboard plow, Goble disc harrows, rototiller, pneumatic seed drill, stubble seed drill, inter-row rotary cultivator, disc harrow and base were used.

Design of trial

The randomized blocks were carried out on a total of 36 plots with 3 replications and 2 applications according to the split plots in the experimental design. Each trial plot was established with a length of 12 m and a width of 2.8 m, leaving a 5 m gap between the replications. In this way, the effects of various tillage tools on adjacent parcels were reduced.

Seeding was performed as 75 cm between rows and 20 cm above rows. In order to obtain data, the 2 rows in the middle part of the four-row parcels were harvested and plant observations were taken from these rows. The remaining two rows were left as edge effects. Sowing and harvesting dates of cotton by years were 10/07/2015 and 16/06/2016, 09/12/2015 and 24/11/2016, respectively. Cotton picking was carried out by hand. In statistical analyses, the JMP 10 software package was used.

Soil tillage and sowing systems applied in the trial

Trials were conducted in annealed soil conditions. In order to compare the findings in the research, one of the methods was the traditional method and the other was protective soil cultivation. The planned methods (A & B) are as follows.

A. Direct sowing on stubble

B. Conventional tillage (moldboard plow + Goble disc harrow + disc harrow + harrow + sowing machine, etc.).

RESULTS AND DISCUSSION

The results of the combined variance analysis of the results of the characteristics obtained in 2015 and 2016 are given in Tables 3, 4 and 5.

Number of nodes

Number of nodes up to the first sympodium was on average lowest in ST363 with 5.44, and highest in Lydia with 6.11. Differences appeared to be significant in terms of year, genotype and application in variance analysis.

Plant height (cm)

While the Aksu genotype had the highest average plant height with 161.75 cm, the Lydia cultivar gave the lowest average plant height with 130.83 cm. The values found were different from those of Sadık and Kaynak (2017), Kıllı et al. (2016), Çopur and Yuka (2016) and Çopur et al. (2019), respectively, 109.56-116.26 cm, 52.3-100.1 cm, 83.53-119.80 cm and 96.44-120.96 cm.

As a result of variance analysis, it was seen that there was a significant difference among genotypes, interaction of year*genotype, year*application, application*genotype and year*application*genotype in terms of plant height as shown in Table 3.

Monopodial branches (number plant^{-1})

While the number of monopodial branches in the plant was on average highest in the Gloria variety with 4.1, it was lowest in the YS6 genotype with 3.14.

In variance analysis, differences appeared to be significant in terms of year, genotype, application and year*genotype.

Table 3. Two-year (2015-2016) LSD groups and variance analysis results of the investigated properties-1

	Number of node up to the first sympodium	Height per plant (cm)	Monopodial branches (Number of plant^{-1})	Sympodial branches (Number of plant^{-1})	Boll (Number of plant^{-1})
Özbek105	5.65 ab	144.21 b	3.97 ab	16.15 a	11.28 bc
Gloria	5.98 ab	145.87 b	**4.10 a**	**16.45 a**	**10.55 c**
Elsa	5.61 ab	137.45 bc	3.79 ab	16.20 a	11.36 bc
ST373	**5.44 b**	137.68 bc	3.55 bc	**14.39 b**	11.63 bc
Lydia	**6.11 a**	**130.83 c**	3.90 ab	15.90 a	12.68 ab
YS6	5.66 ab	158.16 a	**3.14 c**	16.25 a	13.79 a
Aksu	5.56 ab	**161.75 a**	3.96 ab	15.97 a	**14.47 a**
LSD (5%)	0.50	10.38	0.48	1.29	1.83
Year	**	ns	**	**	**
Replication (year)	ns	ns	ns	ns	**
Genotype	*	**	**	*	**
Year*genotype	ns	**	**	ns	*
Replication*genotype (year)	ns	ns	ns	ns	ns
Application	*	ns	**	*	ns
Year*application	ns	*	ns	*	**
Application*genotype	ns	*	ns	ns	*
Year*application*genotype	ns	*	ns	ns	ns
CV	10.8	8.7	15.5	9.8	18.1

The same letter are not significantly different
Ns: non significant
*: P<0.05
**: P<0.01

Sympodial branches (number plant^{-1})

The average value of the number of Sympodial branches in the plant was again highest in the Gloria variety with 16.45, and lowest in ST363 with 14.39. The values found were similar those of Sadık and Kaynak (2017), Kıllı et al. (2016), Çopur and Yuka (2016), Çopur et al. (2019) and Başbağ and Ekinci (2017), respectively, 8.06-9.10, 3.80-7.56, 9.03-16.53, 9.62-13.80 and 7.70-11.10.

Differences appeared to be significant in terms of year, genotype, application and year*application in variance analysis as shown in Table 3.

Boll (number plant^{-1})

The Aksu genotype gave the highest average value in terms of the number of bolls in the plant with 14.47, while the Gloria variety gave the lowest number of bolls whith 10.55. Results found in other studies were Kıllı et al. (2016), Çopur and Yuka (2016), Çopur et al. (2019) and Başbağ and Ekinci 2017, respectively, 3.2-4.2, 6.45-16.10, 7.96-11.89 and 5.30-9.57.

As a result of variance analysis; differences appeared to be significant in terms of year, genotype and year*genotype, year*application, and application*genotype interaction as shown in Table 3.

Boll weight (g plant^{-1})

In terms of average boll weight per plant, the Gloria variety gave the highest value of 5.77 g, while the lowest single boll weight per plant value was seen with 4.77 g in the Lydia variety. Close results were obtained by Kıllı et al. (2016) and Çopur and Yuka (2016), respectively, 4.98-5.36 and 4.22-5.91.

In variance analysis, differences appeared to be significant in terms of year, genotype and year*genotype, year*application*genotype interaction.

Seeds number in boll

In terms of the number of seeds in the boll, the Aksu genotype gave the highest average value with 30.58, and Lydia with the 25.41 number gave the lowest average seed number.

Differences appeared to be significant in terms of year, genotype, application and application*genotype, year*aplication*genotype interaction.

Seed cotton weight per plant (g)

The highest average seed cotton weight per plant was observed in the Aksu genotype with 88.41 g, while the Elsa variety gave the lowest average value with 59.01 g.

Differences appeared to be significant in terms of year, genotype and year*aplication interaction as shown in Table 4.

Ginning outturn (%)

The ginning of genotypes ranged between 37.04% and 39.60% on average. Results found in studies were Sadık and Kaynak (2017), Kıllı et al. (2016), Çopur et al. (2019), and Çopur and Yuka (2016), respectively, 36.58%-37.22%, 37.0%-42.3%, 40.59%-42.87% and 38.28%-43.20%.

Differences appeared to be significant in terms of year, genotype and year*aplication interaction as shown in Table 4.

Table 4. Two-year (2015-2016) LSD grubs and variance analysis results of the investigated properties-2

	Single boll weight per plant (g)	Number of seeds in the boll	Seed cotton weight per plant (g)	Ginning (%)	Seed cotton yield (kg da^{-1})
Özbek105	5.70 ab	29.50 a	66.00 bc	38.84 ab	226.22 bc
Gloria	**5.77 a**	29.08 a	62.78 bc	**39.60 a**	216.79 bc
Elsa	5.17 bc	28.41 a	**59.01 c**	39.06 a	**206.01 c**
ST373	5.34 ab	28.33 a	63.97 bc	37.43 c	222.22 bc
Lydia	**4.77 c**	**25.41 b**	62.71 bc	38.71 ab	217.43 bc
YS6	5.25 abc	28.50 a	75.70 b	**37.04 c**	260.87 ab
Aksu	5.74 ab	**30.58 a**	**88.41 a**	37.87 bc	**300.01 a**
LSD (5%)	0.51	2.75	11.87	1.02	39.76
Year	**	**	**	**	**
Replication (year)	ns	ns	**	ns	**
Genotype	**	*	**	**	**
Year*genotype	**	ns	ns	ns	*
Replication*genotype (year)	ns	ns	ns	ns	ns
Application	ns	**	ns	ns	ns
Year*application	ns	ns	**	**	**
Application*genotype	ns	**	ns	ns	ns
Year*application*genotype	**	**	ns	ns	ns
CV	11.6	11.7	21.1	3.2	20.7

The same letter are not significantly different
Ns: non significant
*: P<0.05
**: P<0.01

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

With an average of 3000.1 kg of seed cotton yield per hectare, the Aksu genotype gave the highest value, while the Elsa variety gave the lowest average value with 2060.1 kg. The results of our study are close to the results of Çopur and Yuka, 2016 (1240-4520 kg ha^{-1}), Sadık and Kaynak, 2017 (2920-3750 kg ha^{-1}), Söyler and Temel, 2007 (1950-2900 kg ha^{-1}), Polat, 2015 (1770-4520 kg ha^{-1}) and Çopur et al., 2019 (2580-3370 kg ha^{-1}) but not close to those of with Kılıç, 2008 (3220-3570 kg ha^{-1}), Yener and Başal, 2016 (2530-6000 kg ha^{-1}), Ekinci et al., 2008 (170-2190 kg ha^{-1}), Başbağ and Ekinci, 2017 (680-2040 kg ha^{-1}) and Kıllı et al., 2016 (1520-2090 kg ha^{-1}).

As a result of variance analysis, differences appeared to be significant in terms of year, genotype and year*genotype, year*application interaction as shown in Table 4.

CONCLUSIONS

Considering the Aksu genotype values, it can be said that the number of bolls, the number of seeds in the boll and seed cotton weight per plant affects the yield per decare. At the same time, when the variety of Elsa, which has the lowest yield per decare, is examined, the fact that seed cotton weight per plant and boll number values are among the lowest group values show that these features support the effect on the yield to decare. We can see the effect of the boll weight and the number of bolls in the same direction when the values of the Gloria and Aksu genotypes are examined.

Besides all these outputs; in second crop cultivation, traditional tillage, which is widely used in the region, leads to high field traffic, deterioration of physical properties of the soil and an increase in fuel consumption. Therefore, low cost alternative soil tillage methods that need to be applied in the region in a short time and are suitable for climatic conditions, and which protect the soil and water resources without damaging them, should be determined in second crop cultivation.

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