Effects Of Harvesting Methods On Fiber Quality In Some Cotton Varieties Under Conditions Of Cukurova Region Of Turkey

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Abstract

In this study carried out in 2012 in Cukuruva region of Turkey (in Adana province) it was aimed at to determine effects of harvesting methods on fiber quality in some cotton (*Gossypium hirsutum* L.) varieties. Four cotton varieties grown in Adana-Yuregir plain (between Seyhan and Ceyhan rivers) were used as material. Hand picking and machine harvesting methods were applied. The trial was established according to randomized block design with three replications. Ginning outturn and fiber proterties such as fiber length, fiber fineness, fiber strength, fiber maturity, uniformity index, elongation, short fiber index, spinning consistency index, brightness (Rd), yellowness (+b), trash count and trash area were investigated.

According to results, trash count, trash area and brightness were negatively affected by harvesting machine. Cv. Flash and cv. BA119 were the best varieties for fiber length, fiber fineness, fiber strength, SCI and short fiber index. For elongation cv. BA151 and cv. SG125 were the best varieties. For yellowness cv. SG125 was the best variety. For trash count cv. Flash and cv. SG125 were the best varieties. For ginning outturn, fiber length and short fiber index interaction of variety x harvesting method was statistically significant.

Key Words: cotton, *Gossypium hirsutum* L., harvesting methods, ginning outturn, fiber quality.

Introduction

Harvesting of seed cotton is the most sensitive work in cotton production and its making with the minimal lost and possibly clean has a great importance. Improperly picking of cotton damages physical properties of lint and decreases quality of product. Therefore problems may occur in textile process. In cotton production the most important problem is trash matter problem. Quality of machine harvested cotton is depends on picking clean and on time.

In Turkey cotton sowing area has been 450.9 thousand ha and seed cotton production has been 2.250.000 tones and lint cotton production has been 877.5 thousand tones in 2013. Cotton production in Turkey has been made in South East Anatolian region, Aegean region, Cukurova region and Antalya province (in South of Turkey). In Turkey 58.3 % of lint cotton has been obtained from South East Anatolian region. The share of Aegean

region is 20.2 %, the share of Cukurova region and Antalya province is 21.5 % (Anonymous, 2013 a).

Over many years In Turkey cotton had been harvested with hand labour. But, in recent years number of cotton picking workers who had come especially from South East Anatolian region to other cotton production regions had decreased because irrigated cotton production has increased in South East Anatolian region. Therefore cotton workers had stayed in their regions and hand picking of cotton had been problematic. In this process number of cotton harvesting machines in Turkey has been gradually increased. In Turkey there are 950 picker machines in 2013. 232 of it has been in Mediterranean region, 284 of it has been in Aegean region and 433 of it has been in South East Anatolian region (Anonymous, 2013b).

Anonymous (2011) noted that mechanical harvesting must spread in Turkey because labour costs are high and labour can not be find although machine harvesting had negatively results.

Oz (2001) reported that machine picked cotton samples were gathered during harvesting of two different varieties (Nazilli-84, and Carmen by CASE – IH pickers of 2155 and 2555, 4 and 5 narrow-rows, models, which belongs the farmers in Turkey. The quality factors were determined by high volume presicion instrument (HVI) method. Researcher noted that more trash count and trash area were determined in machine harvested cottons than hand harvested cottons. Moreover he reported that machine harvesting had not negative effects on the other fiber quality traits.

Evcim and Oz (2002) carried out a study in Aydın province of Turkey. The objective of this study was to determine the effects of mechanical cotton picking on cotton lint technologic properties. During the experiments, two cotton varieties named Nazilli 84 and Deltapine 5690 and two defoliants, Finish and Dropp Ultra were used. A four-row cotton picker was used for the experiments. The qualitative analysis indicated that lint quality of the cotton picked by machine was not significantly different than those picked by hand.

Sımsek (2005) reported that machine harvesting had no negative effect on traits such as seed cotton yield, lint yield, ginning outturn, fiber length, fiber fineness, fiber strength, elongation and yellowness.

Sımsek and Ozkan (2005) determined that harvesting methods were statistically significant for trash count and nep content and that there were differences among varieties for fiber lentgth, fiber fineness, fiber strength and nep content.

Karademir et al. (2005) carried out a study on cotton harvesting methods in Diyarbakır province in Turkey. Researchers reported that fiber quality traits such as fiber length, fiber fineness, fiber strength, elongation, uniformity index, short fiber index, spinning consistency index and yellowness didn't affect significantly. However they noted that ginning outturn and brightness values were decreased by machine harvesting and that trash count and trash area values were increased by machine harvesting.

Oz and Karayol (2006) carried out a study to detrmine qualitative and quantitative performance of two narrow row mechanical pickers on three cotton varieties. Researcher noted that ginning outturn of machine harvested cotton was 1-2 % lower than those of hand picking cottons. Also they reported that trash content was found to be higher in the machine picked samples due to pre-cleaning not being applied before ginning. Moreover researchers reported that no other advers effect on the fiber properties caused by the picker was observed.

Dolancay et al. (2007) carried out a two year's study in Sanlıurfa-Turkey to determine harvesting methods on six cotton varieties. Researchers noted that harvesting methods didn't affect ginning outturn, fiber length, fiber fineness, fiber strength and uniformity index of cotton samples. However brightness, yellowness and trash count were negatively affected by machine harvesting.

According to Guzel (2010), Iscan et al. (2002) reported that ginning outturn, fiber fineness, fiber strength and elongation were not affected by harvesting methods. However trash content of lint samples increased in machine harvesting.

Bange and Long (2013) reported that machine harvesting, lower fiber linear density (fineness), and more immature bolls at harvest are factors that contribute to neps. In all studies spindle harvesting increased neps, but there were no significant statistical interactions between the harvest method with harvest aid timing or branch removal treatments. Researchers noted that spindle harvesting increased neps by an average of 53 count/g compared to hand harvesting.

The aim of this study was to determine the effects of harvesting methods used in cotton production on ginning outturn and lint quality properties.

Material and Methods

Material

In this study BA119, BA151, Flash and SG125 cotton varieties were used as plant materials. Ginning outturn and major fiber properties of cotton varieties used in the study are given in Table 1.

Table 1. Ginning outturn and major fiber properties of cotton varieties used in the study

Varieties	Ginning outturn	Fiber Length (mm)	Fiber Fineness (micronaire)	Fiber Strength (g tex^{-1})	Brightness Degree	Yellowness Degree	Spinnig Consistency Index (SCI)
Flash *	41-42	29-31	4.6-4.8	33-35	77-80	7.4-7.8	150-170
BA119 **	41-43	28-30	4.4-4.6	31-33	70-72	7.8-8.2	140-150
BA151 *	40-42	28-30	4.4-4.8	30-32	76-78	7.5-7.8	140-150
SG125 ***	40-42	29-30	4.6-5.3 (1)	36-38	68-69 (2)	7.8-8.0 (2)	133-140 (2)

*: Anonymous (2013c); **: Anonymous (2013d); ***: Anonymous (2013e); (1): Anonymous (2013f); (2): Alhalabi (2007)

Methods

The study was established in Adana province (in Cukurova region) in 2012 according to randomized block design with three replications. Seed cottons that are plant material of the study were obtained from farmer fields that there were in Adana province (from Karagocer, Cakıroren, Cukurkamıs and Yemisli villages that are between Seyhan and Ceyhan rivers). For each cotton varieties used seed cotton samples of 3 kgs were picked both by hand and by picker machine in each village from three farmer fields. Seed cotton samples were ginned with roller gin machine. Obtained lint cottons were analysed using HVI. In the study ginning outturn, fiber length, fiber strength, fiber fineness, fiber maturity, uniformiy index, short fiber index, fiber elongation, brightness (Rd), yellowness (+b), trash count, trash area and spinning consistency index were investigated. Obtained data were statistically analysed according to randomized block design with three replications by using SPSS package program. Means were compared by using Duncan multiple comparison test.

Results and Discussion

Differences among varieties were statistically significant (P≤0.05, P≤0.01) for all investigated traits except ginning outturn, fiber uniformity, trash area and brightness. Harvesting methods were not statistically significant for all traits except trash count, trash area and brightness (P≤0.01). Variety x harvesting method interactions were statistically significant for ginning outturn (P≤0.01), fiber length (P≤0.05) and short fiber index (P≤0.05). Means of harvesting methods and cultivars for ginning outturn and major lint quality traits and arised groups were given in Table 2.

As seen in Table 2, it was determined that harvesting methods did'nt affect ginning outturn and major lint quality traits. For ginning outturn mean of hand harvesting was 41.4 % and mean of machine harvesting was 41.9 %. Ginning outturn means of varieties were similar to each other and varied between 41.4 % and 42.2 %. Variety x harvesting method interaction was statisticaly significant for ginning outturn. The most ginning outturn value was

taken from machine harvesting and cv. BA119 (43.1 %) and the least ginning outturn value was obtained from hand harvesting and cv. SG125 (40.4 %). For fiber length differences between harvesting methods were not statistically significant and mean of machine harvesting and mean of hand harvesting were similar to each other. Varieties were different from each other and while the longest fibers were taken from cv. Flash, the shortest fibers were taken from cv. BA151 and cv. SG125. For fiber length varietiy x harvesting method interactions were found statistically significant. According to this, the longest fibers were taken from machine harvesting and cv. Flash (30.3 mm), the shortest fibers were taken from hand harvesting and cv. BA151(28.4 mm).

Table 2. Means of harvesting methods and cultivars for ginning outturn and major lint quality traits and arised groups

	Ginning Outturn (%)	Fiber Length (mm)	Fiber Fineness (micronaire)	Fiber Strength (g tex^{-1})	Fiber Uniformity (%)	Spinnig Consistency Index (SCI)
(Means) Hand harvesting	41.4 a	29.2 a	5.3 a	29.4 a	83.4 a	120.9 a
Flash	42.9 ab	29.6 ab	5.4	30.0	83.9	125.0
BA119	41.4 ab	29.7 ab	5.1	31.3	83.5	130.0
BA151	41.4 ab	28.4 b	5.4	28.4	83.4	116.7
SG125	40.4 b	29.1 ab	5.4	28.0	82.7	112.0
(Means) Machine harvesting	41.9 a	29.6 a	5.2 a	29.7 a	83.4 a	119.4 a
Flash	40.5 ab	30.3 a	5.2	31.2	83.7	126.5
BA119	43.1 a	29.1 ab	4.9	31.6	83.0	122.5
BA151	41.5 ab	29.6 ab	5.4	28.2	83.3	114.8
SG125	42.4 ab	29.4 ab	5.3	27.8	83.9	114.0
Means of Flash	41.7 a	29.9 a	5.3 ab	30.6 ab	83.8 a	125.7 a
Means of BA119	42.2 a	29.4 ab	5.0 a	31.5 a	83.3 a	126.7 a
Means of BA151	41.4 a	29.1 b	5.4 b	28.3 bc	83.3 a	115.7 ab
Means of SG125	41.4 a	29.2 b	5.3 ab	27.9 c	83.3 a	113.0 b

Similarly means of fiber fineness for harvesting methods were not statistically different and were very close to each other (5.2 mic. in machine harvesting and 5.3 mic. in hand harvesting). Fiber fineness values of tested varieties were between 5.0 mic. and 5.4 mic. The finest fibers were obtained from cv. BA119 (5.0 mic.) followed by cv. Flash and cv. SG125 (5.3 mic.). The tickest fibers were obtained from cv. BA151 (5.4 mic.). Also for fiber strength harvesting methods were not statistically different and the means obtained from machine harvesting (29.7 g tex^{-1}) and hand harvesting (29.4 g tex^{-1}) were close to each other. But tested varieties were different fort his trait. The most strength fibers were taken from cv. BA119 (31.5 g tex^{-1}) followed by cv. Flash (30.6 g tex^{-1}). Our findings has been supported by findings of some researchers such as Simsek (2005); Karademir et al. (2005); Oz and Karayol (2006); Guzel (2010).

The least strength fibers were taken from cv. SG125 (27.9 g tex^{-1}). For fiber uniformity means of harvesting methods were at the same group and had the same value (83.4 %). Also there were not statistically differences among tested varieties for this trait and the all varieties were at the same group. Means of spinning consistency index for harvesting methods were not statistically significant (119.4 in machine harvesting and 120.9 in hand harvesting). Spinning consistency index values of tested varieties were between 113.0 and 126.7. The best values were taken from cv. BA119 and cv. Flash, the worst values were taken from cv. SG125 (Table 2).

For some lint quality traits means of harvesting methods and cultivars and arised groups were given in Table 3. According to Table 3, harvesting methods hadn't an effect on

some lint quality traits except trash count, trash area and brightness. Some researchers reported that they found similar results (Oz, 2001; Evcim and Oz, 2002; Simsek and Ozkan 2005; Dolancay et al., 2007; Bange and Long, 2013). For elongation differences among harvesting methods were not statistically significant and mean of fiber elongation of hand harvesting was 5.32 % and those of machine harvesting was 5.13 %. However tested varieties were different from each other for this trait. While the highest fiber elongation value was taken from cv. BA151(5.74 %) and SG125 (5.65 %) followed by BA119 (5.04 %), the lowest fiber elongation value was taken from cv. Flash (4.44 %). Also for short fiber index means of harvesting methods were similar to each other and they were at the same group (Table 3). But short fiber index means of tested varieties were between 8.90 % and 9.75 %. The lowest short fiber index value was taken from cv. Flash (8.93 %) followed by cv. BA151(9.21 %) and cv. BA119 (9.49 %) and the highest short fiber index value was taken from cv. SG125 (9.75 %) (Table 3). The least short fiber index were obtained from machine harvesting and cv. Flash (8.55 %) and cv. SG125 (8.90 %). The most short fiber index were obtained from hand harvesting and cv. SG125 (10.60 %). For trash count means of harvesting methods were statistically different from each other. For trash count the more clean fibers were obtained from hand harvesting (68.65) than machine harvesting (181.88). For this trait tested varieties were also statistically different from each other. The most clean fibers were taken from cv. Flash (105.67) and cv. SG125 (108.75) followed by cv. BA151 (119.43). The least clean fibers were taken from cv. BA119 (159.78) (Table 3).

Table 3. Means of harvesting methods and cultivars for some lint quality traits and arised groups

	Elongation (%)	Short Fiber Index (%)	Trash Count	Trash Area (%)	Brightness (Rd)	Yellowness (+b)
(Means) Hand harvesting	5.32 a	9.55 a	68.65 a	1.22 a	69.9 a	7.43 a
Flash	4.40	9.24 ab	68.20	1.17	69.8	7.72
BA119	5.18	9.20 ab	79.40	1.47	70.4	7.68
BA151	5.97	9.17 ab	61.00	1.27	70.9	7.67
SG125	5.75	10.60 b	66.00	0.95	68.6	6.65
(Means) Machine harvesting	5.13 a	9.14 a	181.88 b	3.01 b	63.2 b	7.60 a
Flash	4.50	8.55 a	152.50	2.96	64.0	7.40
BA119	4.88	9.85 ab	260.25	3.83	60.3	7.48
BA151	5.58	9.25 ab	163.25	2.38	66.6	7.98
SG125	5.55	8.90 a	151.50	2.87	62.2	7.55
Means of Flash	4.44 b	8.93 a	105.67 a	1.97 a	67.2 a	7.58 ab
Means of BA119	5.04 ab	9.49 ab	159.78 b	2.52 a	65.9 a	7.59 ab
Means of BA151	5.74 a	9.21 ab	119.43 ab	1.90 a	68.4 a	7.84 b
Means of SG125	5.65 a	9.75 b	108.75 a	1.91 a	65.4 a	7.10 a

Simalarly for trash area differences among harvesting methods were statistically significant. For trash area mean of hand harvesting (1.22 %) was lower than mean of machine harvesting (3.01 %). But differences among tested varieties were not statistically significant and the all varieties were at the same group (Table 3). For brightness means of harvesting methods were statistically significant and mean of brightness value of hand harvesting (69.9) was higher than those of machine harvesting (63.2). However there were not statistically differences among tested varieties fort his trait and the all varieties were at the same group. For yellowness differences among harvesting methods were not statistically significant and mean of yellowness of hand harvesting was 7.43 and mean of yellowness of machine harvesting was 7.60. But tested varieties were different from each other for this trait. While the least yellowness value was taken from cv. SG125 (7.10) followed by cv. Flash

(7.58) and cv. BA119 (7.59), the most yellowness value was taken from cv. BA151 (7.84).

As a result, it was determined that harvesting methods did'nt affect ginning outturn and fiber quality properties except trash count, trash area and brightness. The more clean and the more less yellow fibers were obtained from hand harvesting than machine harvesting. Cv. Flash and cv. BA119 were the best varieties for fiber length, fiber fineness, fiber strength, SCI and short fiber index. For elongation cv. BA151 and cv. SG125 were the best varieties. For yellowness cv. SG125 was the best variety. For trash count cv. Flash and cv. SG125 were the best varieties.

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