FIBROUS WASTE FROM GIN STANDS AND LINT CLEANERS

W. S. Anthony
USDA, ARS,
Cotton Ginning Research Unit
Stoneville, MS

Abstract

The material removed by saw-type gin stands and saw-type lint cleaners was investigated in three studies. For Study 1, gin stand waste varied from 5.5 to 17.7 pounds per 500-pound bale whereas lint cleaner waste ranged from 6.4 to 19.3 pounds. For Study 2, gin stand waste ranged from a low of 4.9 pounds for Deltapine 5409 to 11.2 pounds for Suregrow 125. Lint cleaner waste ranged from 11.4 pounds for NuCotn 33 to 18.7 pounds for Deltapine 5409. For Study 3, which included 25 varieties at two growth locations, gin stand waste averaged 4.9 and 7.6 pounds across all varieties. Lint cleaner waste was 18.4 and 18.9 pounds for the two growth locations. The factors that govern the fibrous waste in cotton should be investigated.

Introduction

The amount of material removed by gin stands and lint cleaners is a function of a number of factors including environmental conditions, production practices, harvesting practices, cotton grades, cotton varieties, and unknown factors. Generally, the gin stand has one or two moting areas where motes (aborted ovules or immature seed) are removed before they exit the gin stand. Gin manufacturers are currently reducing the amount of moting that occurs in gin stands and passing that requirement on to the lint cleaners. This requirement may be met by an air-type lint cleaner, but often is met by a saw-type lint cleaner. The amount of material removed by the moting systems in gin stands has not been reported recently. Typical quantities of total waste removed by one, two, and three stages of lint cleaning, respectively, are 22, 30, and 36 pounds per 500-pound bale of spindle-picked cotton (Mangialardi, 1994). Saw-type lint cleaners have 5 to 8 cleaning points called "grid bars". Anthony (1999) patented a method to selectively use any number of grid bars in order to reduce fiber loss.

This study was initiated as a result of observations of the vast differences between the amount of fibrous material removed by gin stands and lint cleaners as a function of different cottons. Knowledge of the amount and type of material removed by gin stands and lint cleaners that subsequently reduces the amount of marketable lint in the bale could lead to improvements in the genetic characteristics or growth conditions for the cotton or perhaps the cleaning characteristics of gin machinery.

The purpose of this study was to determine the range of the weights of material removed by gin stands and lint cleaners from different cottons.

Materials and Methods

Three separate studies were conducted to ascertain the amount of waste removed by gin stands and lint cleaners (not including material removed by the huller front). In study one, about 100 pounds of raw seed cotton was taken from 21 trailers containing unknown varieties in storage at the Ginning Lab in 1997. This cotton was ginned using an extractor-feeder and a Continental Model 93 gin stand that had been reduced to 20 saws and a 15 inch-wide Continental Model Sixteen-D saw-type lint cleaner.

In study two, 16 varieties of cotton were ginned with equipment similar to study one. The seed cotton was cleaned with a cylinder cleaner, stick machine, cylinder cleaner, and extractor-feeder before ginning. Drying was not used. About 120 pounds of raw seed cotton was ginned with the gin stand and one stage of saw-type lint cleaning for each treatment. Since all available seed cotton was needed to establish the proper amount of raw material for lint turnout calculations, only one replication was used.

In study three, 25 varieties of cotton that were part of the 1998 cotton variety test at Stoneville were evaluated from two growth locations near Stoneville, MS. From 50 to 100 pounds of raw seed cotton was processed through the cylinder cleaner, stick machine, cylinder cleaner, extractor-feeder, one saw-type gin stand, and two stages of saw type lint cleaning for each treatment replication.

Wastes removed by the gin stand and lint cleaner were captured and weighed separately. Lint was adjusted to equivalent 500-pound bales. The fiber content from the lint cleaners was determined with a Shirley Analyzer (ASTM, 1981), and the fiber evaluated with an Advanced Fiber Information System.

Results and Discussion

Study 1

The material removed by the gin stand during study 1 ranged from 5.5 to 17.7 pounds of material per 500 pounds of ginned lint (Table 1). This 3 to 1 difference indicates considerable opportunity for further investigation into the reasons for these differences. Much of this material was motes rather than “good lint.” Lint cleaner waste ranged from 6.4 pounds to 19.3 pounds per 500 pounds of ginned lint. Waste ranged from a low of 12.3 pounds to a high of 33.4 pounds for the

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combination of gin stand and lint cleaner waste. Much of this material was fiber. These variations in materials removed by the gin stand and lint cleaner are likely quite representative of general industry.

Study 2

A subsequent study was completed in 1998 wherein a number of varieties were processed through the same gin stand and lint cleaner treatment as Study 1. Results in terms of pounds of waste were low as compared to the 1997 cotton. Gin stand waste ranged from a low of 4.9 pounds for Deltapine 5409 variety to a high of 11.2 pounds per 500 pound bale for Suregrow 125 and the same Deltapine 5409 variety produced in a different field (Table 2). Lint cleaner waste ranged from a low of 11.4 pounds for NuCotn 33 to a high of 18.7 pounds for Deltapine 5409. When these numbers were added together, the waste removed ranged from a low of about 17 pounds to a high of 29.2 pounds per bale. Interestingly enough, Deltapine 5409 was both at the low end and the high end of the spectrum in terms of waste removed due to the different growth locations, indicating that differences other than variety were important.

Study 3

Twenty-five varieties selected for testing from the Mississippi Cotton Variety Trials near Stoneville, MS, were intended to isolate certain varieties that had a high propensity for mote removal at the gin stand. Samples also represented two growth locations, one at Stoneville and one at Tribbett, MS, only 8 miles apart. Differences due to the growth location are shown in Table 3. The average waste removed by the gin stand from growth location 1 was considerably higher (7.6 pounds per 500-pound bale) than location 2 (4.9 pounds per 500-pound bale). Lint cleaner waste, on the other hand, was about the same at 18.4 pounds at location 1 compared to 18.9 pounds for location 2. Obviously the total waste was more for location 1 because of the higher level of motes removed by the gin stand. These data suggest that growth location is important in establishing the level of motes extracted from cotton by the gin machinery.

The gin stand and lint cleaner waste for the 25 varieties grown at 2 locations from the original cotton variety test is shown in Table 4. With four exceptions (AP7115, Deltapine 428B, PM1220BG/RR and PM1330BG), the motes removed by the gin stand were higher at location 1 as compared to location 2. The gin stand waste range from 3 pounds per 500 pounds of lint for variety AP7114 grown at location 2 to 13.5 pounds per 500 pounds of lint for Paymaster 1560 Bollguard. Lint cleaner waste was relatively consistent across growth locations. Lint cleaner waste ranged from 18.3 to 29.0 pounds per 500 pounds of lint for AP7114 and Paymaster 1560 Bollguard, respectively.

The lint cleaner waste from Study 3, location 2, was cleaned with a Shirley Analyzer to ascertain the amount of retrievable fiber in the waste. Retrievable fiber ranged from 29.3% for Fibermax 819 to 51.0% for NuCotn 33B which suggests that more fiber was lost for NuCotn 33B (Table 4). Analyses of the retrieved fiber with the Advanced Fiber Information System yielded mean lengths from 0.50" to 0.75" and short fiber content from 26.0% to 60.8%; consequently, from 74% to 39.2% of the fiber in the waste was useable (Table 5).

Conclusions

Dramatic differences occur between the amount of material removed by the gin stand as a function of growth condition. Differences in levels of lint cleaner waste are not as great as gin stand waste. These studies indicate that further research is required to isolate the causatives of the differences between the amount of material removed by the gin stand and the lint cleaner.

Acknowledgement

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References

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Table 1. Waste, pounds from 500 pounds of lint, from cotton from 21 trailers of unknown varieties of cotton in 1997 (Study 1).

Gin stand	One lint cleaner	Total
5.6	6.7	12.3
5.5	6.8	12.3
6.2	7.4	13.6
7.5	6.5	14.0
6.6	7.9	14.4
6.8	7.9	14.7
6.8	8.2	15.0
7.8	7.8	15.5
9.5	6.4	15.9
8.0	9.3	17.3
10.1	7.6	17.6
10	7.8	17.8
10.2	7.9	18.1
9.1	9.1	18.2
10.8	8.1	18.9
9.9	9.9	19.8
12.1	8.8	21.0
11.2	11.2	22.4
13.8	13.8	27.5
17.7	12.6	30.3
14.1	19.3	33.4
	Average	
9.1	9.1	17.7

Table 2. Waste from several cotton varieties in 1998 (Study 2).

		Waste per 500 lbs. lint		
Variety	Seed cotton weight, lb	Gin stand	One lint cleaner	Total
BT33	128.6	5.8	11.4	17.2
5409	117	5.6	13.1	18.7
5409	132.9	4.9	14.8	19.8
Mix	120.4	7.3	14.7	22
SG125	120.6	8	15.2	23.2
BT33	145.3	7.6	16.1	23.7
SG125	110.7	8.8	15	23.8
SG125	135.2	7.6	17	24.6
5409	141.7	7.2	17.5	24.7
ST474	116.8	8.1	16.9	24.9
5409	147.3	6.9	18.3	25.2
5409	135.3	9.2	16.7	25.9
5409	129.4	9.5	18.1	27.6
5409	148.5	10.4	18.7	29.1
SG125	136.2	11.2	17.9	29.2
5409	123.6	11.2	17.9	29.2
Average	130.6	8.1	16.2	24.3

Table 3. Means and standard deviations for 25 varieties at two growth locations near Stoneville, MS, and ginned with a Continental 20-saw gin stand and cleaned with two lint cleaners (Study 3).

LOCATION=1

Variable	Minimum	Maximum	Mean	Std Dev
Gin stand motes, %	0.89	2.69	1.52	0.46
Lint cleaner waste, %	2.76	5.11	3.68	0.56
Total waste, %	4.11	7.8	5.2	0.94
Total waste per bale, lb	20.54	39	26.02	4.68
Gin stand waste per bale, lb	4.43	13.46	7.62	2.3
Lint cleaner waste per bale, lb	13.79	25.53	18.4	2.82

LOCATION=2

Variable	Minimum	Maximum	Mean	Std Dev
Gin stand motes, %	0.58	1.52	0.98	0.26
Lint cleaner waste, %	2.76	4.96	3.77	0.62
Total waste, %	3.34	6.01	4.75	0.78
Total waste per bale, lb	16.70	30.03	23.75	3.92
Gin stand waste per bale, lb	2.88	7.62	4.89	1.31
Lint cleaner waste per bale, lb	13.82	24.78	18.86	3.08

Table 4. Waste per 500 pounds of lint from 25 varieties of cotton grown at two locations near Stoneville, MS, for the Mississippi Cotton Variety Trials in 1998 (Study 3).

VARIETY	Location	Gin stand	Two lint cleaners	Total	Lint retrieved from waste, %
AP7114	1	9.1	16.1	25.1	Lint cleaner
AP7114	2	3	15.2	18.3	43.9
AP7115	1	5.6	15.1	20.7	-
AP7115	2	6.3	14.4	20.7	40.3
BXN47	1	6	16.8	22.8	-
BXN47	2	5.1	19.9	24.9	41.6
DES 607	1	6	17.6	23.6	-
DES 607	2	3.2	15.4	18.6	41.9
DPL 20B	1	7.8	17.7	25.5	-
DPL 20B	2	5.4	19.5	24.9	41.6
DPL 32B	1	6.7	13.8	20.5	-
DPL 32B	2	4.1	14.8	18.9	44.0
DPL 428B	1	4.5	20	24.5	-
DPL 428B	2	6	16.7	22.7	45.6
DPL425RR	1	7.4	17.2	24.7	-
DPL425RR	2	5	19.6	24.6	46.7
DPL50B	1	7	16.3	23.2	-
DPL50B	2	5.2	24.8	30	45.7
FIBERMAX 819	1	8.3	21.7	30	-
FIBERMAX 819	2	5.2	23.2	28.4	29.3
NU33B	1	5	15.8	20.7	-
NU33B	2	2.9	13.8	16.7	51.0
PHY PSC 355	1	6.1	18.8	25	-
PHY PSC 355	2	5.2	20.3	25.5	35.0
PM 1210	1	8.8	20.9	29.7	-
PM 1210	2	4.1	19.3	23.4	36.4
PM H1215	1	7.1	21.4	28.5	-
PM H1215	2	4.6	20.7	25.3	45.7
PM1215BG	1	8.9	18.6	27.5	-
PM1215BG	2	5.1	18	23.1	38.1
PM1218BGRR	1	9.3	17.6	27	-
PM1218BGRR	2	6.6	18.8	25.5	37.7
PM1220BG/RR	1	6.6	19.2	25.8	-
PM1220BG/RR	2	6.8	22.6	29.4	35.7
PM1220RR	1	10.5	22.1	32.6	-
PM1220RR	2	6.6	20.9	27.5	39.4
PM1244RR	1	13.4	23.3	36.7	-
PM1244RR	2	7.6	21	28.6	37.0
PM1330BG	1	4.4	17	21.5	-
PM1330BG	2	5.3	20.5	25.8	35.1
PM1560BG	1	13.5	25.5	39	-
PM1560BG	2	5.2	24.4	29.6	42.4
SG 125	1	7.7	18	25.7	-
SG 125	2	3.6	16.3	19.9	43.2
SG 501	1	6.2	18.4	24.6	-
SG 501	2	3.8	16.9	20.6	35.7
SG 747	1	7.3	14.9	22.2	-
SG 747	2	3.4	16	19.5	45.9
STV 474	1	7.2	16.3	23.5	-
STV 474	2	2.9	18.5	21.4	36.1

Table 5. Advanced Fiber Information System data from the lint retrieved from the lint cleaner waste from Location 2 for Study 3[1].

Variety	L(w) [in]	SFC(w) %<0.50	SFC(n) %<0.50	IFC [%]	Mat Ratio	Nep Cnt/g	SCN Cnt/g	Dust Cnt/g	Trash Cnt/g	VFM [%]
AP7114	0.5	60.8	83	10.1	0.76	402	45	265	21	0.4
AP7115	0.63	41.2	71.1	9.5	0.78	426	32	207	7	0.25
BXN47	0.64	38.9	68.7	10.1	0.78	479	38	323	29	0.63
DES 607	0.66	38.1	67.2	10.6	0.77	427	36	270	23	0.38
DPL 20B	0.63	39.8	69.5	10.3	0.78	330	16	247	5	0.18
DPL 32B	0.67	37.7	67.7	9.4	0.79	356	50	285	24	0.48
DPL 428B	0.62	43.3	72.6	8.3	0.8	397	57	588	29	0.66
DPL425RR	0.68	32.9	62	10	0.79	307	21	200	11	0.19
DPL50B	0.61	43.3	71.9	10.3	0.77	382	16	169	22	0.38
FIBERMAX 81	0.63	41.8	71.7	10.2	0.77	377	44	395	23	0.55
NU33B	0.64	38.1	67.9	10	0.78	317	22	181	9	0.19
PHY PSC 355	0.59	46.2	75	11.3	0.75	500	83	411	38	0.74
PM 1210	0.66	36.1	66	8.2	0.81	323	30	272	31	0.65
PM H1215	0.74	26	54.8	8.3	0.83	291	20	141	15	0.2
PM1215BG	0.65	38.5	67.6	10.3	0.78	324	36	354	17	0.41
PM1218BGRR	0.65	37	66.2	9.7	0.78	369	18	150	10	0.21
PM1220BG/RR	0.71	32.7	62.2	9.2	0.8	451	51	208	45	0.65
PM1220RR	0.71	31	61.8	9.6	0.8	456	27	173	17	0.32
PM1244RR	0.75	30.9	62	8.8	0.82	469	26	235	20	0.36
PM1330BG	0.67	34.8	64.8	9.6	0.79	475	33	213	16	0.36
PM1560BG	0.65	39.5	70.1	10.5	0.77	441	36	253	21	0.37
SG 125	0.73	27.1	56	7.2	0.84	355	21	155	9	0.19
SG 501	0.72	31.8	61.4	8.7	0.81	327	33	149	13	0.21
SG 747	0.74	29.6	59.2	8.2	0.82	276	20	144	9	0.18
STV 474	0.65	36.3	66	8.7	0.8	371	19	232	12	0.22

[1]L(w) = mean length by weight
SFC(w) = fibers less than 0.5" in length by weight
SFC(n) = fibers less than 0.5" in length by number
IFC = immature fiber content
Nep = fiber entanglements
SCN = seedcoat nep
VFM = visible foreign matter