# PRELIMINARY EVALUATION OF FIBER QUALITY IN SEED COTTON CLEANER MATERIAL IN A COMMERCIAL GIN Richard K. Byler USDA/ARS Cotton Ginning Research Unit Stoneville, MS Christopher D. Delhom USDA/ARS/SRRC Cotton Structure and Quality Research Unit

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#### <u>Abstract</u>

The main product of cotton gins is the bale of ginned lint but valuable fiber exists in several additional streams in the gin. In recent years more gins have installed equipment to reclaim the fiber in the material removed by the seed cotton cleaners. Data and samples were collected at one commercial gin which had installed such equipment. Three cultivars were used in the data collection. These data showed that about 19.0 lbs of material was reclaimed from the seed cotton cleaners and most of the cleaned material was loose lint and motes with little seed cotton. The material was of lower quality than the lint obtained from the seed cotton but contained considerable valuable fiber. Some differences due to cultivar were detected but no differences were detected with HVI or AFIS measurements of the bale lint quality or in card waste depending on whether this material was mixed with the seed cotton being ginned or not.

#### **Introduction**

A cotton gin is considered to be mainly a set of equipment for taking in seed cotton and producing bales of cotton fiber, perhaps also producing cotton seed for oil and protein. However, there are several other outputs from a gin, one of which is the bales of fibrous material obtained from the material rejected from the lint cleaners perhaps also including material from the gin stand and seed cotton cleaning, referred to as "mote" bales. These cotton ginning byproduct streams result because during the separation process some of the desirable lint material is rejected with the unwanted plant parts.

With increasing prices for cotton fiber, interest in reclaimed fiber has increased. Delhom, et al. (2011) showed that lint cleaner motes from one source had a considerable amount of good fiber and that 20% (or more) semi-processed motes could be mixed with normal cotton fiber and spun into yarn with no measurable loss in yarn quality. Over the past few years some gins have installed cleaning equipment to remove fiber from the seed cotton cleaning stream. Little information has been published regarding fiber reclaimed from the seed cotton cleaning stream.

The purpose of this study was to collect data and samples at a gin that was reclaiming fiber from the seed cotton cleaning line and examine it for quantity and quality, which may help the industry better understand how to use the fiber in this material stream.

#### **Materials and Methods**

While no gin is typical the selected gin was a conventional cotton gin complete with reasonably current cotton ginning equipment and technology. Management upgraded the plant in 1994, and now uses minimum saw type lint cleaning, and low heat. Unloading was accomplished with a Harrell module feeder. In 2011, a Sam Jackson Hot Box pickup was installed and the drying system was converted to a pull through first stage drying system. Precleaning in the first stage used a 120 in. Continental incline cleaner over a 120 in. Continental Super III stick machine. This cleaning was followed by a second stage push/pull drying system. A 120 in. Continental incline over a 120 in. Continental impact cleaner comprised the second stage pre-cleaning. The impact cleaner dropped the cotton into a conveyor distributor that carried the cotton to the Continental Eagle 161 saw Golden Eagle gin stands equipped with Continental 9000 gin feeders. Once the cotton was ginned it moved though a centrifugal lint cleaner and finally to the Continental Eagle 24-D Lint Cleaner.

The reclaimer section of the gin collected the seed cotton cleaning material from the cyclone bank with a 35 - 40 Murray fan, which pulled the reclaimed material to a separator. The exhaust from the Murray fan picked up the trash from under a Murray trash vacuum and blew it to the hull pile. The reclaimed material was processed with a modified Murray HLST 72 in. stick machine, which had the reclaiming section removed, and a 7 cylinder 72 in. Moss Gordon Incline cleaner. At the time of the study the material reclaimed from the seed cotton cleaners was mixed with the material from the lint cleaners and placed in mote bales but for portions of this study the reclaimed material was mixed with the seed cotton in the overflow which was then dropped into the conveyor distributor.

The ginning portion of the test was completed on Nov. 21, 2011. Approximately enough seed cotton to produce 30 bales was used from each of three cultivars: Deltapine 912 B2RF, PhytoGen 367 WRF, and Stoneville 5458 B2RF. While the gin was processing the cotton at full speed, about 30 bales per hour, six bales were selected for inclusion in the test. The reclaimed seed cotton fiber was set to either be included or excluded from the bale and after several bales were ginned samples were taken. For three of the bales the reclaimed lint from the seed cotton cleaning was included in the bale and for three the material was not included in the bale.

For all 18 tested bales a sample of lint was obtained after lint cleaning for testing by High Volume Instrument (HVI) (Uster Technologies, Inc., Charlotte NC), Advanced Fiber Information System (AFIS) (Uster Technologies, Inc., Charlotte, NC), and miniature-scale processing. Both the HVI and AFIS data were the results of the mean of five separate measurements of subsamples of the material. For the three bales per cultivar for which the reclaimed material was not added to the bales the material was collected and weighed. A sample of the material was returned to Stoneville for processing. Also for the bales for which the reclaimed material was not added, while the bale was being ginned, seed cotton was also taken from the gin stand apron and returned to Stoneville for processing. The nine seed cotton and nine reclaimed lint samples returned to Stoneville were processed with the gin stand and one lint cleaner in the microgin at the Cotton Ginning Research Unit and turnout was calculated. The 18 cotton bale lint samples, the 9 ginned seed cotton and 9 ginned reclaimed material samples were sent to the Cotton Structure and Quality Research Unit in New Orleans, LA, for analysis by HVI, AFIS, and miniature-scale processing and yarn analysis.

A subsample of the nine fiber samples taken from the reclaimed material were fractionated, by first removing the larger material manually, then cleaning with the Shirley Analyzer (ASTM D2812-07).

The results of the HVI and AFIS measurements were analyzed with SAS (2003) using procedures MEAN and GLM. With GLM the model included effects of cultivar, whether the material was (or included) reclaimed material, and the interaction.

#### **Results and Discussion**

The mean of the weights of the nine measurements of reclaimed material from the seed cotton cleaners was 19.0 lbs per bale. Table 1 shows the mean fraction of the different components determined from the nine samples taken at the gin. After manually removing the larger material, the lint fraction was cleaned with the Shirley Analyzer so it was exceptionally clean lint, not as typically seen in a cotton bale. This table verifies the observation that there was relatively little seed cotton in the sample, but the material was mostly loose fiber.

Component	Average fraction by weight (percent)
Cleaned lint	35.5
Bolls	0.0
Hulls	6.7
Sticks/stems	2.6
Grass	0.0
Seed	11.6
Miscellaneous	0.0
Motes	37.4
Leaf	6.0
Pin trash	0.2

Table 1. Mean	fractions	of reclaimed	material,	three	cultivars

The mean turnout of the nine samples of reclaimed material after being processed through the gin stand and a single saw-type lint cleaner was 55%. So the expected additional weight added to the bale would be 10.5 lbs. In a commercial gin the 19 lbs of material would be metered slowly into approximately 1500 lbs of seed cotton, or 1.3% by weight, resulting in 500 lbs of lint mixed with the approximately 10 lbs of material from the reclaimer, or 2%.

The AFIS data comparing the lint from seed cotton and from reclaimed material after processing with the gin stand and one saw-type lint cleaner at the Stoneville Lab is shown in Table 2. These data were modeled with source of fiber, cultivar and the interaction. The interaction was not statistically significant for any of the AFIS measurements. This data shows that there were some differences by cultivar but the differences by source of the fiber were significant in every case. The data showed that the reclaimed lint was of usable, but of lower, quality than the fiber ginned directly from the seed cotton.

Table 2. Least squares means of certain AFIS measurements of ginned lint and reclaimed fiber by cultivar and by source of fiber.

AFIS measurement	Cultivar <sup>1</sup>			Source of fiber		
	DP 912	PhytoGen 367	Stoneville 5458	Seed cotton	Reclaimed lint	
Nep Count	426 a	482 a	381 b	228 *	631 *	
Length by weight, in	1.008	1.007	0.997	1.064 *	0.943 *	
Short fiber content, by	9.8	9.9	10.2	6.1 *	13.8 *	
weight, percent						
Trash count	199	192	169	87 *	286 *	
Visible foreign matter	4.0	3.9	3.0	1.7 *	5.6 *	
Maturity ratio	0.930	0.912	0.937	0.959 *	0.893 *	

<sup>1</sup>Means by cultivar followed by the same letter were not significantly different, P<0.05.

\* Means by source of material were significantly different, P<0.05.

Table 3 shows the least squared means of the HVI data for the 18 bales, by cultivar and by whether the reclaimed material was included or excluded from the bale. There were no statistically significant differences (P<0.05) between the means related to the inclusion of the reclaimed lint and none of the interactions were significant. The only significant differences were due to cultivar. Perhaps the differences in quality shown in Table 2 were not measurable because of the small quantity of reclaimed material added to each bale. It is also possible that the removal of motes and short fiber was more effective when a small amount of the reclaimed material was added to the fiber stream. Perhaps when only reclaimed material was processed the cleaning ability of the gin stand and saw-type lint cleaner was overwhelmed.

	Cultivar <sup>1</sup>			Reclaimed material		
	DP 912	PhytoGen 367	Stoneville 5458	Excluded	Included	
Spinning consistency	135 b	140 a	134 b	136	137	
index						
Micronaire	4.61 a	4.14 b	4.64 a	4.53	4.40	
Maturity	0.875 a	0.858 b	0.875 a	0.871	0.868	
Upper half mean length	1.172	1.174	1.170	1.170	1.174	
Uniformity index	81.8	82.0	81.5	81.8	81.7	
Strength	32.0 b	32.2 b	32.8 a	32.3	32.4	
Trash area	0.31 b	0.32 b	0.43 a	0.34	0.36	

Table 3. HVI least squared means of lint taken after the lint cleaners by cultivar and whether reclaimed material was added.

<sup>1</sup>Means by cultivar followed by the same letter were not significantly different, P < 0.05.

Table 4 shows the least squares means by cultivar and whether the reclaimed material was added to the seed cotton stream of selected AFIS measurements. None of the interactions were significant and none of the means by whether the reclaimed material was added were significantly different. The only means which were significantly different were by cultivar, and few of them were significantly different. AFIS measurements are sensitive to small differences and five subsamples were analyzed for each sample yet no differences were detected related to whether the reclaimed material was added to the bale.

Table 4. Least squares means of certain AFIS measurements by cultivar and by inclusion of reclaimed material.

AFIS measurement	Cultivar <sup>1</sup>			Reclaimed material		
	DP 912	PhytoGen 367	Stoneville 5458	Excluded	Included	
Nep Count	261	268	251	250	270	
Length by weight, in	1.013	1.030	1.012	1.017	1.020	
Short fiber content, by	8.5	8.1	8.7	8.4	8.5	
weight, percent						
Trash count	72 b	73 b	94 a	77	82	
Visible foreign matter	1.3	1.3	1.6	1.3	1.5	
Maturity ratio	0.952 a	0.925 b	0952 a	0.947	0.939	

<sup>1</sup>Means by cultivar followed by the same letter were not significantly different, P < 0.05.

At the time of this report most of the data from the miniature-scale processing and yarn analysis were not yet available. Table 5 lists the card waste based on measurements of carding five samples of two treatments (reclaimed material included or excluded) of three bales of three cultivars, 90 observations. The cotton cultivar was the only significant factor with more waste from processing the Stoneville cultivar than from for the other two cultivars.

Table 5. Least squares means of card waste measurements by cultivar and by inclusion of reclaimed material.

	Cultivar <sup>1</sup>			Reclaimed material	
	DP 912	PhytoGen 367	Stoneville 5458	Excluded	Included
Card waste	9.3 b	9.3 b	9.9 a	9.4	9.5

<sup>1</sup>Means by cultivar followed by the same letter were not significantly different, P<0.05.

# **Conclusion**

A study was planned and carried out in a commercial gin examining the differences in properties of fiber reclaimed from the material removed during seed cotton cleaning. There were about 19 lbs. of reclaimed material per bale with an estimated 10.5 lbs retained if it were added to the bale. This reclaimed material was of lower quality than normal lint but contained a considerable amount of valuable lint. No difference in bale fiber quality was detected when measured by HVI or AFIS and no difference in carding waste was detected related to whether the reclaimed material was added.

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## **Disclaimer**

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