THE EFFECT OF LEVEL OF DEFOLIATION ON STORABILITY AND QUALITY OF SEED COTTON

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Abstract

This preliminary study addressed the question of storability of seed cotton in modules and provides a very preliminary look at one storage test where seed cotton from plots treated with three levels of defoliation (0%, 65% and 95% leaf drop) was harvested, placed into open mesh bags containing approximately 30 lb seed cotton each and stored in a grower's module for approximately 5 weeks. Temperatures of each bag and the grower's module were recorded through-out the storage period. Seed cotton moisture contents before and after storage were determined. HVI lint quality and seed quality measurements were made.

Moisture contents of the seed cotton from the 0% 65% and 95% defoliation treatments were found to be 16.8%, 13.4% and 12.0% after mechanically harvesting. Heating occurred in two of the six bags from the 65% defoliation with temperatures reaching 138^0 F. Lint quality (color) from the 0% and 65% defoliation treatments was lower after storage (color grade 32-2 and 42-2 respectively) than the 95% defoliation treatment (color grade 31-4) when HVI Rd and +b data were averaged and converted to color grade. Seed net quality grades were 97.2, 96.3 and 100 for the 0%, 65% and 95% defoliation treatments respectively. Seed composite grades were 96.7, 95.4 and 98.1 respectively for the 0%, 65% and 95% defoliation treatments. The free fatty acid level was higher in the samples that heated the greatest.

This study indicates that moisture or leaf content alone may not be the sole factor to cause rising storage temperatures in seed cotton modules. Lint quality was influenced by level of defoliation during storage. While this study was preliminary, it does suggest that further research needs to be conducted to investigate the effect of defoliation level on the storability of seed cotton.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:1613-1615 (1997)
National Cotton Council, Memphis TN

Introduction

Previous work with seed cotton storage has shown that temperature is an after-the-fact indicator of quality deteriation of both seed and lint. Seed cotton stored in modules increased in temperature with increasing amounts of green trash and moisture in the seed cotton (Sorensen,J.W., et. al. and Curley,R, et. al.). Lint quality, primarily color grade, decreased with higher temperatures and longer storage periods. Some modules of seed cotton heated even though moisture content of the module was at or below 9.5% and defoliation was near 100% leaf drop (Willcutt, M. H., et. al.).

Recent work with defoliation materials in test across the cotton belt has shown little quality differences from defoliation when seed cotton was ginned soon after harvest (Valco, T.D., et. al.). The question then becomes "Why defoliate or under what circumstances is it profitable to defoliate"?

Procedure

A study was conducted using eight-row plots, 300 ft long, with three levels of defoliation; high, medium and low. The defoliation treatments were 1.)untreated, 2.) Folex/Def at 1.5 pt/ac and 3.)Harvade at 0.5 pt/ac plusDrop at 0.1 lb/ac plus Prep at 1.33pt/ac plus crop oil (Agridex) at 1 pt/ac, respectively. The levels of defoliation obtained were 0% or natural leaf drop, 65% defoliation with slight regrowth in the bottom of the plants and 95% with no visible regrowth. The plots were harvested 14 days after first applications. Six mesh bags were filled with about 30 to 35 lb of seed cotton from each defoliation plot. Three seed cotton samples were taken from each defoliation plot by hand picking, filling and sealing in quart jars. Similarly, three seed cotton moisture samples were pulled from each of the three levels of defoliation plots following mechanical harvesting. Moisture determinations were made using standard gravimetric moisture determination procedures.

Seed cotton samples were loaded onto a truck and covered with a vinyl tarp to prevent drying and loss of trash or seed cotton while in transport to a local farmer's field. Upon arrival at the farmer's field the bags of seed cotton were placed in a 50% completed module in a randomized block design with three replications (with 2 sub-samples placed end to end across the module) each of the three treatments. Thermocouples were placed in each of the bags. Seed cotton was then dumped on top of the bags and the module completed with the growers cotton. Thermocouples were then placed at 12 locations in the farmer's module above and below the sample bags. The farmer's field appeared to be equivalent to the 95% defoliation treatment from the experiment station field.

Temperatures were recorded daily for the first nine days, every other day for the next 12 days and then at five day

intervals until the end of the 35 day storage period. The module was ginned and the bag samples retrieved along with moisture samples.

The bags were transported to the USDA Cotton Ginning Lab at Stoneville, Ms. and ginned on the micro gin. Seed samples were sent to a seed lab for standard oil mill grading. Two lint samples were obtained when the seed cotton was ginned from each bag for HVI analysis.

Results and Discussion

Seed cotton moisture content in the hand picked samples was about 1% lower in the 95% defoliation samples (9.3%) as compared to the 0% defoliation treatment(10.3%)(Table 1). The 65% defoliation samples were midway between the other treatments(9.7%). The machine picked samples averaged 16.8%, 13.4% and 12.0% for the 0%, 65% and 95% defoliation treatments, respectively. Moisture added by the harvester appears to be about 2.7% for the 95% defoliation treatment. Since the harvester moistening system was not readjusted between plots it is assumed that the higher moisture contents in the other two treatment samples is a combination of harvester moisture and plant moisture. Most of this would be due to additional leaf content. During storage the treatments equilibrated with the surrounding seed cotton and became 12.8%, 13.1% and 12.1 % for the 0%, 65% and the 95% defoliation treatments, respectively. While the 0% defoliation treatments appeared to loose an average of about 4% moisture to the farmer's module, one of the 65% defoliation treatment samples that heated the most gained about 3.2% in moisture, probably from respiration of the seed and microbial activity.

The average results of the thermocouple readings are shown in Figure 1. Two adjacent sub-samples of one replication of the 65% defoliation treatment heated during the storage period. One of these samples heated to 138^0 F before it began to cool nine days later. Thermocouples in the farmer's module indicated heating of the farmer's cotton adjacent to these bags was delayed and only reached 122^0 F. A second heating cycle began peaked and began declining before the samples were retrieved from the module. The average temperatures of the samples from the 65% defoliation treatment ranged about 10^0 F higher than the temperatures from the 0% defoliation treatment and about 6^0 F higher than the 95% defoliation treatment temperatures. The average temperatures of the farmer's module were almost identical to the 95% defoliation treatment temperatures.

Figure 2 shows the average temperatures from each treatment after one of the samples with the highest temperatures were omitted from each treatment average. Although the difference in the temperatures was reduced, the ranking remained the same.

Seed quality data are presented in Table 2. The free fatty acid levels in the 0% and 65% defoliation treatments were higher than that in the 95% defoliation treatment. Free fatty acid levels were higher for individual samples that increased in temperature the greatest. Seed net quality and composite grade were lower for the 0% and 65% defoliation treatments than the 95% defoliation treatments. Neither the farmer's seed or lint were sampled for quality measurement.

The lint sample HVI color grades and Rd and +b components are given in Table 3. Only the +b for the 0% and 95% defoliation treatments were found to be statistically different at the 5% level. The color grades computed from the treatment averaged Rd and +b components were 32-2, 42-2 and 31-4 for the 0%, 65% and 95% defoliation levels, respectively. When one sample that heated the highest was eliminated from each treatment average, the 65% defoliation color grade became 32-2. The other color grades did not change. There were no significant differences in any of the other fiber properties.

Conclusions and Recommendations

While the authors have reservations about the small bag-implant method used in this study, it appears that defoliation level does have an effect on the storability of seed cotton in modules. Seed cotton moisture contents were lowest for the best defoliated field plot which would permit earlier initiation of harvesting in the mornings. Green plant materials appeared to increase the total moisture contents of the samples by as much as 4% for the 0% defoliation treatment. Lint and seed quality was best from the 95% defoliation treatment. Temperatures during storage were unexplainably lowest in the 0% defoliation treatment. The 95% defoliation treatment had temperatures approximately equal to the farmer's module and slightly higher than the 0% defoliation treatment temperatures. The 65% defoliation treatment had the greatest visible juvenile leaf growth at harvest and heated to higher temperatures during storage.

Additional testing is needed to verify that the small bagged sample-implant method is reliable. This will necessitate test at several locations with multiple replications at each location. It is believed that larger samples, perhaps 60 pounds each, spaced at greater distances apart in the farmer modules may add to the reliability of this method. Whole module treatment/replications will be needed in some test as comparisons to finally prove or disprove the reliability of small sample-implant methods.

Acknowledgments

The authors wish to acknowledge the many cooperators who made this study possible. The staff of the Delta Research and Extension Center prepared the plots with different levels of defoliation and harvested the seed cotton samples. The staff of the USDA cotton Ginning Lab at Stoneville,

Ms. conditioned and ginned the seed cotton samples. Cotton Incorporated provided partial funding, guidance and lint quality analysis for the study. Certainly one of the greatest contributions came from the staff and management of Kansas Plantation near Indianola, Miss. who provided the module of seed cotton that served as the surrogate mother for the sample-implants and assisted in the data collection and sample retrieval.

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Table 1: Seed cotton Moisture Contents (%)

	0% Def	65% Def	95% Def
Hand Picked	10.3	9.7	9.3
Machine Pick	16.8	13.4	12.0
After Storage	12.8	13.1	12.1

Table 2: HVI Color

	Rd	plus b	CGRD
0% Defoliation	72.64	9.60	31-2
65% Defoliation	71.33	9.83	42-2
95% Defoliation	73.33	9.13	31-4

Table 3: Cotton Seed Quality

	FFA	NET QUAL	GRADE
0% Defoliation	2.47	97.20	96.67
65% Defoliation	2.62	96.33	95.42
95% Defoliation	1.47	100.00	98.08

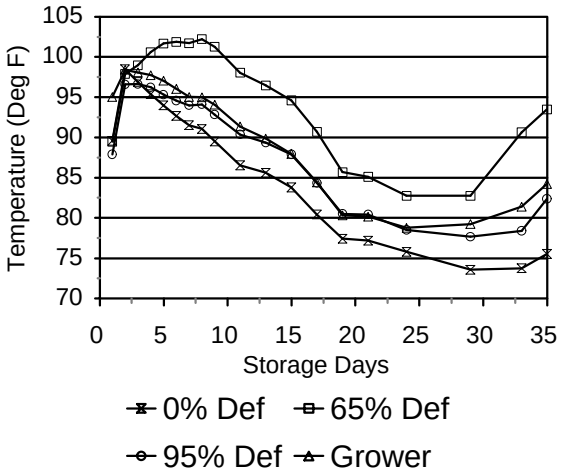

Figure 1: Seed Cotton Temperatures

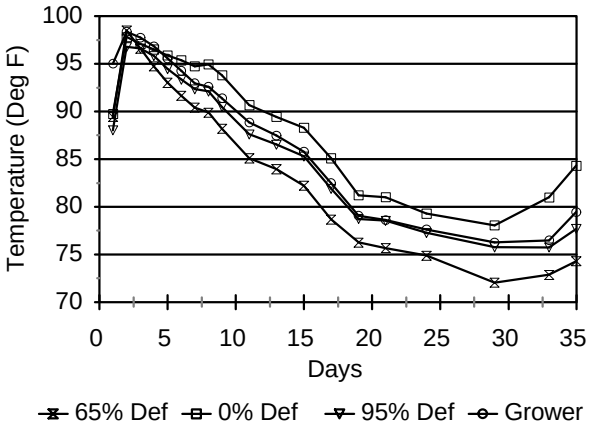

Figure 2: Seed Cotton Temperatures Worst Samples Removed