HARVEST AID EFFECTS ON LINT QUALITY

Thomas D. Valco, Kenneth Bragg
Cotton Incorporated, USDA, ARS
and The Cotton Defoliation Work Group
Raleigh, NC - Clemson, SC

Abstract

Harvest aids are important in preserving cotton quality by facilitating a timely harvest. Harvest aids enhance defoliation of plant leaves, accelerate boll opening, improve seed-cotton drying in the field and, in some cases, desiccate green plant material. This paper describes an ongoing research project of the Cotton Defoliation Work Group and includes data collected from 16 growing regions over a three year period (1992 - 1994). The objective of this beltwide project is to develop effective, practical harvest aid recommendations that contribute to harvest efficiency and high quality fiber, especially by evaluating performance of standard defoliation treatments on a uniform basis and relating this performance to biotic and environmental factors. Analysis of lint quality data revealed little differences among harvest aid treatments when recommended production practices are followed. Most of the fiber quality differences between the untreated check and the harvest aid treatments were of little practical significance. Harvest aids can reduce trash, reduce micronaire and improve color. Harvest aids did not increase white specks or neps, reduce strength, length or uniformity. Even though differences in defoliation efficacy are measured, ginning and lint cleaning tend to normalize differences in trash content.

Introduction

This paper describes an ongoing research project of the Cotton Defoliation Work Group. This project, Uniform Harvest Aid Performance and Fiber Quality Evaluation, was initiated in 1992 and is planned to be a 5-year project. This initial report will review the fiber quality data collected from a three year period (1992 - 1994).

Successful cotton production is largely dependent upon the use of harvest aid products to defoliate plant leaves, accelerate boll opening, enhance seed cotton drying in the field and, in some cases, desiccate green plant material. Harvest aids facilitate timely harvesting, improve storage conditions after harvest, and improve lint grades (Williford, 1992).

Timing the application of harvest aid treatments is an important, but difficult decision. The condition of the plant prior to application and environmental factors during and after application play an important role in the efficacy of a product or mixture of products applied (Supak, 1994). Even though harvest aids are intended to improve quality, in certain situations quality losses can occur. Studies have shown that harvest aids applied too early, 20% open boll, can reduce yield and micronaire and increase neps (Snipes and Baskin, 1994; Thibodeaux, et.al., 1993). After defoliation, regrowth sometimes occurs when favorable plant growing conditions exist. These new leaves are difficult to remove and can reduce lint quality (Supak, 1994).

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 1:94-96 (1996)
National Cotton Council, Memphis TN

Objective

The objective of this beltwide project is to develop effective, practical harvest aid recommendations that contribute to harvest efficiency and high quality fiber, specifically by evaluating performance of standard defoliation treatments on a uniform basis and relating this performance to biotic and environmental factors.

Materials and Methods

The specific details of this experiment are described in the previous manuscript (Snipes, 1996). In general, seven core harvest aid treatments were applied at 16 test sites located in Alabama, Arkansas, California, Florida, Georgia, Louisiana, Mississippi, Missouri, North and South Carolina, Oklahoma, Tennessee and Texas (4). These locations were combined into four regions, Southeast, Mid-South, Southwest and West (California only). The seven core treatments beltwide are as follows:

1. Untreated Check
2. Folex®/Def® (1.5 pt/acre)
3. Dropp 50WP® (0.2 lb/acre)
4. Harvade® w/ Crop Oil (8 oz/acre + 1 pt/acre)
5. Harvade w/ Crop Oil + Prep® (6.5 oz/acre 1.33 pt/acre)
6. Folex/Def + Prep (0.75 pt + 1.33 pt/acre)
7. Dropp + Prep (0.1 lb/acre + 1.33 pt/acre)

Additionally, at least five treatments with specific regional applications were applied. These will not be discussed in this report.

Standard agronomic practices for each location were used at each of the test sites. Cotton variety was uniform for each of the test sites in the four regional locations. Harvest aid chemicals were applied at about 60% open bolls. Standardized evaluation data recorded by each of the participants includes percent defoliation at 7 and 14 days after treatment (DAT). Plots were mechanically harvested at approximately 14 DAT. All stripper plots (3) were desiccated prior to harvest. Seed cotton samples were collected by plot for all treatments and stored in bags. These samples were divided into large and small samples. The small samples (2.5 lb) were shipped to the Texas A&M Research and Extension Center in Lubbock, TX for ginning. All samples were ginned at the same time period. This gin is equipped with an inclined cleaner, extractor feeder, 10 saw gin and single stage of lint cleaning. Lint collected from ginned samples were subjected to HVI analysis. HVI analysis included micronaire, strength, length, % trash, Rd, +b, length uniformity index (LUI), short fiber content (SFC), and leaf grade. The 1994 data were also analyzed using the Uster AFIS (Advanced Fiber Information System) instrument for all samples from selected locations. These included five spindle picked locations (Louisiana, Mississippi, Georgia, North Carolina and California) and two stripper harvested locations (Lubbock, Tx and Oklahoma).

For the large samples, all replications were combined and sent to the USDA, ARS Cotton Ginning Laboratory in Stoneville, MS for ginning using the micro gin and one lint cleaner. The lint was sent to USDA, ARS at Clemson where these samples were spun into yarn and knitted into fabric. The fabric was dyed and white specks counts were made. White specks are defined as entanglements of immature fiber that will not absorb dye.

All data from 1992, 1993 and 1994 were analyzed with the assistance of Debbie L. Boykin, Statistician, USDA, ARS in Stoneville, MS using SAS. A preliminary analysis of variance of the data combined over year and location indicated treatment interacted with year and location in a similar manner. Therefore, in a subsequent analysis, year and location were considered environment and were used as replications for comparing treatments. Differences in treatment means were declared significant at the 5% level of probability and were separated by Least Significant Difference (LSD). In a separate analysis, percent defoliation at 14 DAT was used as a continuous effect (X) to describe the treatment effect on selected fiber quality measurements (Y). Slopes were estimated and tested for significance ($p<0.05$) to evaluate the overall effect of percent defoliation on fiber quality.

Results and Discussion

This report includes three years of lint quality data collected from the seven core treatments. However, not all test locations have three years of data. Because of the large number of samples (about 1200), relatively small measurement differences are statistically significance. However, these differences are of little practical significance.

Table 1 lists defoliation percentages of the harvest aid treatments at 7 and 14 DAT intervals, along with selected HVI measurements. As expected, the % trash content for the untreated check is slightly higher than all other treatments but only significantly higher than treatment 6. The analysis also shows that the micronaire is slightly higher for the untreated check. The color measurements, reflectance (Rd) and yellowness (+b), are indicators of a higher trash level for the untreated check. Differences in lint quality between harvest aid treatments are small. Treatment 6 has the best defoliation rating and a corresponding low trash content and high reflectance. All treatments with Prep, 5-7, have the numerically lowest micronaire values. Color grades for all treatments are 31 and lint value for any of the treatments would not be significantly different.

Average white speck counts, Table 2, show little variation between treatments. There is considerable variation between years or production seasons, but no trend to indicate that any of the defoliation treatments cause increased neps. A more sophisticated analysis of selected lint samples using the AFIS instrumentation is shown in Table 3. Neither nep counts nor visible foreign matter (VFM) showed any significant differences between treatments. The test did show an increase in short fiber content (SFC) for two of the Prep treatment combinations (5 and 6) and slight differences in upper quartile length (UQL) measurements between treatments 3 and 5. All the SFC percentages are in the average range. The differences in length are not readily explained.

To determine if harvest methods caused significant differences in lint quality for the different harvest aid treatments, a comparison of slopes for several quality parameters versus percent defoliation at 14 DAT are shown in Table 4. Micronaire and SFC are most affected by stripper harvesting. As defoliation efficacy is improved, micronaire is reduced and SFC is increased for stripper harvested cotton. No significant differences occurred with spindle harvesting.

Conclusions

This study revealed little differences among harvest aid treatments and lint quality when recommended production practices are followed. Most of the fiber quality differences between the untreated check and the harvest aid treatments are very small. Harvest aids can reduce trash, reduce micronaire and improve color. Harvest aids did not increase white specks or neps, reduce strength, length or uniformity. Even though differences in defoliation efficacy are measured, ginning and lint cleaning tend to normalize differences in trash content.

The question now becomes, why are harvest aids used when there are little or no improvements in lint quality? One thing this study failed to consider is the effect of wet plant material on lint quality when seed cotton is stored in modules or trailers. Since all samples were stored lose in bags after harvest, no problems with heating or staining of compacted seed-cotton occurred.

This is a preliminary look at the harvest aid effects on lint quality. Data from 1995 and planned 1996 production years will be incorporated into this study and analyzed. Additional tests will be conducted on the affects of defoliation level on lint quality when seed cotton is stored in a module immediately after harvest.

Acknowledgements

This project is truly a team effort with support and cooperation from the agricultural chemical industry, federal and state research groups and producer organizations. Primary funding in 1992 was provided by the Cotton Foundation of the National Cotton Council. All funding subsequent to 1992 was provided by Cotton Incorporated. Special thanks to the Cotton Defoliation Work Group Committee, the support of Dr. John Gannaway, TAES, Mr. Stanley Anthony, USDA,ARS and Cotton Incorporated's Textile Services Laboratory for their valuable contributions to this project.

References

1. Cotton Defoliation Work Group. 1995. Uniform Harvest Aid Performance and Fiber Quality Evaluation. Proceedings - Beltwide Cotton Conference. 1:196.

2. Thibodeaux, D.P., et. al. 1993. Applications of AFIS Measurement Technology to Evaluating the Quality of Cotton Treated with Prep. Proceedings - Beltwide Cotton Conferences. 2:1113-1115.

3. Snipes, C.E. and C.C. Baskin. 1994. Influence of Early Defoliation on Cotton Yield, Seed Quality, and Fiber Properties. Field Crops Research 37:137-143.

4. Snipes, C.E. et.al. 1996. Uniform Harvest Aid Performance and Fiber Quality Evaluation. Proceedings - Beltwide Cotton Conference. In Press.

5. Supak, J.R. 1995. Harvest-Aids for Picker and Stripper Cotton. Proceedings - Beltwide Cotton Conferences. 1:5-8.

6. Williford, J.R. 1992. Influence of Harvest Factors on Cotton Yield and Quality. Transactions of the ASAE. July/Aug 35(4):1103-1107.

Table 1. Influence of harvest aid treatments on percent defoliation and selected HVI lint quality measurements at all test sites (1992-1994).

TREATMENT DESCRIPTION	%DEFOL 7 DAT	%DEFOL 14 DAT	TRASH (% area)	MIC
1. Untreated CK	24 e	38 d	0.40 a	4.38 a
2. Folex® @1.5pt	66 b	76 b	0.36 ab	4.31 bc
3. Dropp® @ 0.2 lb	52 d	68 c	0.36 ab	4.33 ab
4. Harvade® @8oz+ Agridex® @ 1 pt	58 c	71 c	0.39 ab	4.30 bcd
5. Harvade @ 8 oz+ Prep® @ 1.33 pt+ Agridex @ 1 pt	66 b	77 b	0.36 ab	4.25 e
6. Folex @ 0.75 pt+ Prep @ 1.33 pt	71 a	82 a	0.34 b	4.26 de
7. Dropp @ 0.1 lb+ Prep @ 1.33 pt	64 b	78 ab	0.38 ab	4.27 cde

Means within columns followed by the same letter are not different. Location and year had an equal impact on error structure, thus were considered environment and combined as rep (Snipes - 1995).

Table 1 Continued.

TREATMENT DESCRIPTION	Color Rd	Color +b	Color* Grade
1. Untreated Check	74.4 c	8.71 a	31-4
2. Folex® @1.5pt	75.1 ab	8.52 c	31-2
3. Dropp® @ 0.2 lb	74.9 b	8.56 bc	31-4
4. Harvade® @ 8 oz + Agridex® @ 1 pt	75.1 ab	8.50 c	31-2
5. Harvade @ 8 oz + Prep® @ 1.33 pt + Agridex @ 1 pt	74.9 b	8.58 bc	31-4
6. Folex @ 0.75 pt + Prep @ 1.33 pt	75.2 a	8.57 bc	31-2
7. Dropp @ 0.1 lb + Prep @ 1.33 pt	74.9 b	8.61 b	31-4

*All color grades are based on the Nickerson and Hunter Color/Grade Translator.

Table 2. Number of white specks observed in 40 square inches of dyed jersey knit fabric over a three year period.

TREATMENT DESCRIPTION	1992 (n=12)	1993 (n=16)	1994 (n=18)	MEAN (n=46)
1. Untreated	293	136	88	158
2. Folex® @ 1.5 pt	300	132	83	158
3. Dropp® @ 0.2 lb	261	128	82	144
4. Harvade® @8 oz + Agridex® @1 pt	294	136	91	159
5. Harvade @ 8 oz + Prep®@1.33 pt + Agridex @ 1 pt	269	123	86	144
6. Folex @0.75 pt + Prep @ 1.33 pt	289	131	85	154
7. Dropp@0.1lb+ Prep @ 1.33 pt	278	119	74	143

LSD at the 5% and 10% level of probability is 18 and 15, respectively (Snipes-1995).

Table 3. Influence of harvest aid treatments on selected AFIS fiber quality measurements from selected 1994 test locations.

TREATMENT DESCRIPTION	NEP (ct)	VFM (%)	SFC (%)	UQL (in)
1. Untreated	185	1.83	9.88 c	1.13 ab
2. Folex® @ 1.5 pt	186	1.74	10.11 abc	1.12 ab
3. Dropp® @ 0.2 lb	181	1.81	10.17 abc	1.14 a
4. Harvade® @ 8 oz + Agridex® @1 pt	190	1.82	9.98 bc	1.12 ab
5. Harvade @ 8 oz + Prep® @ 1.33 pt + Agridex @ 1 pt	186	1.85	10.44 ab	1.11 b
6. Folex @ 0.75 pt + Prep @ 1.33 pt	193	1.79	10.61 a	1.12 ab
7. Dropp @ 0.1 lb + Prep @ 1.33 pt	182	1.80	10.07 bc	1.12 ab

Means within columns followed by the same letter are not different at the 5% level of probability (Snipes - 1995).

Table 4. Slope comparisons of selected quality measurements and harvest method versus percent defoliation at 14 DAT.

Quality Measurement	Y-intercept	Slope	Pr>T
1992-1994 HVI quality measurements			
micronaire (spindle)	4.36	-0.00073	0.5019
micronaire (stripper)	4.92	-0.0089	0.0421
white speck (spindle)	96.72	-0.022	0.8528
white speck (stripper)	93.33	0.27	0.5599
1994 AFIS quality measurements			
nep (spindle)	175	0.174	0.2657
nep (stripper)	127	0.88	0.1657
sfc (spindle)	10.96	0.002	0.6656
sfc (stripper)	6.07	0.034	0.0793

Percent defoliation (x) is used to describe treatment effect on fiber quality (y) and tested for significance to evaluate the overall effect (Snipes - 1995).