STORAGE OF SEED COTTON AFTER FOUR HARVEST AID TREATMENTS

A.D. Brashears
Agricultural Engineer
USDA, ARS
Cotton Production and Processing Research Unit
Lubbock, TX
J.W. Keeling
Assoc. Professor,
Texas A&M Research Center
Lubbock, TX,
T.D. Valco
Director, Agriculture Research
Cotton Incorporated,
Raleigh, NC

Abstract

Defoliation of leaves on the cotton plant is necessary before the plant is harvested with a brush roll stripper. Although some desiccation of the plant is necessary, it is desirable not to completely dry the cotton plant prior to harvest. Complete drying of the plant will significantly increase foreign matter, in particular sticks and fine trash. It is necessary to sufficiently dry the seed cotton to permit storage for 3 to 4 week periods prior to ginning without loss of fiber quality. Four harvest aid combinations which included defoliants, desiccants and boll openers were selected for this study and were compared to a nonchemical treatment that was harvested after termination by a freeze. One module of seed cotton, harvested from each harvest aid treatment, was ginned immediately after harvest while a second module of each treatment was stored for 34 days before ginning. Moisture content of the seed cotton before storage was less than 8.5% for all treatments. An early application of Prep (ethephon) plus Def (tribufos)(1.3 pt/a+0.5 pt/a)(P+D→C) followed by an application of Cyclone (paraquat)(1.5 pt/a) along with the treatment of Ginstar (thidiazuron+diuron)(0.5 pt/a) applied at an early date followed by a late application of Cyclone(1.5 pt/a) (G→C) had significantly higher moisture contents after storage than the other harvest aid treatments. Sticks and fine trash in seed cotton at the feeder apron were less for the stored cotton than for the non-stored for all harvest aid treatments. Eighty percent of the color grades for the cotton moduled but not stored were color grade 11, compared to 73% of the grades for the stored cotton that were color grade 11 or better. The treatment that received no harvest aid treatment and was harvested after a killing freeze had higher levels of sticks and fine trash and lower fiber qualities than the harvest aid treatments. This was due to the additional exposure to the weather. This study indicates that chemicals are available for harvest aids to prepare cotton for stripper harvest on the Texas High Plains and that the cotton can be stored with no significant loss of fiber quality. It also indicates that early harvest using harvest aids gave consistently better fiber quality than waiting to harvest the cotton after a killing freeze.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:1609-1612 (1997)
National Cotton Council, Memphis TN

Introduction

Harvest aids have become an integral part of the production of cotton on the Texas High Plains the past 4 to 5 years. Selection of chemical treatments for this study included the following factors: cost of treatment, maturity of crop, degree of boll opening, and weather conditions at time of application. Stripper harvest of cotton requires that the leaves be defoliated with some desiccation of the cotton plant. If the plant is completely desiccated, however, excessive amounts of foreign matter will be removed from the plant and subsequent cleaning in the gin process may not remove this foreign matter, thus resulting in lower fiber quality. Supak, et al (1993) show that the nodes above cracked boll can be effectively used in timing the application of harvest aids. State wide evaluations of harvest aid chemicals by Supak et al (1994) have shown their effectiveness as defoliants and desiccants in the cotton growing areas of Texas. Brashears, et al (1995) reported on several combinations of harvest aids that effectively prepared the cotton for stripper harvest. Although these studies included the harvest of plots with and without field cleaners, the cotton was ginned immediately after harvest and the effect of harvest aids with storage were not evaluated. The object of this study was to determine the effectiveness of harvest aids in preparing the cotton for harvest and the subsequent effect of storage on moisture, foreign matter and fiber properties.

Materials and Methods

Four harvest aid treatments and 2 storage treatments were compared to a treatment where no harvest aid was applied and the cotton was terminated by a killing freeze. The harvest aid treatments were (1) early application of Prep(ethephon)+Def (tribufos) (1.3 pt/a+0.5 pt/a) followed by a later application of Cyclone(paraquat) at a rate of 1.5 pt/a (P+D→C), (2) an early application of Ginstar (thidiazuron+diuron) (0.5 pt/a) followed by a later application of Cyclone at the rate of 1.5 pt/a (G→C), (3) a early application of Cyclone(0.5 pt/a) followed by a later application of Cyclone at the rate of 1.5 pt/a (C→C) and (4) a early application of Harvade Harvade(dimethipin) plus Defol 6 (sodium chlorate) plus a crop oil concentrate (8 oz/a+3 lb/a+1 p/a) followed by a late application of Cyclone at the rate of 1.5 pt/a (H+D→C), Table 1. The fifth treatment used no chemicals allowing a killing freeze to defoliate and desiccate the cotton plant which has been the most accepted method of preparing the crop for harvest. The early application was applied with a 8 row ground sprayer on Oct. 7, 1995 followed by the second application on Oct 17, 1995. The early harvest aid treatment was applied when the cotton was approximately 80% open. Each harvest aid treatment was replicated 3 times. The cotton variety was Paymaster HS26 grown under irrigated production practices. Plots were harvested with a 4 row brush roll stripper on Oct. 25 and Oct. 26, 1995. The fifth treatment which had no harvest aid chemicals was harvested on Nov. 20, 1995 after a killing freeze occurred on Nov. 11, 1995. A 12' long module builder was used to build modules. This facilitated the harvesting, storing, and ginning of the cotton in that all three replications of each harvest aid treatment could be made into a single module with each replication making up 1/3 of the length of the module.

Two modules with cotton harvested from each of the 3 replications were built as the cotton was harvested. One module of each treatment was ginned on Oct 30, 1995 and represented cotton that had no field storage. The second module from each treatment was covered with a module tarp and left in the field until Nov. 28, 1995 when the cotton was removed from the field and ginned. The cotton was ginned on a commercial gin which included in the following sequence: a module feeder, tandem incline cleaners, multistage stick machine, tandem incline cleaners, feeder cleaner, 112 saw gin stand, air jet cleaner and tandem lint cleaners. Drying in the gin process was accomplished with a hot box at the module feeder and a hot shelf dryer in the gin. Seed cotton samples were fractionated to determine foreign matter fractions. Lint samples were sent to the USDA-AMS Cotton Classing Office and to Cotton, Inc, Raleigh, NC for fiber quality determinations.

Discussion

Seed cotton moisture for non-stored and stored seed cotton collected at the module feeder and the feeder apron are shown in Table 2. Moisture content for the non-stored seed cotton at the trailer was higher for the P+D→C and G→C treatments with H+D→C treatment having the lowest seed cotton moisture content. Seed cotton samples collected at the feeder apron for the non-stored cotton found the G→C treatment significantly higher than the P+D→C, C→C, and the H+D→C, while the NT→ND sample was significantly lower than the other samples. The stored cotton had significantly higher moisture contents for the seed cotton treated with P+D→C and G→C treatments, 10.45% and 10.23 %, respectively, than the C→C and H+D→C treatments which had moisture contents of 8.73% and 8.72%, respectively. Seed cotton moisture contents at the feeder apron separated significantly for each of the four treatments with the P+D→C treatment moisture content being higher at 8.29% and with the H+D→C treatment having the lowest moisture content at 6.63%.

Foreign matter fractions collected at the module feeder for the non-stored and stored cotton are shown in Table 3. No significant difference was found between either storage time for burs or for sticks and total trash for the stored cotton. Stick content for the non-stored cotton was significantly higher for the NT→ND treatment compared to the chemical treatments, while stick content was lowest for the H+D→C treatment. No significant differences in stick content were found for the non-stored P+D→C, G→C, and C→C treatments. Total trash for the non-stored cotton was highest for the C→C treatment and lowest for the H+D→C treatment.

Although significant differences in bur content existed for seed cotton samples collected at the feeder apron there was no trend for the non-stored or stored cotton(Table 4). The stick content for the non-stored cotton was significantly higher for the NT→ND cotton. Since this was the cotton harvested after a killing freeze, the plant had been through a longer weathering period and thus more prone to higher foreign matter content. The lowest stick content at the feeder apron for non-stored seed cotton was for the H+D→C treatment. Stick content at the feeder apron is important since it has been shown that the incidence of barky grades can be significantly reduced if the stick content is 2% or less (Laird and Baker, 1975). Fine trash for the non-stored cotton was significantly higher for the C→C and NT→ND treatments. No significant differences was found for total trash in non-stored seed cotton at the feeder apron. There were significant effects due to treatments for burs, sticks, fine trash and total trash for stored seed cotton sampled at the feeder apron. The P+D→C treatment had significantly more sticks and the P+D→C and C→C treatments had significantly more fine trash than the other treatments. The P+D→C had significantly more total trash after storage in modules than the G→C, C→C, And H+D→C treatments. The stored cotton also had less sticks and fine trash at the feeder apron than did the non-stored cotton.

Lint moisture contents are shown in Table 2. The G→C treatment had the highest moisture content and P+D→C had the lowest moisture content for the non-stored cotton. Moisture content of lint from the stored cotton was highest for the C→C treatment and lowest for the H+D→C treatment. Color grades of the test cotton are shown in Table 5. There were a total of 15 grades for each of the treatments for each storage method. The largest difference in the non-stored cotton was between the chemical treated plots where 80% of the samples had a color grade of 11 while less than 50% of the samples harvested after a killing freeze had a color grade of 11. This is due to a longer exposure period for the NT→ND treatment which was exposed to environmental conditions in the field for 34 days more than the chemically treated cotton. The stored cotton had 73% of its samples with a color grade of 11 which was 7% less than the non stored cotton. The stored C→C treatment had 9 color grades of 11 while stored H+D→C had 12 samples with color grade of 11. All samples in the test had color grades of 21 or better.

Fiber quality after processing through 2 lint cleaners as determined by HVI is shown in Table 6 and Table 7. The staple for the non-stored cotton was significantly shorter for the NT→ND cotton(Table 6). The fiber length of the stored cotton was significantly longer for the P+D→C treatment. The staple was slightly less than 1 1/8 in for all except the P+D→C treatments for the stored cotton but slightly longer than 1 1/8 in for all treatments of the non-stored cotton. Micronaire was significantly higher for the non-stored P+D→C and G→C treatments but no significant difference was found in micronaire due to treatments for the stored cotton. Fiber strength was the weakest for the NT→ND cotton which received the effects of weathering. Significant treatment effects were not found for strength for the stored cotton. Leaf grades in the non-stored cotton were higher for the NT→ND treatment while the P+D→C had the lowest leaf grade. Leaf grades for the stored cotton were not affected by the harvest aids. All leaf grades for the study were 2 or less. The grayness of cotton is measured by the HVI color Rd with the higher number indicating brighter color. The brightest cotton was from the H+D→C treatment for both storage treatments. Yellowness of cotton is measured by the HVI color +b with smaller values indicating a lower degree of yellowness. The G→C treatment for the non-stored cotton had the highest degree of yellowness while the NT→ND treatment had the lowest degree of yellowness. The P+D→C treatment was significantly higher for the stored cotton indicating a higher degree of yellowness. HVI trash is the percent of the surface that is covered by trash particles. No significant difference was observed for HVI trash for the non-stored cotton but there were significant differences due to treatments for the stored cotton. The P+D→C had the highest surface trash area, 1.07%, while the C→C had the lowest area of 0.73%. Length of the cotton was shorter for the NT→ND cotton that was not stored. P+D→C treatments had a significantly longer length for the stored cotton. Length uniformity was lower for the non-stored P+D→C treatment. No significant difference in fiber uniformity aid was found due to harvest for the stored cotton. The stored cotton uniformity was 0.4% less than the non-stored cotton.

Non-lint content as determined by AFIS is shown in Table 8. Visible foreign matter was significantly greater for the NT→ND treatment than for the chemical treatments for the non-stored cotton. The stored cotton treated with P+D→C had a much higher VFM value than the other harvest aid treatments. Visible foreign matter for the stored cotton was significantly higher for the P+D→C treatment than the G→C and C→C harvest aids. Visible foreign matter for the stored cotton averaged 0.61% for all treatments compared 0.98% for the non-stored cotton. No significant differences were found for neps in the non-stored cotton. Neps in the non-stored cotton was significantly higher for the P+D→C while the G→C treatment had a significantly lower nep count.

This study indicates that chemicals are available for harvest aids to prepare cotton for stripper harvest on the Texas High Plains and that the cotton can be stored with no significant loss of fiber quality. It also indicates that early harvest using harvest aids gave consistently better fiber quality than waiting to harvest the cotton after a killing freeze.

Disclaimer

Acknowledgments

We give special thanks to David Keeling, manager of Keeling Brothers Farms, and Dan Taylor, owner of Busters Gin, Ropesville, TX, for their cooperation in conducting this test.

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Table 1. Harvest aid treatments.

Treatment Code	First Treatment	Second Treatment
P+D→C	Prep+Def(1.3 pt/a+0.5 pt/a)	Cyclone(1.5 pt/a)
G→C	Ginstar(0.5 pt/a)	Cyclone(1.5 pt/a)
C→C	Cyclone(0.5 pt/a)	Cyclone(1.5 pt/a)
H+D→C	Harvade+NaClo+COC. (8 oz/a + 3 lb/a +1 p/a)	Cyclone(1.5 pt/a)
NT→ND[1]	No Treatment	No desiccation

[1]Harvested after killing frost.

Table 2. Moisture content of seed cotton at trailer and feeder apron and lint foisture after 2 lint cleaners.

Harvest Aid Treatment	Seed Cotton Module Feeder	Seed Cotton Feeder Apron	Lint After 2 LC
	----------------------	%	----------------------
	Non-stored		
P+D→C	8.27 a[1]	7.45 b	4.91 b
G→C	7.97 a	8.97 a	5.20 a
C→C	7.49 ab	7.53 b	5.00 ab
H+D→C	6.15 b	7.17 b	4.98 ab
NT→ND	7.37 ab	6.30 c	4.96 ab
Average Non-stored	7.47	7.53	5.01
		Stored	
P+D→C	10.45	8.29 a	4.77 ab
G→C	10.23	7.63 b	4.55 bc
C→C	8.73	7.12 c	4.97 a
H+D→C	8.72	6.63 d	4.41 c
NT→ND	—	--	--
Average Stored	9.53	7.43	4.67

[1]Means within data columns and for each harvest method followed by the same letter are not significantly different at the 10% level by DMRT.

Table 3. Foreign matter fractions in bur cotton from trailer samples.

Harvest Aid Treatment	Burs	Sticks	Fine Trash	Total Trash
	----------------------	%	----------------------	
	Non-stored			
P+D→C	21.6[1]	2.3 b	4.5 b	28.4 ab
G→C	20.0	2.4 b	5.1 b	27.5 ab
C→C	20.8	2.5 b	6.4 a	29.7 a
H+D→C	19.8	1.9 c	5.1 b	26.8 b
NT→ND	19.2	3.2 a	6.0 a	28.4 ab
Average Non-stored	20.3	2.5	5.4	28.2
	Stored			
P+D→C	18.7	2.8	4.1 c	25.6
G→C	18.5	2.5	5.0 b	25.9
C→C	17.8	2.4	5.2 a	25.5
H+D→C	18.7	2.2	4.2 c	25.2
NT→ND	--	--	--	--
Average Stored	18.7	2.5	4.5	25.5

[1]Means within data columns and for each harvest method followed by the same letter are not significantly different at the 10% level by DMRT.

Table 4. Foreign matter fractions in bur cotton at feeder apron.

Harvest Aid Treatments	Burs	Sticks	Fine Trash	Total Trash
	------------%-----------			
	Non-stored			
P+D→C	1.05 ab[1]	2.3 b	4.5 b	2.88
G→C	1.42 a	2.4 b	5.1 b	3.46
C→C	1.06 ab	2.5 b	6.4 a	2.84
H+D→C	1.31 ab	1.9 c	5.1 b	3.47
NT→ND	0.84 b	3.2 a	6.0 a	2.73
Average	1.14	2.5	5.4	3.08
	Stored			
P+D→C	1.19 a	1.10 a	1.11 a	3.40 a
G→C	0.83 b	0.69 b	0.84 b	2.36 b
C→C	0.94 ab	0.57 b	1.18 a	2.70 b
H+D→C	0.78 b	0.65 b	0.82 b	2.25 b
NT→ND	--	--	--	--
Average	0.94	0.75	0.99	2.68

[1]Means within data columns and for each harvest method followed by the same letter are not significantly different at the 10% level by DMRT.

Table 5. Number of color grade after 2 lint cleaners.

	Color Grades[1] 11	21
	Non-stored	
P+D→C	13	2
G→C	11	4
C→C	12	3
H+D→C	13	2
NT→ND	7	8
	Stored	
P+D→C	10	5
G→C	11	4
C→C	9	6
H+D→C	12	3
NT→ND	--	--

[1]Each treatment had a total of 15 grades.

Table 6. Fiber quality after 2 lint cleaners.

Harvest Aid Treatments	Staple	Micron-aire	Strength	Leaf Grade
	-1/32 in-	-gm/tx-		
		Non-stored		
P+D→C	34.5 a[1]	4.08 a	30.2 bc	1.27 b
G→C	34.7 a	4.07 a	30.9 a	1.53 ab
C→C	34.6 a	3.99 b	30.4 abc	1.40 ab
H+D→C	34.6 a	3.99 b	30.7 ab	1.33 ab
NT→ND	34.1 b	3.98 b	30.0 c	1.60 a
Average	34.5	4.02	30.4	1.43
		Stored		
P+D→C	34.5 a	4.01	30.2	1.47
G→C	33.8 b	4.01	30.1	1.33
C→C	33.9 b	4.08	30.1	1.47
H+D→C	33.9 b	4.10	29.9	1.20
NT→ND	—	--	--	--
Average	34.0	4.05	30.1	1.37

[1]Means within data columns and for each harvest method followed by the same letter are not significantly different at the 10% level by DMRT.

Table 7. Fiber quality after 2 lint cleaners.

Harvest Aid Treatments	HVI Rd	HVI +b	HVI Trash Unifor..	Length	Length
	-%-		-%-	-in-	-%-
	Non-stored				
P+D→C	81.67 ab[1]	9.41 b	1.13	1.07 bc	81.9 b
G→C	81.33 b	9.80 a	1.20	1.08 ab	82.4 a
C→C	81.73 a	9.66 ab	0.93	1.08 ab	82.5 a
H+D→C	82.00 a	9.53 ab	1.13	1.08 ab	82.5 a
NT→ND	81.67 ab	8.74 c	1.07	1.06 c ab	82.1
Average	81.68	9.43	1.09	1.07	82.3
	Stored				
P+D→C	80.86 b	9.77 a	1.07 a	1.07 a	81.9
G→C	81.13 b	9.41 b	0.93 ab	1.05 b	81.9
C→C	81.00 b	9.28 b	0.73 b	1.06 b	81.9
H+D→C	81.40 a	9.35 b	0.80 ab	1.06 b	81.9
NT→ND	--	--	--	--	--
Average	81.35	9.45	0.88	1.06	81.9

[1]Means within data columns and for each harvest method followed by the same letter are not significantly different at the 10% level by DMRT.

Table 8. Non-lint content of lint before andafter being processed through 2 lint cleaners.

Harvest Aid Treatment	Visible Non-lint Content	Neps
	---%---	-per gram-
	Non-stored	
P+D→C	0.94 b	405
G→C	0.88 b	377
C→C	0.92 b	375
H+D→C	0.96 b	391
NT→ND	1.18 a	394
Average 0.98 388		
	Stored	
P+D→C	1.21 a	411 a
G→C	0.76 b	363 c
C→C	0.79 b	385 b
H+D→C	0.89 ab	367 c
NT→ND	--	--
Average	0.61	382

[1]Means within data columns and for each harvest method followed by the same letter are not significantly different at the 10% level by DMRT.