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ORIGIN OF SEED COAT FRAGMENTS IN GINNED LINT

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Abstract

Two cotton varieties, A and B, were ginned in the microgin at Stoneville, MS to track seed coat fragments (SCFs) as they were produced, altered, and removed by gin machinery. For bales of variety A there were 2100 grams of SCFs and 5460 grams of motes found leaving the gin stand, and for bales of variety B there were 4500 grams of SCFs and 8110 grams of motes found leaving the gin stand. For the two varieties tested, SCF weights were reduced by 5.5% to 7.0% at the gin stand moting points and by 15% to 16% in the lint cleaner. Mote weights were reduced by 15% to 17% at the gin stand moting points and by 40% to 47% in the lint cleaner. Both the gin stand and the lint cleaner removed larger SCFs from the lint and fractured SCFs into smaller fragments. A mote balance for both the gin stand and lint cleaner did not reveal any degradation of motes to SCFs, so they were not considered a major source. There was not a significant number of SCFs found in seed cotton samples due to the high error associated with the measurement, but analysis of seed cotton cleaner trash revealed 1,660 seed meats (embryos) per bale for variety A and 8,860 seed meats per bale for variety B. The SCFs associated with these seed meats were estimated to be 3% and 9% of SCFs leaving the gin stand for varieties A and B, respectively. About 65% of these seed meats were found at the first seed cotton cleaner indicating that most seed damage seen before the gin stand occurred before the cotton reached the gin plant. The dominant source of SCFs appeared to be the gin stand where seed or immature seed were either fragmented in the seed roll or allowed to pass the ginning ribs. Some conclusions reached in this report were based on measurements with high levels of error, so results should be considered preliminary.

Introduction

As cotton is harvested and processed through a gin, the coat of the cottonseed may be damaged and pulled off with the lint. Some of these SCFs are not removed during gin processing and remain in the baled lint. Problems due to SCF contamination in ginned lint occur in textile mills during spinning and dyeing. Some early studies on damage to cotton seed were concerned with reduced germination. Moore and Shaw (1967) found 7.3% of the seed entering the gin plant were damaged with an additional 1.9% damaged before the gin stand and 7.2% damaged at the gin stand. Their research indicated that seed damage during harvest was equally important as seed damaged in the gin. Columbus and Mangialardi (1996) and Bargeron and Garner (1991) studied the correlation between seed damage seen in ginned seed and SCFs in ginned lint and found weak trends that were not always significant. The problem with this type of analysis is that destroyed seed may not be counted as damaged seed but do contribute to SCF contamination.

Levels of SCF contamination have been measured by counting SCFs in samples of ginned lint or in the card web. Columbus and Mangialardi (1996) found that SCFs in ginned lint tended to increase with gin stand feed rates and seed moisture levels. Mangialardi et al. (1990) counted SCFs in ginned lint and the card web. They found that SCF counts in ginned lint increased with mote weights in ginned lint but did not vary with seed properties. Decreases in SCFs in the card web were found with increased fiber maturity. Bargeron and Garner (1991) counted SCFs in fabric and showed a positive relationship with the coefficient of variation of seed diameter and suggested that small seed passing the ginning ribs were a source of SCFs. They also found that SCFs increased with the force required to pull fiber bundles from the seed. Bargeron and Garner (1991) also measured the chalazal SCF potential of 13 upland varieties as the percentage of seed resulting in a SCF when fiber bundles were removed from the chalazal end of the seed. They found that chalazal SCF potential was weakly related to SCFs found in fabric.

Two of the most important factors contributing to the occurrence of SCFs have been shown to be both the variety of cotton grown and timing of the harvest. The SCFs in ginned lint can vary by 50% due to cotton variety and 100% due to harvest timing (Mangialardi and Meredith, 1990). Another study showed that SCFs in lint may vary by 50% due to the variety, crop year, or timing of harvest, but these differences became less apparent as the lint was cleaned by up to three lint cleaners (Anthony, et al., 1988). The first, second, and third lint cleaners were shown to remove 47%, 16%, and 9% of SCFs by weight but did not change the number of SCFs.

It was suspected that SCFs originate from several seed sources including mature, immature, and aborted seed (motes). A single fragment may be removed from the seed or the whole seed coat may be fragmented either in the gin stand or during seed cotton cleaning. Also, small seed may pass the ginning ribs and either be removed or fragmented in the gin stand or lint cleaner. Motes may be pulled apart to produce SCFs. This study was conducted to determine the contribution of seed, immature seed, and motes in the seed cotton cleaners, gin stand, and lint cleaner to bale SCF content for two cotton varieties.

Methodology

Three 100-pound test lots of variety A and variety B were ginned randomly in the microgin in Stoneville, MS on May 15, 2004. The ginning machine sequence was dryer, cylinder cleaner, stick machine, Trashmaster, extractor-feeder/gin stand, and two lint cleaners. Each test lot was sampled three times for seed cotton moisture, nine times for pneumatic trash fractionation, and three times for SCF content before ginning (Shepherd, 1972). Nine seed cotton samples were also taken at the gin stand feeder for pneumatic trash fractionation and three samples were taken for SCF content. Nine lint samples were collected before and after the first lint cleaner for Advanced Fiber Information System (AFIS, Uster Technologies, Knoxville, TN) analysis with three of those samples also analyzed for SCF content. Nine samples were collected after the second lint cleaner for AFIS and moisture.

Trash from the seed cotton cleaners, the gin stand, and the lint cleaners were collected for each test lot and analyzed for SCF content. These samples were taken individually for each machine and included all waste produced for each test lot. Samples of seed cotton cleaner trash included the cylinder cleaner, stick machine, trashmaster, and extractor-feeder. Gin stand motes were collected separately from the lower and upper mote locations. Lint cleaner waste was collected individually for both lint cleaners, but only waste from the first lint cleaner was analyzed. All the ginned seed were also collected, weighed, and sampled for each test lot.

Analysis of SCF content included the number and weight of motes, SCFs, and seed meats manually fractionated from seed cotton, seed cotton cleaner waste, gin stand motes, seed, lint, and lint cleaner waste. For seed cotton fractionation, three samples weighing 10g were analyzed for each test lot. For seed cotton cleaner waste, either the entire sample or three sub-samples weighing 40g were fractionated for each test lot. All the gin stand motes from the upper mote location were fractionated and three sub-samples weighing 10g from the lower mote location were fractionated. Three samples of lint weighing 3g were fractionated before and after the first lint cleaner, and three sub-samples of lint cleaner waste weighing 5g were fractionated.

Results

Gin Conditions and Performance

Moisture contents were consistent, ranging from 8% to 9% for the seed and 4.2% to 4.6% for the lint. There were some differences in the two varieties in trash levels and in their gin performance (Table 1). Compared to variety B, A had a higher gin turnout and ginned faster. Variety A produced less trash at the seed cotton cleaners, gin stand, and lint cleaners. Variety A also contained less pneumatically fractionated trash and motes, which were different than manually fractionated motes reported later. Pneumatically fractionated motes were separated from seed cotton by machine and included trash and lint. Pneumatically fractionated motes were based on seed cotton weights.

AFIS Neps and Seed Coat Neps

Variety A contained more neps, but variety B contained larger neps (Table 2). The number of neps increased and became smaller after lint cleaning. Seed coat nep size was not different between varieties, but Variety B had more seed coat neps. The size and number of seed coat neps did not change after lint cleaning.

Seed Coat Fragments in the Lint Cleaner

Samples were collected throughout the gin plant to identify the origin of SCFs. Most of the results were reported on a per bale basis with one bale equal to 500 pounds of lint. The results were also reported in reverse order of the ginning process starting with the cotton bale and working backwards.

Samples of lint and lint cleaner waste from the second lint cleaner were not analyzed. These results include trash and lint produced by one lint cleaner. Seed coat fragment contents are reported in Table 3 for all sample locations. The weight of SCFs found in ginned lint before cleaning was much lower for variety A (1870 g/bale) than variety B (4300 g/bale), but the average weight of individual SCFs was 1.12 mg for both varieties. Before lint cleaning, bales

of variety A contained 1,910 SCFs and bales of variety B contained 3,650 SCFs. After one lint cleaner, the average weight of individual SCFs decreased from 1.12 mg to 0.77 mg. Based on lint samples only, the total weight of SCFs was decreased with one lint cleaner by 16% and 26% for varieties A and B, respectively, but changes in the number SCFs for both varieties were not statistically significant.

Table 1. Gin performance and trash properties for two varieties.

	Variety	
Parameter	A	B
Gin turnout, %	42.1	37.8
Ginning rate, pounds lint/saw/min.	0.198	0.177
Seed cotton cleaner trash, %	2.22	4.80
Pneumatic fractionation of seed cotton, %		
Total wagon	3.15	7.08
Motes wagon	1.30	3.82
Total feeder	1.55	2.40
Motes feeder	1.05	1.81
Gin stand motes, % of lint		
Upper	0.238	0.247
Lower	0.745	1.197
Ratio	0.759	0.831
Lint cleaner waste, % of lint		
First	1.97	3.20
Second	0.517	0.767

Table 2. Results from the Advanced Fiber Information System test for neps in lint for two varieties at three locations.

Location[1]	Variety	Nep size, um	Neps / g lint	Seed coat nep size, um	Seed coat neps / g lint
1	A	688	163	1155	7.81
2	A	673	208	1158	7.48
3	A	674	255	1150	7.96
1	B	706	126	1167	11.41
2	B	696	150	1210	12.78
3	B	690	185	1224	12.56
Factor		P values			
Variety		<.0001	<.0001	0.0846	<.0001
Location		0.0003	<.0001	0.6891	0.6717
Variety*Location		0.6439	<.0001	0.6226	0.5385

1) Location 1 before first lint cleaner, location 2 before second lint cleaner, location 3 after second lint cleaner

Table 3. Seed coat fragments in seed cotton waste, seed, gin stand waste, lint cleaner waste, seed cotton, and lint.

	Thousand SCFs/bale				Gram SCFs/bale				Milligram/SCF			
	A		B		A		B		A		B	
Sample	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI
Seed cotton cleaner waste												
CC[1]	0.36	0.15	0.94	1.06	4.9	5.3	8.8	19.7	14	18	8	11
SM[2]	0.05	0.12	0.26	0.26	1.3	3.3	1.7	2.2	25	40	7	14
TM[3]	0.12	0.08	0.49	0.63	3.8	3.2	10.6	19.7	30	11	21	17
EF[4]	0.04	0.03	0.08	0.12	0.3	0.8	1.4	2.6	7	14	18	29
Total	0.58	0.07	1.77	1.47	10.3	8.0	22.4	37.3	18	n.a.	13	n.a.
Hull[5]	0.05	0.11	0.16	0.20	0.3	0.6	2.3	3.6	5.2	2.8	13.8	7.5
Seed	16.0	24.1	38.7	48.5	110	110	380	610	7.8	6.1	9.0	5.4
Gin stand motes												
Upper	4.0	2.2	8.1	7.1	25	19	53	47	6.15	1.28	6.54	0.26
Lower	18.5	1.4	56.8	7.8	90	14	260	27	4.84	0.54	4.62	0.37
Total	22.5	3.8	65.0	9.6	115	42	313	27	5.12	1.08	4.82	0.30
LC[6]	135	34	256	48	302	72	572	111	2.31	0.31	2.24	0.22
Seed cotton												
Wagon	34	52	460	370	190	330	2200	2700	5.1	9.0	4.0	6.5
Feeder	0	0	200	170	0	0	1200	1300	n.a.	n.a.	7	16.5
Lint0[7]	1910	530	3650	800	1870	740	4300	880	1.00	0.39	1.23	0.28
Lint1[8]	2000	290	4360	630	1580	330	3200	410	0.79	0.12	0.75	0.12

Notes: n.a.=not available
1)CC=first stage cylinder cleaner
2)SM=stick machine
3)TM=Trashmaster
4)EF=extractor/feeder
5)Hulls=waste from gin stand huller front
6)LC=waste from lint cleaner 1
7)Lint0=lint before lint cleaner
8)Lint1=lint after 1 lint cleaner

Removal of SCFs by one cleaner was revealed more clearly with the analysis of waste material from the lint cleaner. There were fewer SCFs in lint from variety A, and there were fewer SCFs in the lint cleaner waste (Table 3). The weight of SCFs removed by the lint cleaner averaged 302 g/bale for variety A and 572 g/bale for variety B. Based on SCF weights in the lint cleaner trash and cleaned lint samples, an estimated 1890 g/bale was reduced 16% for variety A and an estimated 3770 g/bale was reduced 15% for variety B. The number of SCFs found in the first lint cleaner waste averaged 135,000 and 256,000 per bale for varieties A and B, respectively. The SCFs averaged 2.28 mg each, which was twice as much as the weight in lint before cleaning, suggesting that the lint cleaner mostly removed heavier SCFs and created smaller ones.

The weight of SCF removal measured with lint samples was smaller than the confidence interval associated with the measurement. The error was highest for lint samples taken before lint cleaning. The cleaned lint samples were the best estimate for final SCF content, and adding SCF weights from the lint cleaner waste to the cleaned lint SCF weights gave the best estimate for SCF content before lint cleaning.

Motes in the Lint Cleaner

Motes were measured for lint and trash samples from the first lint cleaner only. Figure 1 shows motes recovered from seed cotton cleaners. Motes recovered from lint contained less trash than those recovered from the lint cleaner or seed cotton cleaner waste. The number of motes found in bales before and after one lint cleaner are reported in Table 4. Before lint cleaning, the average mote content of cotton bales were 5100 g/bale for variety A and 4600 g/bale for variety B. There were about 820,000 motes found in each bale, averaging 5.8 mg/mote. After lint cleaning, motes decreased 45% to 2800 g/bale for variety A and 22% to 3600 g/bale for variety B with 580,000 motes found in each bale.

Figure 1. Seed meats or embryos (top) and aborted seed or motes (bottom) recovered from the first cylinder type seed cotton cleaner.

Table 4. Motes in seed cotton waste, seed, gin stand waste, lint cleaner waste, seed cotton, and lint.

	Thousand motes/bale				Gram motes/bale				Milligram/mote			
	A		B		A		B		A		B	
Sample	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI
Seed cotton cleaner waste												
CC[1]	4.7	1.7	39.4	10.2	49	20	663	285	10.5	1.9	16.8	5.8
SM[2]	4.5	1.9	18.9	5.0	62	44	367	46	13.8	6.2	19.6	6.0
TM[3]	10.7	2.5	60.4	11.8	142	37	1136	612	13.3	0.9	18.7	7.1
EF[4]	5.2	1.0	20.7	2.6	75	12	426	36	14.5	3.9	20.6	1.4
Total	25.0	6.0	139.4	23.8	328	97	2591	759	13.1	n.a.	18.6	n.a.
Hull[5]	0.0	0.0	0.0	0.1	0.03	0.14	0.84	2.27	8.0	0.0	18.2	16.1
Seed	8.0	23.8	5.3	16.5	0.02	0.06	0.01	0.03	2.5	0.1	1.25	0.9
Gin stand motes												
Upper	14.5	6.7	21.1	18.6	180	148	229	255	12.26	4.65	11.78	13.73
Lower	67.1	7.8	98.9	11.9	618	74	1135	191	9.22	0.68	11.37	1.10
Total	82	13	120	43	798	168	1364	346	9.78	1.32	11.36	2.71
LC[6]	285	37	460	59	1860	220	3150	440	6.59	0.58	6.87	0.61
Seed cotton												
Wagon	810	130	860	200	10800	1400	12800	5100	13	0.2	15	12.5
Feeder	510	120	930	200	5600	2000	14100	2900	11	1.0	16	7.0
Lint0[7]	820	290	830	220	5100	2400	4600	1400	5.9	1.5	5.6	1.2
Lint1[8]	560	180	600	170	2800	1200	3600	1200	4.9	1.3	6.0	1.0

Notes: n.a.=not available
1) CC=first stage cylinder cleaner
2)SM=stick machine
3)TM=Trashmaster
4)EF=extractor/feeder
5)Hulls=waste from gin stand huller front
6)LC=waste from lint cleaner 1
7)Lint0=lint before lint cleaner
8)Lint1=lint after 1 lint cleaner

As with SCFs, mote removal was more clearly revealed with lint cleaner waste analysis. The weight of motes found in waste from one lint cleaner averaged 1860 g/bale for variety A and 3150 g/bale for variety B. Adding these mote weights to final lint values, an estimated 4660 g/bale was reduced 40% for variety A and an estimated 6750 g/bale was reduced 47% for variety B. The number of motes found in the lint cleaner waste averaged 285,000/bale and 460,000/bale for variety A and variety B, respectively, averaging 6.73 mg each. The motes retrieved from the lint cleaner waste tended to be slightly larger than those found in the lint, suggesting heavier motes were more easily removed by the lint cleaner.

For mote weights, the error associated with lint samples was large compared to weights found in the lint cleaner waste. As with SCFs, this was especially true for samples taken before lint cleaning. The final lint samples were the best estimate for final mote content, and adding lint cleaner waste mote weights to the final lint mote weights gave the best estimate for mote content before lint cleaning.

One objective of the experiment was to predict if SCFs created by destroying motes in the lint cleaner contributed to total SCFs in the bale. For both varieties, the number and weight of motes found in the lint cleaner waste samples were larger or not statistically less than the difference seen in lint samples, suggesting that most motes removed from the lint were accounted for in the waste. These results are based on measures with a high degree of error, so it is only concluded that motes were not a dominant source of SCFs. The test should be repeated with methods with improved precision to determine the actual distribution of motes as they pass the gin stand.

Seed Coat Fragments from the Gin Stand

The weights of SCFs found in the gin stand trash were 115 g/bale for variety A and 313 g/bale for variety B, and individual fragment weights averaged 5.0 mg and were larger than those found in the ginned lint (Table 3). Also, there were 110 g/bale and 380 g/bale SCFs found in samples of the ginned seed for varieties A and B, respectively, but the confidence interval associated with these samples was over 100% of the measured values. The SCFs in the ginned seed were heavy, averaging 8.4 mg/fragment. Adding SCF weights found in seed, gin stand trash, and lint cleaner waste to the weights found in lint after lint cleaning, the average weight for SCFs leaving the gin stand were 2100+/-450 g/bale and 4500+/-430 g/bale for varieties A and B, respectively. The percentage by weight of SCFs exiting the gin stand that were found in the gin stand waste was 5.5% and 7.0% for varieties A and B, respectively.

Seed Coat Fragments before the Gin Stand

For variety A, no SCFs were found in seed cotton sampled just before the gin stand, so there was no evidence of SCFs originating before the gin stand (Table 3). For variety B, the weight of SCFs averaged 1200 g/bale as the cotton entered the gin stand, but this measure was not statistically different from zero. Fractionating SCFs from seed cotton was difficult and time consuming, and it was suspected that some were not recovered. Variation between samples was too large, so the sample size was too small. Conclusions could not be made concerning SCFs in seed cotton based on these results, so additional tests should be conducted to measure SCFs in seed cotton with alternate methods that reduce error.

There was not a significant amount of SCFs found in seed cotton cleaner trash (Table 3). It did not appear that seed cotton cleaners removed a significant amount of SCFs, but additional tests should be conducted with reduced measurement error before making any conclusions.

Since it proved difficult to find SCFs in seed cotton and seed cotton trash, seed meats were counted to indicate the occurrence of SCFs in seed cotton cleaners. Seed meats found in seed cotton cleaner trash without their seed coat indicated SCFs in the cotton. Seed meats from seed cotton trash are shown in Figure 1. Seed meat contents of all samples are reported in Table 5. There were fewer seed meats found in the seed cotton cleaner trash from variety A (1,660 meats/bale) than variety B (8,860 meats/bale) which also had the most SCFs. It was known from cotton variety trials that seeds from variety A weighed 8g/hundred and from variety B weighed 10 g/hundred, including residual linters (Boykin and Creech, 2004). Also, seed meats made up approximately half the weight of the seed. The calculated seed coat fragments resulting from ruptured seed, approximated by the number of seed meats found in seed cotton trash, were 70 g/bale and 400 g/bale for varieties A and B, respectively, representing 3.3% and 8.8% of the fragments exiting the gin stand.

Table 5. Seed meats in seed cotton waste, seed, gin stand waste, lint cleaner waste, seed cotton, and lint.

	Thousand seed meats/bale				Gram seed meats/bale				Milligram/seed meat			
	A		B		A		B		A		B	
Sample	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI
Seed cotton cleaner waste												
CC[1]	1.09	0.53	5.76	2.90	22.8	12.5	138.8	119.9	20.9	7.8	23.7	8.7
SM[2]	0.23	0.30	0.97	0.47	4.8	5.6	17.0	13.4	21.0	7.8	17.6	11.7
TM[3]	0.27	0.21	1.79	2.11	5.4	3.3	44.5	46.7	20.6	8.9	25.4	5.0
EF[4]	0.07	0.04	0.34	0.27	2.1	0.4	8.1	6.8	31.6	24.0	23.9	10.7
Total	1.66	0.22	8.86	5.45	35.1	10.1	208.3	178.5	21.1	n.a.	23.5	n.a.
Hull[5]	0.7	1.4	0.7	1.2	18.5	23.3	26.5	44.7	30.9	20.7	39.6	3.2
Seed	0	n.a.	3.08	7.6	0	n.a.	70.6	213.1	n.a.	n.a.	30.25	79.9
Gin stand motes												
Upper	0.1	0.3	0.0	0.1	1.8	5.6	0.5	1.2	13.2	9.4	12.8	10.2
Lower	0.5	0.5	0.5	0.3	3.8	5.3	6.1	4.0	7.2	5.1	14.2	13.8
Total	0.59	1.02	0.55	0.52	5.6	4.2	6.7	3.2	9.4	n.a.	12.1	n.a.
LC[6]	0.79	0.63	1.43	1.26	4.2	4.5	10.1	12.9	5.7	4.2	6.8	3.4
Seed cotton												
Wagon	6	13	6	15	46.0	106.2	194.0	447.3	8	n.a.	30	n.a.
Feeder	0	n.a.	0	n.a.	0.0	n.a.	0.0	n.a.	n.a.	n.a.	n.a.	n.a.
Lint0[7]	0	n.a.	0	n.a.	0	n.a.	0	n.a.	n.a.	n.a.	n.a.	n.a.
Lint1[8]	0	n.a.	0	n.a.	0	n.a.	0	n.a.	n.a.	n.a.	n.a.	n.a.

Notes: n.a.=not available
1) CC=first stage cylinder cleaner
2)SM=stick machine
3)TM=Trashmaster
4)EF=extractor/feeder
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6)LC=waste from lint cleaner 1
7)Lint0=lint before lint cleaner
8)Lint1=lint after 1 lint cleaner

Based on SCFs found in seed cotton, there was not a significant amount SCFs that occurred before reaching the gin stand. Based on seed meats found in seed cotton trash, the amount of SCFs produced by seeds that were destroyed before reaching the gin stand was predicted to be 3% to 9% of those exiting the gin stand depending on variety. These results are preliminary and the test should be repeated before establishing this connection between seed meats and SCFs.

For both varieties, 65% of the seed meats recovered from seed cotton trash were found in trash from the first stage cylinder cleaner, so substantial seed damage occurred before the cotton entered the gin. No seed meats were found in seed cotton samples taken at the gin stand, so most were removed by the seed cotton cleaners. The third stage of seed cotton cleaning, the Trashmaster, removed about 18% of the seed meats, which indicated that seed meat removal increased with cylinder-type cleaners.

Seed Passing Ginning Ribs

Seed in the gin stand waste averaged 41mg, about half the weight of the average seed, and seed in the lint cleaner waste averaged 23 mg (Table 6). Seed passed the ginning ribs, especially for the small seed variety A, and were recovered in waste material, but some seed probably fragmented into the lint resulting in SCF contamination. These seed were much smaller than average and, and some were probably immature.

Table 6. Seed found in gin stand motes and lint cleaner waste.

	Variety A		Variety B	
Sample	Mean	95% CI	Mean	95% CI
Thousand seed/bale				
Gin stand motes	2.57	1.10	0.95	0.87
Lint cleaner waste	1.10	0.59	2.18	1.70
Gram seed/bale				
Gin stand motes	113	34	35	43
Lint cleaner waste	23	16	48	36
Milligram/seed				
Gin stand motes	44	7	37	20
Lint cleaner waste	21	7	26	13

Seed Damage in the Gin Stand

The number of damaged seed found in ginned seed samples averaged 34,000+/-17,000 /bale for variety A and 36,000+/-24,000 /bale for variety B with no significant difference between varieties. Differences between varieties in seed damage did not explain differences in SCF content. The measurement for seed damage included seed that were intact but missing a portion of the seed coat. The measurement did not count seed damage when the seed coat separated from the seed meat or when the seed was destroyed. Destroyed seed were probably a major contribution to SCF content, but they were not measured in this test.

Seed meats were also measured in the ginned seed samples (Table 5). For variety A, no seed meats were found in the seed samples. For variety B, 3,000 seed meats per bale were found weighing 71 g/bale. The error associated with seed meats found in the seed roll was too large to make any conclusion concerning SCFs produced by the gin stand.

Motes by the Gin Stand

The motes found in the gin stand trash averaged 800 g/bale for variety A and 1360 g/bale for variety B (Table 4). Gin stand motes numbered 82,000/bale for variety A and 120,000/bale for variety B. Gin stand motes from variety A were lighter (9.78 mg/mote) than those from B (11.36 mg/mote), and these motes were larger than those found in the lint. There was not a significant amount of motes found in the ginned seed. Adding mote weights from gin stand trash and lint cleaner waste to the weights found in lint after lint cleaning, the weight of motes leaving the gin stand totaled 5460+/-2540 g/bale and 8110+/-2810 g/bale for varieties A and B, respectively. The number of motes totaled 930,000+/- 250,000/bale for variety A and 1,180,000+/- 450,000/bale for B. The gin stand removed 15% and 17% of the weight of motes for varieties A and B, respectively.

Motes before the Gin Stand

The mote contents of all samples are reported in Table 4. The number of motes entering the gin stand was estimated by manually fractionating seed cotton samples taken at the feeder apron. The weight of motes entering the gin stand was 5610 g/bale for variety A and 14100 g/bale for B. The number of motes that entered the gin stand was 510,000/bale for variety A and 930,000/bale for B. Variety A motes (11 mg) were larger than variety B motes (16 mg).

For variety A, the weight of motes entering the gin stand was the same as the weight exiting the gin stand, but twice as many motes were found exiting the gin stand. For variety B, the weight of motes entering the gin stand was twice the weight of motes exiting the gin stand, but the number of motes was the same.

For variety A it appeared that motes became smaller and more numerous as they passed the gin stand. For variety B it appears that the motes became smaller but did not change in number. These differences could be explained by motes being picked apart resulting in more motes or SCFs, but the error associated with these measurements was very high. The test should be repeated with increased precision before making any conclusions pertaining to the balance of motes entering and exiting the gin stand.

The precision of the seed cotton samples for number and weight of motes was tested by comparing differences seen in samples taken at the gin stand and before ginning to the motes found in seed cotton cleaner trash. For mote weights, there were 328 g/bale and 2591 g/bale removed from the seed cotton for varieties A and B, respectively, found in seed cotton trash. These weights were very different from the weights calculated from differences in seed cotton samples before and after seed cotton cleaning, which indicated that variety A lost 4800 g/bale and B gained 1300 g/bale. The seed cotton trash samples were much more precise than the seed cotton samples, so these differences indicate a higher than expected level of error in the seed cotton samples. The same was true when comparing data for number of motes in the trash to the difference in mote contents before and after seed cotton cleaning. Sample sizes were similar for seed cotton and seed cotton trash, but trash samples represented a larger portion of the total population of motes and were more precise. Larger seed cotton samples are needed in future experiments to reduce the error associated with mote measurements.

Summary and Conclusion

The presence of SCFs were detected throughout the ginning process and ranged in weight from about 15 mg/SCF in the seed cotton trash to 0.8 mg/SCF in lint after one lint cleaner. The SCFs found in the gin stand waste averaged 4.9 mg/SCF, and those found in lint cleaner waste averaged 2.3 mg/SCF. After lint cleaning, bales of variety A contained 1580 grams of SCFs and bales of variety B contained 3200 grams of SCFs.

The efficiency of SCF removal by the lint cleaner was determined by counting and weighing SCFs in lint before and after lint cleaning. SCFs were also counted in lint cleaner waste. Differences in lint samples did not reveal any significant removal of SCFs, but SCFs were found in the lint cleaner waste. The confidence interval was very high for lint sample measurements, expecially before lint cleaning. The weight of SCFs in the lint cleaner waste indicated a removal efficiency of 15% to 16%. The lint cleaner tended to remove larger fragments and probably broke some fragments into smaller fragments. Similar results were found for mote removal by the lint cleaner. Differences in lint samples did not reveal any significant removal of motes, but the lint cleaner waste indicated a removal efficiency of 40% to 47%. All the motes entering the lint cleaner were accounted for leaving the lint cleaner, so none of the motes were found to degrade into SCFs. This observation was preliminary, and further tests with reduced error are needed before making any conclusions. The gin stand had a removal efficiency of 5.5% to 7.0% for SCFs by weight and 15% to 17% for motes by weight. SCFs and motes were much larger in the gin stand trash than in the lint.

None of the variety A seed cotton samples taken at the gin stand contained any SCFs, and measurements for variety B SCFs varied over 100%. These measurements could not be used to compare to SCFs leaving the gin stand. Seed meats found in the seed cotton trash were analyzed to predict SCFs resulting from ruptured seed prior to the gin stand. The SCFs associated with the seed meats represented up to 3% and 9% of the SCFs found leaving the gin stand for variety A and B, respectively. Seed meats found in the first seed cotton cleaner represented 65% of the total found during seed cotton cleaning, so much of these seed meats resulted from damage to seed cotton prior to entering the gin.

The degradation of motes was not a dominant contribution to SCFs. Most of the SCFs originated in the gin stand, probably from seed. The number of SCFs produced before reaching the gin stand was significant but small for variety B. Seed damage was not related to SCF contents, but destroyed seed were not counted in seed damage analysis. Small seed were found in lint cleaner waste and gin stand motes, so some SCFs originated from small or immature seeds passing the ginning ribs. These results should be considered preliminary since most measurements had large error components.

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