INFLUENCE OF DEFOLIANT USE ON COTTON (*GOSSYPIUM HIRSUTUM* L.) FIBER YIELD AND QUALITY IN MACHINE HARVESTING

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Abstract. Cotton is a globally significant crop whose market value depends primarily on fiber quality. The quality of the fiber directly affects the profit obtained from the product. However, fiber quality is influenced by production techniques, pre-harvest preparations, and harvesting methods. In this study, the effects of different doses and times of defoliant application methods on cotton yield, boll opening, and fiber technological properties were investigated. The study was conducted in a commercial farm in Bismil district of Diyarbakır province in Turkey, at three application doses, two spraying methods (top only and top + inter-row), and three boll opening periods (40%, 60%, and 90%). The analysis of cotton samples collected by workers and taken from the machine basket during harvest was made with the help of the HVI (high-volume instrument) device. According to the results of variance analysis and LSD test, fiber yield (ginning) was not significantly affected by boll opening rate, defoliant dosage, and spray methods ($p < 0.05$). Except fiber strength (Str), the effect of boll opening rate (defoliation time) on micronaire (Mic), maturity (Mat) and elongation (Elg) were found to be insignificant. Significant differences ($p < 0.05$) were observed between spray methods based on HVI analysis.
Keywords: *spraying, cotton picker, dose, ginning, HVI*

Introduction

Cotton (Gossypium hirsutum L.) harvesting period is one of the most critical processes that has an impact on the cotton fiber quality, foreign matter, yield and the earning of the producers. Therefore, cotton should be harvested promptly and with minimal losses to maximize quality and profitability (Sessiz et al., 2016). Another important problem of harvest is defoliant application time, application volume and spray methods. In many regions, extended harvest periods result from labor shortages, adverse weather conditions, and reliance on manual harvesting. These factors increase production costs, reduce fiber quality, and cause product losses. Machine harvesting must be optimized to improve fiber quality and lower production costs.

Harvesting too early can interrupt maturation, lowering fiber quality, while waiting too long can result in lower fiber yield. The degree to which seed cotton and lint are mechanically processed during gin processing has a significant impact on production and quality (Williford., 1992). Therefore, mechanical harvesting has become a necessity, and for a successful harvest, the defoliant application time must be determined correctly. Because, harvest time, maturation period, harvest date, rainfall, defoliation timing and the settings of the cotton harvester are factors which have direct impacts on fiber yield and quality (Williford., 1992; Collins, 2006). With the help of chemicals, leaves are fall earlier and bolls are opened more quickly. With these applications, it helps to achieve higher yield and fiber quality by enabling the harvest to be done earlier (Bednarz et al., 2002; Karademir et al., 2005; Sessiz et al., 2016). However, early or delayed defoliation can result decrease yield and micronaire (Faircloth et al., 2004).

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Snipes and Baskin (1994) has been investigated at different boll opening time and application volume of defoliant on yield losses fiber properties. They reported that defoliation is recommended after 60% boll opening, and delayed defoliation allows immature bolls to develop, thus increasing yield. Similar results were obtained by Bednarz (2001). He has been reported that defoliation at 60% boll opening obtained the highest fiber yield. Also, Öz et al. (2011), Öz and Evcim (2002) and Sessiz et al. (2012) carried out a study to determine the effects of machine harvesting on basic cotton fiber parameters. Different defoliants were used by these researchers and obtained values according to the applications rate were compared. Larson et al. (2002) investigated the effect of harvesting time and defoliant application on cotton yield, quality and net income. The best results were obtained at 50-60% boll opening time. Edmisten (2006b) has been argued that delayed defoliation can increase boll rot or fiber loss or damage due to adverse conditions in the field; emphasized that defoliation is the safest when most of the plants (60%) bloom. Wanjura et al. (2009) reported that it would be advantageous to apply the application when 50-60% of the bolls were opened to ensure maximum leaf falling from plants. Balkcom et al. (2010) stated that defoliant application times should be done when boll opening is 40% - 80%, while Gwathmey and Hayes (1997) stated that applications should be made when boll opening exceeds 50%. Similar results were also expressed by Byrd et al. (2016). According to researchers, the effective application time is when 50-60% of the boll are opened.

Today, many cotton producers still settle for lower fiber yield and quality due to more or less than necessary defoliant dosage, wrong choice of defoliant application time, etc. In the light of this information, the aim of this study was to determine the effects of different defoliant application doses and different defoliant spraying methods applied to the plant at different boll opening rates on cotton fiber yield, foreign matter and fiber quality characteristics for machine harvesting.

Materials and methods

Experiment area and seeding

The experiments were carried out on a commercial farm in the Bismil district (37.872 N, 40.729 E) of the province of Diyarbakır in Turkey. Diyarbakır, situated in south eastern Anatolia, Türkiye, has a climate feature that is hot and dry in summers and warm in winters. The highest temperature was 44°C in August, the lowest was 13°C in October and the average temperature was 24°C at the experimental location during the period from sowing to harvest. Total rainfall from sowing to harvest was 78 mm. These climatic data are close to the long-years average values data of the location. The soil texture in the experimental area is clay loam. Some climate values obtained for 1991-2020 long years average climate values in research area were presented in *Table 1* (Anonymous, 2024).

The cotton seed, BA 440 variety, was planted by 6-row pneumatic seeding machine with 0.7 m spacing under irrigated condition. Cottons were irrigated by drip irrigation method (The amount of irrigation water was determined as approximately 820 mm). Standard cultural treatments throughout the growing season were made until harvesting.

Defoliation treatment and field sprayer

Before harvesting, defoliation treatment was performed by mounted type field sprayer (*Fig. 1*). Some changes were made on the sprayer, such as spray bar, nozzles

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and row separator for purpose of study. The existing spray bar on the machine was completely changed, instead of this, a new spray bar was fabricated and mounted on the machine. Also, hydraulic nozzles with rotary heads were used instead of the existing nozzles (*Fig. 1*). In spraying applications made with conventional field sprayers, the distribution of drops within the plant is not equal, especially under conditions where the leaf area index of cotton is high. Therefore, the expected benefit from defoliant application is limited. In order to prevent this, telescopic spray booms that can be adjusted according to the plant height were placed inter row. Two spray nozzles were mounted at the end of the spray booms the inter-rows. One of the two nozzles was placed to spray to the right and the other to spray to the left. These spray nozzles (under leaf nozzles) provide more effective application by spraying the lower leaves. Another aim of the project was to determine the spray efficiency of the modified sprayer. Although the analyses are not yet complete, preliminary results show that the distribution within the plant is better than the conventional sprayer.

Table 1. *Some climate parameters belonging to Diyarbakır province in 1991-2020 long years average climate values (LYA) in research area*

	May	June	July	August	September	October	November
Mean temp. (°C)	18.90	26.30	31.00	30.50	25.00	17.80	9.30
Max. temp. (°C)	26.80	34.40	38.90	38.70	33.40	25.70	16.30
Min. temp. (°C)	10.90	16.80	21.70	21.20	15.90	10.40	3.80
Hours of sunshine (h)	9.10	11.60	11.70	11.00	9.30	7.10	5.50
Average number of rainy days	9.47	2.90	0.40	0.23	1.37	5.83	7.43
Rain (mm)	50.00	10.80	1.00	0.40	8.40	37.30	54.30

Figure 1. *Defoliation treatment in cotton field by sprayer*

Dropp Ultra (thidiazuron 120 g l^{-1} + diuron 60 g l^{-1}) and Finish Pro (720 g l^{-1} Ethephon + 45 g l^{-1} Cyclanilide) chemicals mixture were used as defoliant. The treatment was conducted at two different spraying methods [the top only (T) and top + inter-row (TI)], three different application doses (300 ml ha^{-1}, 600 ml ha^{-1} and 1200 ml ha^{-1}) and three stages of boll opening (40%, 60%, and 80%). In the spraying processes, defoliant and plant growth regulator (boll opener) were mixed with each other. All chemical doses were applied to each plot with application volume of approximately 500 L/ha (Öz et al., 2011). Percent open boll measurements were made on ten adjacent plants chosen randomly in each plot for all defoliation timing (Collins, 2006).

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Harvest

Cotton harvesting was carried out in both defoliated and untreated areas. Four-row John Deere 7460 spindle picker (*Fig. 2*) was used for mechanical harvest, and also manual harvesting was made by workers. The forward speed of the cotton harvester was kept between 2.5-2.7 m s^{-1} during the harvest (Sessiz et al., 2012). For moisture analysis performed according to the ASABE standard (2012), three 150 g cotton seed samples were hand-picked before mechanical harvesting.

Figure 2. *The view of self-propelled cotton harvester (John Deere 7460) during the harvest*

Ginning

One of the important factors in ginning is the cotton moisture content. For effective cleaning, effective ginning, simpler bale packaging, and least amount of fiber damage, cotton should have a moisture content (MC) of 6 to 7% wet basis (w.b.) (Valco et al., 2004). Moisture content was measurement as 6.81% during the ginning. To determine the effect of machine harvesting on fiber quality properties, the cotton samples were taken from both defoliant and non-defoliated areas for ginning. Then, to determine lint percentage and lint weight and the gin yield values, 5 samples of seed cotton, about 1.5 kg, were randomly taken from the cotton harvester basket. Obtained samples from experimental area were placed in bags and then transported to laboratory for ginning. Each sample taken from the experimental area was ginned with a laboratory type gin (Roller gin) (*Fig. 3*).

Fiber analysis

After ginning, fiber quality analysis was determined by the high-volume instrumentation (HVI) device, USTER HVI1000 fiber classification and analysis system (Uster Technologies AG, Switzerland) in laboratory, where they were stored for about 6 months. Fiber characteristics such as micronaire (Mic), maturity index (Mat), fiber strength (Str), elongation (Elg), fiber length, uniformity, short fiber (FS), spinning consistency index (SCI), Rd (Reflectance or Whiteness), +b (Yellowness), trash count (TrCnt), trash area (TrAr), trash grade (TrID) were examined (Sayeed et al., 2022).

The data analysis

The statistical design at each location was a randomized complete block with a factorial arrangement of treatments with three replications. Plot size were four rows kept as 4.2 m × 40 m in total (168 m^2). All data were collected from the center row of each plot. All treatment means were compared using the fit model in JMP Pro version 3. Analysis of variance (ANOVA) was conducted to determine overall differences

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between selected independent parameter. Significant differences between means were determined by Least Significant Difference (LSD) at $p = 0.05$ level.

Figure 3. *Samples of cotton and the ginning process of the seed cotton*

Results

Ginning fiber yield

The average fiber (gin) yield values are shown in *Table 2*. As seen in the table, the fiber yield was not reduced either increase boll opening stage and application dosage. The fiber yield values changed between 43.3% and 43.9%. According to result of the variance analysis and LSD test, fiber yield (ginning) was not significantly from effect boll opening rate (defoliation time), defoliant application dosage and spray methods ($p < 0.05$). Also, the effect of interactions of these parameters were not found significant as statistically ($p < 0.05$).

Table 2. *Average cotton fiber yield values*

Parameters		Fiber (ginning) yield (%)
Boll opening rate (%)	40 (early)	43.69 a
	60 (mid)	43.70 a
	90 (late)	43.69 a
Dosage rate (ml ha^{-1})	300	43.91 a
	600	43.88 a
	1200	43.30 a
Spray methods	T	43.722 a
	TI	43.671 a
Control (untreatment)	Mean	43.78

No significant differences were detected ($\alpha = 0.05$) between means in the same row followed by the same letter

Fiber quality

The quality parameters of primary for cotton are micronaire, strength, fiber color, length and uniformity (Edmisten, 2006a). Therefore, in this study, micronaire (mic), maturity index, uniformity, length, short fiber, fiber strength, reflectance, elongation,

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yellowness, TrCnt, TrAr and TrID were evaluated as quality parameters of cotton fibers. These properties were divided into four groups (Darawsheh et al., 2022) as presented in *Table 3*.

Table 3. *The selected cotton quality properties divided in four groups: (a) fiber maturity; (b) fiber length; (c) color and (d) trash properties*

Group	Quality properties
Maturity properties	Micronaire (Mic) Maturity index (%) (Mat) Elongation (%) (Elg) Fiber strength (g tex^{-1}) (Str)
Length properties	Upper half mean length in mm (UHML) Short fiber index < 12.5 in mm (SF) Uniformity index (%) (UI)
Color properties	Spinning consistency index (SCI) Yellowness (+b) Reflectance (RD)
Trash properties	Trash grade (1–8 index) (TrID) Trash area (%) (TrAr) Trash count (number) (TrCnt)

Strength, length and Micronaire (fineness) are critical properties for elongation, spinning while short fiber index and maturity are significant fiber properties (Darawsheh et al., 2022). According to these groups average results of HVI test are shown in *Tables 4, 5, 6,* and *7* respectively.

The statistical analysis of fiber maturity properties is shown *Table 4*. As you seen in table, except fiber strength (Str), the effect of boll opening rate (defoliation time) on micronaire (Mic), maturity (Mat) and elongation (Elg) were found to be insignificant. However, while the effect of spray dosages was found significant on Mic and Str, the effect on Mat and Elg were found insignificant. Significant ($p < 0.05$) differences were found between spray methods to cotton plant according results of fiber classification and analysis system. Also, the effect of interactions was found for Elg. Our average results consistent with Montenegro et al. (2003) results. However, except micronaire, the other parameters were not significantly affected. Significant differences occurred between defoliant spray forms. The difference between them was found to be significant. Except maturity index, micronaire, fiber and elongation were affected by defoliant spray form.

Micronaire values were found approximately 5.00 for all selected independent parameters in our study (*Table 4*). However, Mat index were not affected cotton boll opening rate, application dosage and spray methods. Obtained Mat index values were changed between 0.868 and 0.873%.

In the study, Fiber Strength (Str) and Fiber Elongation (Elg) values were obtained as 29 g/tex and 7%, respectively.

When the fiber length values are examined in *Table 5*, significant differences were obtained among boll opening rate, application dosage rate and defoliant spraying methods on cotton plants for fiber length properties. As can be seen from the table, no significant relationship was observed between selected parameters. the effect of all selected independent parameters was found significant ($p < 0.05$) on fiber length.

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Significant differences occurred between defoliant spray forms. The difference between them was found to be significant. In the top + inter-row of plant (TI) method, fiber length and uniformity decreased, while the ratio of short fibers increased. Fiber length (mm) values were found approximately as 26.50 mm for all parameters. In a study conducted by Williford (1992), the length values varied between 26.80-29.8 mm as a result of defoliant applications depending on climatic conditions and harvest period. However, this value was found by Öz et al. (2011) for different variety as 29-30 mm. Uniformity value were not changed by defoliation application time. While no significant differences were detected ($p < 0.05$) between boll opening rate for uniformity, however, it was affected from defoliant application dosage and defoliant spray methods.

Table 4. *Defoliant effect on fiber maturity properties of HVI analysis*

Parameters		**Micronaire (Mic)**	**Maturity index (Mat) %**	**Fiber strength (Str), g tex^{-1}**	**Elongation (Elg), %**
Boll opening rate (%)	40 (early)	5.10 a	0.872 a	29.32 c	7.12 a
	60 (mid)	5.07 a	0.873 a	29.38 b	7.13 a
	90 (late)	5.07 a	0.868 a	29.49 a	7.08 a
Dosage rate (ml ha^{-1})	300	5.168 a	0.871 a	29.20 c	7.29 a
	600	5.060 b	0.873 a	29.45 b	7.11 a
	1200	4.964 c	0.870 a	29.54 a	7.10 a
Spray methods	T	5.204 a	0.872 a	29.53 a	6.98 b
	TI	4.924 b	0.870 a	29.26 b	7.26 a
Control (untreatment)	Mean	5.10	0.88	29.48	6.80

Level not connected by same letter are significantly different at the 0.05 level of probability according to LSD test

Table 5. *Fiber length properties results of HVI analysis*

Parameters		**Fiber length (mm)**	**Uniformity (%)**	**Short fiber (FS) (%)**
Boll opening rate (%)	40 (early)	26.71 a	82.78 a	7.32 a
	60 (mid)	26.67 a	82.88 a	6.82 b
	90 (late)	26.57 b	82.85 a	6.43 c
Dosage rate (ml ha^{-1})	300	26.55 b	82.30 b	7.13 a
	600	26.61 b	82.32 b	6.73 b
	1200	26.79 a	83.88 a	6.71 b
Spray methods	T	26.82 a	83.32 a	6.77 b
	TI	26.48 b	82.36 b	6.95 a
Control (untreatment)	Mean	26.25	82.55	7.66

Level not connected by same letter are significantly different at the 0.05 level of probability according to LSD test

Short fiber rate was affected by all parameters. The highest short fiber was observed at early (40%) defoliant timing as 7.32%. This value was obtained as 7.66% at control plot.

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The results of color properties are given in *Table 6*, significant differences were detected among the cotton boll opening rate for SCI. SCI values were changed between 112.27 and 118.35 depend on cotton boll opening rate. While the higher value was measured at late boll opening time (90%), the lowest value was observed at early (40%) boll opening rate. However, the highest SCI were obtained interaction of the medium boll opening time, high dosage and top + inter-row of plant spray method as 124.30.

Table 6. *Results of HVI analysis*

Parameters		Spinning consistency index (SCI)	Rd Reflectance	+b Yellowness
Boll opening rate (%)	40 (early)	112.27 c	68.058 a	8.945 c
	60 (mid)	114.35 b	68.211 a	9.027 b
	90 (late)	118.35 a	66.88 b	9.275 a
Dosage rate (ml ha^{-1})	300	118.35 a	67.32 a	9.153 a
	600	114.57 b	68.05 a	9.091 b
	1200	112.27 c	67.78 a	9.002 c
Spray methods	T	116.74 a	67.83 a	9.126 a
	TI	113.38 b	67.60 a	9.0522 b
Control (untreatment)	Mean	114.52	68.56 a	9.052 b

Level not connected by same letter are significantly different at the 0.05 level of probability according to LSD test

Color grades consist of reflectance (Rd) and yellowness (+b). Reflectance (Rd) values were changed between 66.88-68.21. While boll opening rate increase, reflectance (Rd) values decrease, yellowness (+b) values increase. +b value significantly differs according to time, dosage and spray methods. Yellowness was affected boll opening time, application defoliant dosage end spray methods. Yellowness values ranged from 8.945 to 9.275.

Foreign matter includes, stem, seed, leaf, dirt, bract, bark, grass, and particles introduced by handling and harvesting equipment. In this study, foreign matter is as consider any substance in the cotton other than fiber. The amount of foreign matter and trash content remaining in the lint after ginning determine the grade. Trash content can also determine the color property.

The results of Trash properties are given in *Table 7*, Foreign matter content of cotton was significantly different for all three treatments. Significant differences were detected among the cotton boll opening rate for TrCnt, TrAr and TrID. TrCnt, TrAr and TrID were affected statistically by the boll opening rate. The difference between the boll opening rates were found significant. However, while the highest values of TrCnt were obtained at 90 (late) boll opening rate, the highest values of TrAr and TrID were found at 40 (early) boll opening rate. TrCnt values were changed between 98.31 and 115.06 depend on cotton boll opening rate. However, TrCnt values were not affected by dosage rate. There were not found differences between dosage application rates. TrAr and TrID were affected by dosage rate. While the amount of TrCnt and TrAr decreased with increasing application dosage, TrID increased. On the other hand, TrCnt and TrAr defoliant applications were not affected by spraying methods, except for TrID (*Table 7*).

Trash content in cotton has significant impact on all phases of cotton chain. In the initial stage of this process, this measurement plays an important role in fair valuation of

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grower’s cotton thru services provided by classing operation (Ghorashi, 2014). Darawsheh et al. (2022) and Kazama et al. (2018) found TrCnt, TrAr and TrID values as 42.1, 0.56, 4.03 and 112, 5.56, and 0.07 respectively in their study. As can be seen from the table, these values are highly differences from we obtained values. We can argue that these differences may be due to the variety, climate, harvesting methods, defoliant time, spray methods, crop management and environmental conditions.

Table 7. *Results of trash analysis*

Parameters		TrCnt, unit (per g)	TrAr (%)	TrID (1-8)
Boll opening rate (%)	40 (early)	98.31 b	1. 322 b	6.002 a
	60 (mid)	101.30 ab	1. 314 b	5.931 b
	90 (late)	115.06 a	1.140 a	5.395 c
Dosage rate (ml ha^{-1})	300	109.58 a	1.380 a	5. 395 c
	600	105.24 a	1.292 a	5. 852 b
	1200	99.89 a	1.266 b	6.002 a
Spray methods	T	99.37 a	1.348 a	5.65 b
	TI	110.41 a	1.343 a	5.85 a
Control	Mean	91.89	0.93	5.00

Level not connected by same letter are significantly different at the 0.05 level of probability according to LSD test

Discussion

The average fiber yield values obtained as a result of the study are compatible with the catalog limit values (42%-44%) given for the BA 440 cotton variety. Similar results were found by Sessiz et al. (2012) for B119 cotton variety. However, in a study conducted by Karademir et al. (2011), different fiber yield values were obtained for different cotton genotypes. The fiber yield percentage changed between 36.31%-44.77%. These values changed according to stress and unstress water condition.

The micronaire index is important for the commercialization of fiber quality, as high values (>5.0) are classified as very thick fibers due to the increased percentage of irregularity and imperfections in the cross section of the yarn. However, low values (<3.5) suggest that the fiber is immature and can cause tissue defects (neps), and, consequently, low incorporation of dye during finishing (Kljun et al., 2014; Kazama et al., 2018). According to values, our results (~ 5) can be countable among desirable and coarse group. This classification was also obtained by Özkaya and Tuylu (2024) and Kazama et al. (2018).

Average fiber strength (Str) values obtained in the study were similar (same) results were obtained by El-Yamani et al. (2017) and Ye et al. (2024), obtained values by Karademir et al. (2011) were changed between 26.58 and 32.50 g/tex according to variety. Compared to the results of our study, the lint strength was found to be higher (35 g/tex^{-1}) by Terzi and Kaynak (2019).

The fiber elongation is a significant factor for determination of the fiber strength value. Mathangadeer et al. (2020) have highlighted the necessity of controlling the variance of the degree of elongation at break of constituent fibers of a yarn to maximize the yarn and fabric strengths. In addition, they found elongation ranged from 7.7% to 8.8%. Darawsheh et al. (2022) found mic, mat, str and elg values as 4.7, 0.859, 29.4 and 7.6, respectively, in

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their study conducted in different locations. They reported that climatic conditions and environmental effects may affect the quality. It was found to be compatible with the data we obtained in our study. In the light of the obtained results, we can argue that Mic, Str and Elg directly related to each other. However, in our study, Mat not effected by defoliant application time, defoliant application dosage and spray methods.

In a study conducted by Williford (1992), the fiber length values varied between 26.8-29.8 mm as a result of defoliant applications depending on climatic conditions and harvest period. However, this value was found by Öz et al. (2011) for different variety as 29-30 mm.

Similar results to the mean value (83%) obtained for Uniformity in the study were also observed (79%-83%) by Karademir et al. (2011) and Istipliler et al. (2024). Our average results consistent with Faulkner et al. (2007) and Karademir et al. (2011).

Antony and Bragg (1987) reported that the short fiber content increased after boll opening, depending on weather conditions. Consistent with this, the highest rate of short fiber obtained in the study was observed in early (40%) defoliant timing.

According to Öz et al. (2011) an increase in (+b) values due to the increase in trash content is inevitable, leading to a decrease in the (Rd). Rd values were found by Williford (1992) between 65.8 and 73.3 depending on the harvest period and years. In the defoliation applications made in different years and at different harvest times, the Rd value decreased with the delayed applications. These results were similar to our results. Rd and +b values were found by Darawsheh et al. (2022) 71.5 to 73.3 and 9.3 to 9.7, respectively. In their study conducted in different locations of Greece. They reported that climatic conditions and environmental effects may affect the quality. These values are consistent with the results we obtained in our study.

Trash content in cotton has significant impact on all phases of cotton chain. In the initial stage of this process, this measurement plays an important role in fair valuation of grower's cotton thru services provided by classing operation (Ghorashi, 2014). Darawsheh et al. (2022) and Kazama et al. (2018) found TrCnt, TrAr and TrID values as 42.1, 0.56, 4.03 and 112, 5.56, and 0.07 respectively in their study. As can be seen from the table, these values are highly differences from we obtained values. We can argue that these differences may be due to the variety, climate, harvesting methods, defoliant time, spray methods, crop management and environmental conditions.

Conclusions

These results clearly show that cotton fiber yield and quality are influenced by selected independent parameters such as defoliant time, application defoliant dosage and spray methods. The proper use of defoliant rate, suitable boll opening rate and spray methods can help harvest early date. This can help maintain better quality. Also, it can be increase quality and economic value. If applied defoliant before boll opening reaches 90%, yield and quality can be reduced. So, dosage and application spray method are as important as defoliant application time. In the study, it was seen that there were significant differences between the defoliant spray forms and the difference between them was statistically significant. In the top + inter-row of plant (TI) method, fiber length and uniformity decreased, while the ratio of short fibers increased. With these practices, the quality will be preserved when the harvest is made early before the rains. Harvesting after rains is a critical period and causes a decrease in quality. It is important in terms of providing economic gain with timely defoliant applications with an effective defoliant sprayer.

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