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ENGINEERING AND GINNING

Seed Coat Fragments, Motes, and Neps: Cultivar Differences

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ABSTRACT

Cotton lint with large quantities of neps, seed coat neps (SCN), or seed coat fragments (SCF) causes problems for textile mills. This lint can be difficult to spin into yarn and the fabric can be difficult to dye. Cultivars grown in three tests as part of the Mississippi Regional Cotton Variety Trials were processed through a typical gin sequence and analyzed manually for SCF and motes (aborted seed) in the lint. The Advanced Fiber Information System (AFIS) was used to measure neps and SCN in lint. These results were used to characterize cultivars and identify trends between measurements. The most discernable difference among cultivars was the number of neps, which ranged from 140 to 292 neps/g lint. Cultivar differences were also found for the number of SCF, motes, and SCN. Across all tests, the SCF number ranged from 6 to 35 and averaged 13 SCF/g lint, and the SCN number ranged from 6 to 22 and averaged 11 SCN/g lint. The correlation (*r*) between manual SCF and AFIS SCN ranged from 0.59 in one test to 0.84 in another, so these measurements were similar. But, statistical analysis revealed that these measurements yielded different results. For the 19 cultivars common to the three test groups, three cultivars (SG215BR, BCG28R, and SG105) were statistically equal to the minimum number of both SCF and SCN content, and DES810 had the highest number of both.

The coats of mature, immature, or aborted cottonseed may be damaged and pulled off with the lint as cotton is harvested and processed through the gin. Some of these seed coat fragments (SCF) are not removed by lint cleaners and remain in the baled lint. Neps are fiber entanglements created during gin processing. Problems due to SCF and neps in ginned lint arise in textile mills during spinning and dyeing (Bargeron and Garner, 1991; Krifa and Gourlot, 2001; Pearson, 1955; Pilsbury, 1992). Jacobsen et al. (2001) confirmed earlier findings that most impurities in cotton are neps, followed by SCF and nonseed impurities. The primary focus of this paper is the SCF content of ginned lint.

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Three of the most important factors contributing to the occurrence of SCF have been shown to be cultivar selection, environmental conditions, and harvest timing. Anthony et al. (1988) found that the number of SCF varied among five cultivars from 14 to 19 SCF/g lint and the weight varied from 12 to 21 mg SCF/g lint. Large differences in SCF content were reported between the two years tested, but the interaction between cultivar and year was not significant. Mangialardi and Meredith (1990) studied nine cultivars and found that the number of SCF ranged from 13 to 20 SCF/g lint and the weight ranged from 11 to 18 mg SCF/g lint. They showed that the number and weight of SCF tended to increase across 6-wk harvest intervals. The test was repeated in two years, and an interaction was found between cultivar and year for the weight of SCF but not the number.

Mangialardi and Meredith (1990) reported that the number of aborted seed (motes) found in ginned lint ranged from 2.0 to 3.7 motes/g lint across cultivars. Mote content increased across harvest intervals and there was an interaction between variety and year for the number of motes. Davidonis et al. (2000) found discrepancies between reports relating mote frequency and boll location. They concluded from their study that long fiber motes were related to the timing and intensity of environmental stress, not harvest date or boll location. They also concluded that the factors contributing to the occurrence of short fiber motes was more complicated. Because SCF can be created from motes, these results indicate that environmental stresses may also impact SCF content.

Mangialardi et al. (1993) reported the SCF number found in lint increased with the number of motes ($p = 0.04$). The SCF number also increased with card web imperfections such as biological neps ($p = 0.09$), mechanical neps ($p = 0.11$), total neps ($p = 0.11$), and seed coats ($p = 0.13$); but the correlations were not significant. The SCF number did not change significantly with micronaire, but all card web imperfections decreased with micronaire.

Seed coats in ginned lint can be measured by manual and automated methods. In Method D 2496, SCF are manually counted and weighed in lint (ASTM, 1985). This method is subjective and likely to vary from person to person. Results of the test may change with the person's ability to see and recover SCF from lint, the amount of lint removed from the SCF, the number of SCF broken during sample analysis, and other tendencies to alter the sample during analysis. These effects can be overcome by randomizing samples for analysis and having only one person analyze samples within experimental blocks. These effects should be considered when comparing experimental blocks. Analysis is very slow with this method with fewer than two samples of lint weighing 3 g analyzed each hour. The Advanced Fiber Information System (AFIS, Version 4.22, Uster Technologies, Knoxville, TN) is an automated method to detect fiber properties including the number and size of seed coats in lint. Baldwin et al. (1995) described how the instrument individualizes components of the fiber sample and characterizes them as neps, seed coat neps (SCN), fibers, or other material with different properties. The sample is first separated into lint, trash, and dust. The instrument counts and sizes SCN in the lint stream as they are detected with sensors. Small SCF in the dust stream (under 0.5 mm) and large SCF in the trash stream are not recognized as SCN. The authors stated that these SCF are less likely to remain with the fiber through opening, cleaning, carding, and combing. The authors analyzed sliver for SCN, spun the remainder of the sliver into yarn, tested the evenness of the yarn with the Uster Tester3 (Uster Technologies, Knoxville, TN) (number of +200% imperfections), and determined the cause (nep, SCN, or other) of each +200% imperfection. The correlation (R^2) between SCN and +200% yarn imperfections (total) was found to be greater than 0.8, and the correlation (R^2) between SCN and +200% imperfections (with SCN) was found to be greater than 0.9. Jacobsen et al. (2001) studied saw-ginned lint with a stereo dissecting microscope and found that more SCF were found microscopically than with the AFIS (SCN). Among the gin treatments, there were 18.4 to 23.6 SCN/g lint found with the AFIS and 105 to 187 SCF/g lint found microscopically.

The current study included modern cultivars grown in Mississippi's Regional Cotton Variety Trials (RCVT). The objectives of this study were to analyze cultivar differences in SCF, motes, neps, and SCN, and to determine the relationships among these and other fiber properties. The primary focus was on the number of SCF and SCN.

METHODOLOGY

Cotton cultivars from the 2002 and 2003 Mississippi RCVT were tested. This included three separate test groups (field*year combination). In 2002, there were 38 cultivars grown in one field near Stoneville, MS; and in 2003 there were 38 cultivars grown in two fields, one near Stoneville, MS and one near Tribbett, MS. The cultivars grown in 2002 are listed in Table 1 and those grown in 2003 are listed in Table 2. The 19 cultivars common to both test years are noted in these tables. Each cultivar was replicated in six plots, blocked by replication. Plots consisted of 2 rows, 100 cm (40 in) wide and 12.2 m (40 ft) long.

The cotton was spindle harvested and stored at the Cotton Ginning Lab in Stoneville, MS, and processed through the microgin (Anthony and McCaskill, 1974). Cotton was stored for at least 3 d in the microgin to equilibrate the moisture content. The amount of cotton from each plot was insufficient for processing in the microgin, so plots replicated in adjacent blocks were combined. For example, each cultivar plot in rep 1 was combined with the same cultivar plot in rep 2. There were three lots ginned for each cultivar within each test. The microgin contained all the machines of a typical gin including a shelf-type dryer, cylinder cleaner, stick machine, extractor-feeder, gin stand, and lint cleaner. The test group grown in 2002 was processed through two lint cleaners. Settings on the feed controls for cotton entering the dryer and the gin stand were adjusted before ginning and maintained within each test. Deviations in ambient conditions within each test were minimized by cooling the air within the gin to 75 ± 5 ºF (24 ± 3 ºC). This minimized heating in the gin as the machinery warmed up. For each lot, three samples were taken for fiber quality measurements by AFIS including nep count, nep size, SCN count, and SCN size. The three samples were also analyzed manually to determine the SCF and mote content as described in Method D2496 (ASTM, 1985). These measurements were made at the USDA Cotton Testing Lab in Stoneville, MS. Three samples per lot were also analyzed by High Volume Instrument (HVI - Uster Technologies, Knoxville, TN) at the USDA Cotton Classing Office, Dumas, AR. Statistical analysis was performed using the general linear model procedure (Proc GLM, SAS v8.2, Cary, NC, 2001).

Table 1. Early maturing cultivars grown in 2002 at the Stoneville location

Cultivar	Abbreviation[z]
Bayer FM958	FM958†
Bayer FM958BG	FM958BG†
Bayer FM966	FM966†
Beltwide Cotton Genetics BCG28R	BCG28R†
Delta and Pine Land Company DP436RR	DP436RR†
Delta and Pine Land Company DP451BR	DP451BR†
Delta and Pine Land Company PM1199RR	PM1199RR†
Delta and Pine Land Company PM1218BR	PM1218BR†
Delta and Pine Land Company SG105	SG105†
Delta and Pine Land Company SG215BR	SG215BR†
Delta and Pine Land Company SG521R	SG521R†
Delta and Pine Land Company SG747	SG747†
Delta Research and Extension Center DES810	DES810†
Delta Research and Extension Center DES816	DES816†
Phytogen Seed Company PSC355	PSC355†
Stoneville Pedigreed Seed Company BXN49B	BXN49B†
Stoneville Pedigreed Seed Company ST4793R	ST4793R†
Stoneville Pedigreed Seed Company ST4892BR	ST4892BR†
Syngenta NX2429	NX2429†
ACALA1517-99	AC1517-99
Agri ProAP7115	AP7115
Alltex Atlas	ATAtlas
Delta and Pine Land Company DP20B	DP20B
Delta and Pine Land Company DP458BR	DP458BR
Delta and Pine Land Company DP555BR	DP555BR
Delta and Pine Land Company DPLX99X35	DPLX99X35
Delta and Pine Land Company SG2501BR	SG2501BR
Delta Research and Extension Center DES607	DES607
Mississippi State University MISCOT8806	MIS8806
Mississippi State University MISCOT8839	MIS8839
Olvey and Associates OA87	OA87
Olvey and Associates OA89	OA89
Olvey and Associates OA90	OA90
Phytogen Seed Company PH98M-2983	PH98M2983
RGC2001	RGC2001
RGC2002	RGC2002
Stoneville Pedigreed Seed Company BXN47	BXN47
Stoneville Pedigreed Seed Company ST457	ST457

[z] Cultivars followed by "†" common to both crop years.

Table 2. Early maturing cultivars grown in 2003 at the Stoneville and Tribbett locations

Cultivar	Abbreviation[z]
Bayer FM958	FM958†
Bayer FM958BG	FM958BG†
Bayer FM966	FM966†
Beltwide Cotton Genetics BCG28R	BCG28R†
Delta and Pine Land Company DP436RR	DP436RR†
Delta and Pine Land Company DP451BR	DP451BR†
Delta and Pine Land Company PM1199RR	PM1199RR†
Delta and Pine Land Company PM1218BR	PM1218BR†
Delta and Pine Land Company SG105	SG105†
Delta and Pine Land Company SG215BR	SG215BR†
Delta and Pine Land Company SG521R	SG521R†
Delta and Pine Land Company SG747	SG747†
Delta Research and Extension Center DES810	DES810†
Delta Research and Extension Center DES816	DES816†
Phytogen Seed Company PSC355	PSC355†
Stoneville Pedigreed Seed Company BXN49B	BXN49B†
Stoneville Pedigreed Seed Company ST4793R	ST4793R†
Stoneville Pedigreed Seed Company ST4892BR	ST4892BR†
Syngenta NX2429	NX2429†
BayerFM 958LL(FM989R)	FM958LL
BayerFM 960BR	FM960BR
BayerFM 966LL(FM819RR)	FM966LL
Beltwide Cotton Genetics BCG 28RBCG295	BCG295
Delta and Pine Land Company DP449BR	DP449BR
Delta and Pine Land Company DPLX00W12	DPX00W12
Delta and Pine Land Company DPLX01W99R	DPXW99R
Delta and Pine Land Company DPLX01X99R	DPX99R
Delta and Pine Land Company DPLX02X71R	DPX02X71R
Delta and Pine Land Company DP444BR	DP444BR
Olvey and Associates OAX300BR	OAX300BR
Olvey and Associates OAX302BR	OAX302BR
Olvey and Associates OAX303	OAX303
Olvey and Associates OAX304BR	OAX304BR
Phytogen Seed Company PHY410RR	PHY410RR
Stoneville Pedigreed Seed Company ST4563B2	ST4563B2
Stoneville Pedigreed Seed Company ST474	ST474
Stoneville Pedigreed Seed Company STX0202B2R	STX202B2R
Stoneville Pedigreed Seed Company STX0204BR	STX0204BR

[z] Cultivars followed by "†" common to both crop years.

RESULTS

SCF. The SCF content was reported for each cultivar in the 2002 Stoneville test (Table 3), 2003 Stoneville test (Table 4), and 2003 Tribbett test (Table 5). The number (SCF/g lint) and weight (mg SCF/g lint) of SCF varied significantly between cultivars in each test, but the average individual SCF weight (mg/SCF) did not. The number of SCF averaged across all cultivars and tests was 13 SCF/g lint; and this value ranged from 5.8 SCF/g lint for both DPXW99R (2003 Stoneville, Table 4) and FM966 (2003 Tribbett, Table 5) to 35.5 SCF/g lint for DES810 (2002 Stoneville, Table 3). The 19 cultivars common to each test group were analyzed for SCF, but no interaction was found between cultivar and test for any SCF measurement (Table 6). This indicated that cultivar differences in the number and weight of SCF in lint were consistent in each test. Averaged over cultivars, the most SCF by number and least SCF by weight were found in the 2002 Stoneville test (Table 6). In Stoneville 2002, the average individual SCF weight (0.32 mg/SCF) was half the weight seen in the other tests, most likely due to the use of two lint cleaners. Only one lint cleaner was used in the 2003 tests.

Motes. Cultivar differences in mote content were reported for the 2002 Stoneville test in Table 3, the 2003 Stoneville test in Table 4, and the 2003 Tribbett test in Table 5. The average number of motes across all cultivars in all tests was 1.9 motes/g; and this value was lowest for MIS8806 (0.3/g lint), FM958BG (0.4/g lint), and DES810 (0.4/g lint) in the 2002 Stoneville test (Table 3); and highest for DPXW99R and SG215BR (3.9/g lint) in the 2003 Stoneville test (Table 4). For the 19 cultivars common to all test groups, interactions were not significant for the number or weight of motes (Table 6). Like SCF, the least motes by weight were in the 2002 Stoneville test due to the additional lint cleaner, but unlike SCF there were fewer motes found (Table 6).

AFIS SCN. Results for SCN measurements were reported for the 2002 Stoneville test in Table 3, the 2003 Stoneville test in Table 4, and the 2003 Tribbett test in Table 5. The average number of SCN in lint over all tests and cultivars was 11 SCN/g lint, and this value ranged from 6 SCN/g lint for DP555BR (2002 Stoneville, Table 3) and OAX303 (2003 Tribbett, Table 5) to 22 SCN/g lint for DES810 (2003 Stoneville, Table 4). Cultivar differences were found for SCN size in the 2002 Stoneville and 2003 Stoneville tests but not the 2003 Tribbett test. For the 19 cultivars common to all test groups, no interactions were found between cultivar and test for the number or size of SCN (Table 6). Overall, the SCN number was greatest in the 2003 Stoneville test (Table 6), and was 17% greater than the average SCN number found in the 2002 Stoneville test. This was quite different for the SCF number, which was 71% greater in the 2002 Stoneville test than the 2003 Stoneville test (Table 6).

AFIS neps. Results for nep content were reported for the 2002 Stoneville test in Table 3, the 2003 Stoneville test in Table 4, and the 2003 Tribbett test in Table 5. Cultivar differences were found for the size and number of neps in each test. Overall, the number of neps averaged 200 neps/g lint, and ranged from 140 neps/g lint for PM1199RR (2003 Tribbett, Table 5) to 292 neps/g lint DP555BR (2002 Stoneville, Table 3). More neps were found in the 2002 Stoneville test than in other tests, but neps were largest in the 2003 Stoneville test. Overall, the size of neps averaged 687µm and ranged from 661µm for DPX00W12 (2003 Tribbett, Table 5) to 719µm for DES810 (2003 Stoneville, Table 4). For the 19 cultivars common to all test groups, there was a significant interaction between cultivar and test for the number of neps but not nep size (Table 6). For the number of neps, the F value for cultivar was 24.3 and for the interaction was 3.6, so the overall differences in cultivars was much more important than the effects of the interaction.

Relationship between SCF, motes, neps, and SCN. Relationships between SCF, SCN, mote, and nep content and other properties were studied to reveal physiological factors associated with cultivars containing high SCF levels. First, relationships were studied among similar properties such as the various measurements of SCF, SCN, motes, and neps. The linear correlations found among these properties are reported separately for each test (2002 Stoneville in Table 7, 2003 Stoneville in Table 8, and 2003 Tribbett in Table 9).

Because SCF and SCN are both measures of seed coats in lint, it is first important to understand the relationship between SCF and SCN. It was discussed earlier that the number of SCF ranged from 6 to 36 and averaged 13 SCF/g lint; and the number of SCN ranged from 6 to 22 and averaged 11 SCN/g lint. Overall, there were more SCF with a larger range than SCN. In each test, there was a significant positive correlation between the number of SCF and the number of SCN (Tables 7, 8, and 9). The weakest correlation was found in the 2003 Stoneville test where R^2 = 0.35 (r = 0.59, Table 8). Figure 1 illustrates the trend between the number of SCF and SCN when common cultivars were averaged across all tests (data from Table 6). The correlation between SCF and SCN (R^2 = 0.70, Fig. 1) was strong, but these measurements were obviously different. Figure 1 shows that DES810 and PSC355 ranked first and third highest, respectively, for the number of both SCF and SCN. The second highest for the number of SCF was PM1218BR, but it was just above average for the number of SCN; and the second highest for SCN was NX2429, but it was just above average for the number of SCF. SG215BR ranked lowest for the number of SCF and SCN. FM966 ranked lowest for the number of SCF but not SCN, and FM958 ranked lowest for the number of SCN but not SCF. Data points for PM1218BR, NX2429, FM966, and FM958 fell furthest from the regression line (Fig. 1). As mentioned in the introduction, there are differences in these measurements, but they should provide similar results (Baldwin et al., 1995). The average individual weight of SCF (mg/SCF) and average size of SCN (µm) were measured. They were expected to increase together if similar pieces of seed coat were counted with the manual and AFIS methods, but this was not the case. Averaged across common cultivars, Fig. 2 shows this trend was slightly negative (not significant, $p > 0.05$), and it was nearly flat within each test (Tables 7, 8, and 9). This indicated that the AFIS either altered or excluded many larger seed coats found manually. This was supported by the negative correlation found between average SCF weight (mg/SCF) and number of SCN in the 2002 Stoneville test (r = –0.36, Table 7), but this relationship was not found in the other tests (Tables 8 and 9). The number of neps increased with the number of SCF and SCN, but the trend was only significant in the 2003 Stoneville test (Table 8). Overall, the trend was not significant ($p > 0.05$). Nep size increased with the number of SCF and SCN in all tests (Tables 7, 8, and 9), and this relationship is shown averaged across common cultivars in Fig. 3. DES810 had the largest neps as well as the most SCF and SCN, and SG215BR had the smallest neps along with the fewest SCF and SCN. Since the AFIS distinguishes neps and SCN by size, an increase in the number of SCN and SCF may have increased the number of small SCN categorized as large neps.

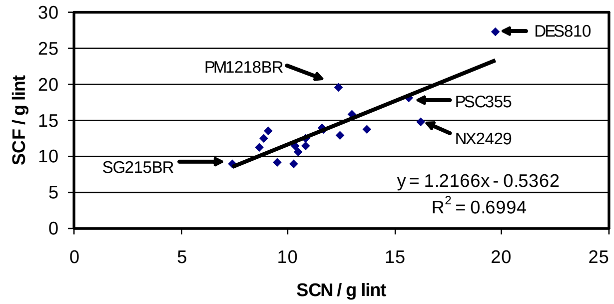

Figure 1. The number of SCF (manually counted) plotted with the number of SCN determined with the AFIS for cultivars averaged across the three test groups.

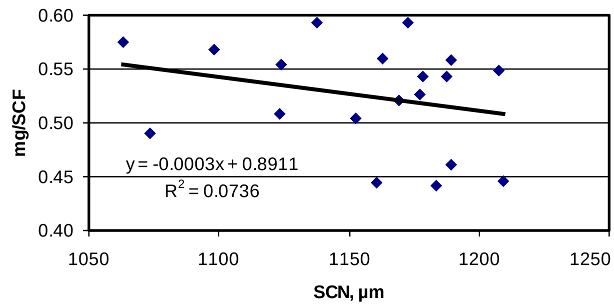

Figure 2. The average weight of individual SCF (manually fractionated) plotted with the average SCN size determined with the AFIS for cultivars averaged across the three test groups.

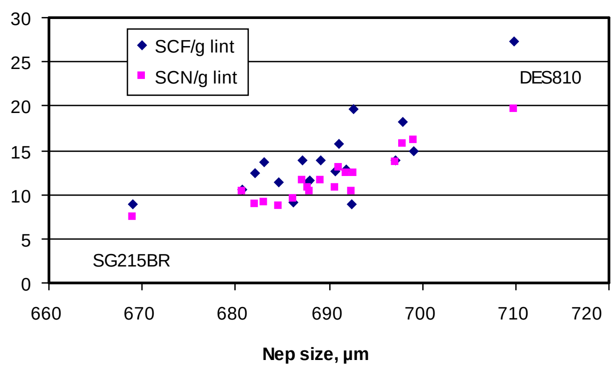

Figure 3. The number of SCF (manually counted) and the number of SCN determined with the AFIS plotted with the average nep size determined with the AFIS for cultivars averaged across the three test groups.

Because the number of SCF and SCN were determined for different subsamples of the same sample, an alternate explanation of the poor correlation between SCF and SCN was that differences were due to the high variability of SCF in lint. To test this explanation, a statistical model was developed to determine cultivar differences in seed coat levels using both SCF and SCN measurements (Table 10). The statistical model included all three test groups and the 19 cultivars common to each test group. Differences were found between test groups, measurements (either SCN/g lint or SCF/g lint), and cultivars. The most important finding was the significant interaction between cultivar and measurement, which indicated that cultivar differences depended on the method used to measure seed coat levels. This indicated that the imperfect correlation between SCF and SCN was related to the method and not related to high sample variability. The *F* value for the interaction (*F* = 2.80) was less than cultivar (*F* = 21.24), so cultivar differences were similar with each method, as shown in Fig. 1.

Other Fiber Properties. Other AFIS and HVI fiber properties, as well as seed index, were averaged and reported for each cultivar common to all three test groups (Tables 11 and 12). Correlations between these properties and nep, SCN, SCF, and mote properties were reported in Table 13a and 13b. The number of both SCN and SCF increased with HVI trash (Table 13a) and the number of dust or trash particles determine with the AFIS (Table 13b), but the trend was stronger in each case for the number of SCN. The number of SCN and SCF decreased with reflectance (Table 13a). Because these tests were conducted in controlled test plots with no differences in production practices, cultivars with high trash levels after cleaning had lower cleaning efficiencies; so less trash, including seed coat, was removed by the lint cleaner for these cultivars. The cultivars DES810, PSC355, and NX2429 stood out with high trash and SCN content (Fig. 4), but only DES810 and PSC355 stood out with high trash and SCF content (Fig. 5). This indicated that high trash levels may have interfered with (or increased) the number of SCN measured for NX2429. The cultivar PM1218BR had high SCF content and low trash content (Fig. 5), but it did not have a high SCN content (Fig. 4). The low trash content may have reduced the number of SCN recognized by the AFIS for PM1218BR. The same observations were made when comparing the number of SCN and SCF to the number of dust particles found in lint (Figs. 6 and 7), so the relationship was independent of the particle size. It is possible that trash particles entangled in neps were counted as SCN, but there was no direct evidence of this. The number of neps decreased with micronaire and fineness and increased with immature fiber content (Tables 13a and 13b). The properties SCN/g lint and SCF/g lint were not significantly correlated with micronaire, fineness, or immature fiber content (Tables 13a and 13b). Similar trends with micronaire were also found by Mangialardi et al. (1993). Nep, SCN, and SCF counts were not significantly correlated with seed index (Table 13a) and Mangialardi et al. (1993) found similar results.

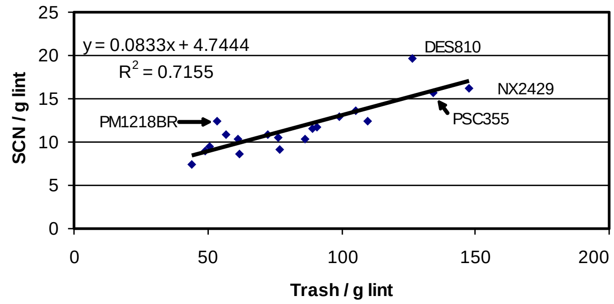

Figure 4. The number of SCN determined with the AFIS plotted with the number of trash particles determined with the AFIS for cultivars averaged across the three test groups.

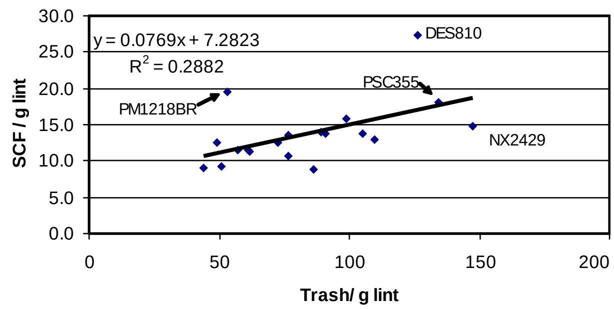

Figure 5. The number of SCF (manually counted) plotted with the number of trash particles determined with the AFIS for cultivars averaged across the three test groups.

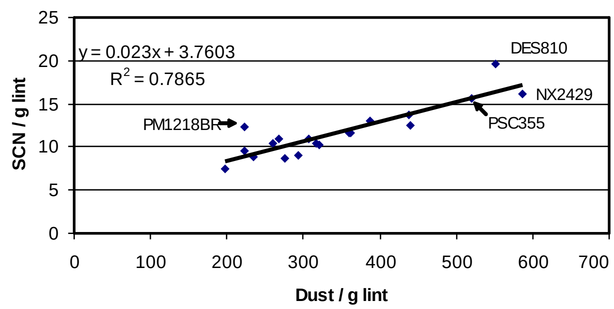

Figure 6. The number of SCN determined with the AFIS plotted with the number of dust particles determined with the AFIS for cultivars averaged across the three test groups.

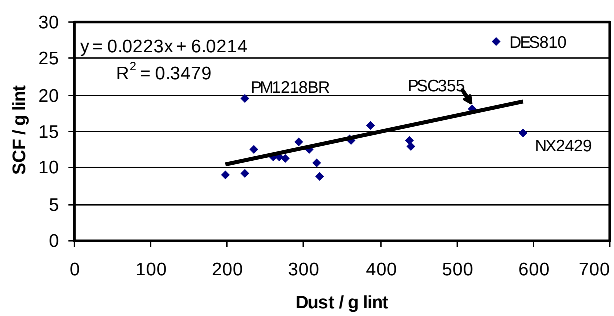

Figure 7. The number of SCF (manually counted) plotted with the number of dust particles determined with the AFIS for cultivars averaged across the three test groups.

Table 3. Least square means and statistical analysis of AFIS neps, AFIS SCN, SCF content, and motes for cultivars tested in the 2002 Stoneville test

Cultivar[z]	AFIS neps		AFIS SCN		SCF per 1g lint			Motes per 1g lint		
	Size, µm[y]	Per 1g lint[y]	Size, µm[y]	Per 1g lint[y]	No.[y]	mg[y]	mg / SCF[y]	No.[y]	mg[y]	mg / mote[y]
DP458BR	687H	244	1282H	8.7L	7.4L	2.3L	0.30L	2.1	9.5H	4.5HL
DES607	687H	269H	1103L	9.7	11.2L	4.3L	0.38H	1.4L	6.8	4.2HL
OA87	666L	205L	1080L	7.0L	11.3L	3.2L	0.30L	2.0	7.7H	4.2HL
AP7115	683	252	1128L	10.9	11.6L	3.7L	0.30L	1.1L	4.3L	3.6L
SG747†	677L	177L	1085L	8.2L	12.4L	3.9L	0.32L	0.7L	2.9L	4.4HL
SG215BR†	665L	208	1113L	6.9L	12.6L	4.4L	0.35H	2.1	9.4H	4.3HL
BXN47	681L	210	1067L	7.8L	12.8L	4.4L	0.33HL	1.3L	4.9L	3.3L
PM1199RR†	678L	196L	1185H	10.3	12.9L	4.1L	0.32L	2.0	10.7H	5.8H
SG2501BR	673L	184L	1122L	9.8	13.0L	4.3L	0.34HL	1.1L	2.9L	2.8L
FM966†	693H	243	1050L	9.9	13.1L	3.6L	0.28L	1.3L	6.4L	4.6HL
RGC2002	676L	230	1086L	9.3L	13.8L	4.3L	0.31L	0.9L	3.2L	4.3HL
DP555BR	685	292H	1062L	6.4L	14.2L	5.9	0.43H	0.9L	2.6L	2.9L
SG521R†	686	208	1098L	11.6	14.2L	5.4	0.37H	2.1	12.9H	6.2H
DP20B	684	265H	1115L	10.1	14.6	5.8	0.41H	1.4L	4.8L	4.3HL
SG105†	677L	225	1107L	8.7L	15.4	4.6L	0.30L	1.9	6.9	3.6L
RGC2001	686	210	1119L	11.6	15.4	4.4L	0.27L	0.7L	1.6L	2.7L
OA90	684	209	1148L	9.3L	15.6	4.1L	0.26L	1.4L	5.1L	3.0L
ST4892BR†	686H	185L	1196H	10.8	15.7	4.9L	0.33HL	1.8	7.5H	4.3HL
BCG28R†	682	254	1166HL	9.7	15.8	4.0L	0.26L	2.0	7.0	3.7L
DPLX99X35	686	236	1076L	11.0	16.1	4.3L	0.27L	0.8L	2.2L	3.1L
DP451BR†	676L	262	1118L	9.7	16.3	5.1L	0.31L	2.4H	9.9H	3.6L
MIS8806	690H	217	1145L	11.3	16.3	4.7L	0.29L	0.3L	1.0L	3.1L
DP436RR†	682	251	1201H	10.6	16.4	5.6	0.34HL	1.9	8.7H	4.5HL
OA89	692H	246	1211H	12.2	17.8	5.5	0.31L	3.3H	11.8H	3.5L
PH98M2983	679L	216	1121L	10.1	18.1	5.6	0.30L	0.9L	2.5L	2.9L
ST457	683	285H	1215H	11.0	18.1	5.5	0.31L	1.6	5.1L	3.7L
ATAtlas	688H	243	1081L	13.7	18.6	5.6	0.30L	0.8L	2.5L	3.3L
FM958BG†	685	284H	1054L	11.7	18.8	6.0H	0.32L	0.4L	1.8L	3.7L
ST4793R†	685	192L	1227H	11.3	18.9	8.1H	0.40H	2.7H	12.0H	4.4HL
BXN49B†	681L	276H	1042L	11.4	19.3	8.0H	0.41H	0.7L	2.3L	3.8L
MIS8839	685	241	1138L	11.9	19.3	5.2	0.27L	1.6	6.2L	4.0L
DES816†	686	229	1154L	12.6	20.7	5.3	0.26L	1.0L	4.8L	4.8H
NX2429†	691H	233	1117L	13.3	21.0	7.1H	0.34HL	0.9L	3.3L	3.8L
FM958†	688H	241	1112L	12.1	21.6	6.4H	0.29L	0.8L	2.7L	3.5L
AC1517-99	697H	288H	1278H	13.2	23.1	7.3H	0.32L	1.9	7.8H	4.3HL
PM1218BR†	677L	239	1056L	10.9	24.2	7.2H	0.29L	2.1	7.0	3.5L
PSC355†	696H	211	1156HL	14.8	26.8	6.8H	0.24L	1.2L	4.2L	3.5L
DES810†	703H	285H	1178H	19.3H	35.1H	8.9H	0.25L	0.4L	2.2L	5.3H
Cultivar *F*-value[x]	1.7 *	8.76**	1.81 *	4.97**	4.04**	1.96**	1.48	2.56**	2.76**	1.15
Mean	684	235	1,131	10.8	16.8	5.3	0.32	1.4	5.7	3.9
LSD	16	30	127	3.0	7.0	2.9	0.11	1.2	5.5	2.1

[z] Cultivars followed by "†" common to both crop years.

[y] Values statistically equal to maximum followed by "H" and minimum followed by "L".

[x] *F* values corresponding to *p* values > 0.05 followed by "*" and > 0.01 followed by "**".

Table 4. Least square means and statistical analysis of AFIS neps, AFIS SCN, SCF content, and motes for cultivars tested in the 2003 Stoneville test

Cultivar[z]	AFIS neps		AFIS SCN		SCF per 1g lint			Motesper 1g lint		
	Size, µm[y]	Per 1g lint[y]	Size, µm[y]	Per 1g lint[y]	No.[y]	mg[y]	mg / SCF[y]	No.[y]	mg[y]	mg / mote[y]
DPXW99R	692L	195	1134L	9.8L	5.8L	4.7L	0.89H	3.9H	16.4H	4.2L
SG215BR†	679L	162L	1219	7.6L	6.6L	4.6L	0.69HL	3.9H	23.1H	6.6H
SG747†	697L	156L	1166L	10.2L	6.8L	3.4L	0.51L	1.9L	12.6L	6.3
STX0204BR	696L	226H	1151L	14.7	6.8L	4.2L	0.62HL	2.9H	15.9H	5.4
DP449BR	695L	174L	1126L	11.3L	7.1L	4.6L	0.68HL	3.3H	19.2H	5.7
FM966†	699	182	1119L	11.7	7.9L	5.4L	0.67HL	1.8L	8.3L	4.6L
DP451BR†	691L	186	1184	9.9L	7.9L	5.2L	0.67HL	3.4H	19.8H	5.7
FM958LL	686L	178	1098L	10.6L	8.1L	4.6L	0.55L	1.2L	5.7L	4.5L
OAX300BR	678L	179	1203	9.3L	8.3L	5.1L	0.59HL	3.3H	15.9H	4.7L
BCG28R†	696L	203	1230H	9.6L	8.7L	6.9L	0.79H	2.9H	16.7H	5.8
SG105†	693L	170L	1300H	9.9L	8.7L	4.3L	0.51L	3.0H	13.3	4.1L
FM966LL	689L	179	1147L	10.1L	8.8L	4.7L	0.56L	2.2HL	10.8L	4.7L
FM958BG†	712H	223	1109L	15.2	8.9L	6.8L	0.77HL	2.4HL	4.8L	2.3L
DES816†	712H	196	1220	14.9	8.9L	4.6L	0.50L	1.6L	5.7L	3.0L
OAX304BR	688L	192	1127L	12.6	9.0L	5.6L	0.64HL	3.9H	15.9H	4.4L
FM960BR	698L	180	1123L	13.6	9.1L	4.7L	0.54L	1.9L	4.7L	2.4L
SG521R†	678L	164L	1153L	11.1L	9.1L	4.8L	0.50L	2.2HL	12.9L	5.6
ST474	696L	163L	1039L	13.1	9.2L	5.6L	0.59HL	2.1L	9.2L	4.3L
FM958†	682L	159L	1056L	7.8L	9.4L	7.4L	0.80H	1.9L	6.9L	2.7L
DP436RR†	699H	209	1168L	13.0	10.1L	8.6	0.79HL	1.7L	8.1L	4.3L
DPX00W12	702H	172L	1268H	12.3	10.4	7.3L	0.72HL	3.9H	23.7H	6.0
PHY410RR	701H	192	1148L	16.0	10.4	5.9L	0.54L	1.8L	8.1L	5.9
NX2429†	708H	212	1031L	20.4H	10.7	8.3	0.79HL	3.3H	16.4H	5.4
ST4793R†	695L	164L	1172L	12.6	10.9	6.2L	0.56L	1.8L	9.2L	5.2
OAX302BR	692L	192	1371H	9.4L	11.1	7.9	0.72HL	2.9H	13.4	4.7L
DP444BR	684L	215	1098L	13.2	11.2	7.3L	0.66HL	2.4HL	15.8H	6.8H
OAX303	697L	179	1168L	11.6	11.4	8.3	0.72HL	2.1L	13.2L	5.7
BCG295	689L	205	1084L	9.7L	11.9	6.9L	0.58L	0.8L	2.3L	2.3L
PM1199RR†	709H	173L	1233H	13.1	12.4	9.6H	0.77HL	2.2HL	17.4H	8.2H
DPX02X71R	687L	193	1126L	11.3L	13.0	8.3	0.64HL	2.6H	14.3	5.7
STX202B2R	702H	208	1112L	15.7	13.3H	10.6H	0.79H	3.1H	11.1L	3.7L
ST4892BR†	690L	164L	1190	12.7	13.7H	9.4H	0.67HL	2.7H	12.8L	4.7L
ST4563B2	698	244H	1110L	14.0	14.0H	6.8L	0.49L	2.7H	15.2H	5.9
PSC355†	704H	187	1132L	18.8H	14.3H	8.2	0.58L	3.0H	25.6H	9.2H
BXN49B†	702H	228H	1179	14.0	15.6H	13.0H	0.86H	2.0L	7.4L	3.7L
DPX99R	703H	195	1139L	15.4	15.8H	12.7H	0.78HL	3.4H	13.4	3.5L
PM1218BR†	712H	203	1254H	15.4	17.0H	12.9H	0.76HL	2.8H	13.2L	4.7L
DES810†	719H	231H	1247H	21.7H	17.7H	10.6H	0.60HL	2.3HL	12.4L	5.5
Cultivar *F* value[x]	1.92**	9.94**	1.92**	5.3**	3.67**	2.97**	1.06	1.61*	1.94**	2.52**
Mean	696	190	1161	12.7	10.5	7.0	0.66	2.6	12.9	4.9
LSD	20	20	144	3.9	4.4	4.2	0.30	1.7	11.0	2.6

[z] Cultivars followed by "†" common to both crop years.

[y] Values statistically equal to maximum followed by "H" and minimum followed by "L".

[x] *F* values corresponding to *p* values > 0.05 followed by "*" and > 0.01 followed by "**".

Table 5. Least square means and statistical analysis of AFIS neps, AFIS SCN, SCF content, and motes for cultivars tested in the 2003 Tribbett test

Cultivar[z]	AFIS neps		AFIS SCN		SCF per 1g lint			Motes per 1g lint		
	Size, µm[y]	Per 1g lint[y]	Size, µm[y]	Per 1g lint[y]	No.[y]	mg[y]	mg / SCF[y]	No.[y]	mg[y]	mg / mote[y]
FM966[†]	685	146L	1051L	9.3L	5.8L	3.0L	0.51HL	0.6L	4.1HL	8.2H
SG215BR[†]	665L	171	1205HL	7.7L	7.8L	3.9L	0.54HL	1.4HL	6.4HL	5.7HL
DP436RR[†]	682	169	1150HL	9.0L	7.9L	4.9L	0.65HL	1.2HL	7.3HL	5.3HL
SG747[†]	684	170	1300H	10.1	8.2L	4.0L	0.50HL	1.8HL	8.3HL	3.6L
SG521R[†]	678L	157L	1120HL	8.7L	8.6L	5.2L	0.65HL	2.3H	7.3HL	4.0L
FM958[†]	679	145L	1204HL	7.3L	9.7L	5.8L	0.57HL	0.6L	1.3L	2.6L
DP451BR[†]	697H	195	1233H	11.4	10.4L	6.7	0.64HL	1.3HL	6.9HL	4.8HL
DES816[†]	693H	173	1194HL	13.7	11.8	7.4	0.63HL	2.0HL	6.8HL	3.4L
ST4793R[†]	687	152L	1164HL	10.9	12.0	8.3	0.67HL	1.9HL	10.6HL	6.0HL
ST4892BR[†]	685	155L	1103L	11.6	12.1	8.1	0.68HL	2.8H	10.8HL	3.8L
PM1199RR[†]	684	140L	1203HL	9.1L	12.3	6.9	0.56HL	1.7HL	5.7HL	3.4L
BXN49B[†]	690H	231H	1193HL	13.6	12.4	6.3L	0.51HL	2.1HL	8.3HL	4.5HL
NX2429[†]	698H	160L	1146HL	14.9H	12.8	7.0	0.57HL	2.1HL	13.6H	6.0HL
SG105[†]	676L	156L	1074L	8.1L	13.2	6.8	0.52HL	1.9HL	8.3HL	3.9L
PSC355[†]	694H	157L	1170HL	13.4	13.3	9.0	0.69HL	2.1HL	14.3H	6.2HL
PM1218BR[†]	689	182	1199HL	10.8	17.6	8.8	0.51HL	2.1HL	12.7H	5.3HL
DES810[†]	708H	181	1202HL	17.7H	29.3H	14.2H	0.48HL	2.6H	10.8HL	4.2HL
OAX303	679L	165	1119HL	6.3L	n.a.[w]	n.a.	n.a.	n.a.	n.a.	n.a.
BCG28R[†]	677L	186	1173HL	6.7L	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
OAX302BR	666L	180	1206HL	6.9L	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
DPX00W12	661L	154L	1185HL	7.3L	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
OAX300BR	675L	168	1257H	7.7L	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
OAX304BR	679	186	1265H	7.7L	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
STX0204BR	666L	188	1097L	8.0L	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
DPX99R	672L	176	1110L	8.0L	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
DP449BR	679	178	1076L	8.2L	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
FM960BR	685	176	1232H	8.7L	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
FM966LL	679L	152L	1106L	9.2L	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
ST4563B2	687	235H	1085L	9.2L	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
ST474	689	153L	1255H	9.2L	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
DP444BR	669L	203	1107L	9.7L	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
DPXW99R	685	215H	1236H	9.8	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
DPX02X71R	674L	164	1218H	10.2	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
FM958LL	689	161L	1144HL	10.3	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
FM958BG[†]	679L	175	1026L	10.4	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
BCG295	690H	201	1219H	10.6	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
STX202B2R	691H	224H	1146HL	11.6	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
PHY410RR	682	177	1110L	12.8	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Cultivar *F* value[x]	2.27**	8.67**	0.96	4.33**	9.98**	4.5**	0.80	1.15	0.88	0.98
Mean	682	175	1165	9.9	12.1	6.8	0.58	1.8	8.4	4.8
LSD	18	23	189	3.3	4.8	3.5	0.23	1.7	10.4	4.0

[z] Cultivars followed by "†" common to both crop years.

[y] Values statistically equal to maximum followed by "H" and minimum followed by "L".

[x] *F* values corresponding to *p* values > 0.05 followed by "*" and > 0.01 followed by "**".

[w] Data not available.

Table 6. Least square means and statistical analysis of AFIS neps, AFIS SCN, SCF content, and motes for cultivars common to the three test groups

	AFIS neps		AFIS SCN		SCF per 1g lint			Motes per 1g lint		
	Size, µm	Per 1g lint	Size, µm	Per 1g lint	No.	mg	mg / SCF	No.	mg	mg / mote
Cultivar					Least square means					
FM966	692	190	1073L	10.3	8.9L	4.0L	0.49HL	1.2L	6.3L	5.8H
SG215BR	669L	178L	1175H	7.2L	9.0L	4.3L	0.53HL	2.5H	13.0H	5.5H
SG747	686	168L	1184H	9.5	9.1L	3.8L	0.44L	1.4L	7.9L	4.8H
SG521R	681	176L	1124HL	10.4	10.6L	5.1L	0.51HL	2.2H	11.0H	5.3H
BCG28R	685	214	1189H	8.6L	11.3L	5.5L	0.56HL	2.4H	11.3H	4.7HL
DP436RR	688	209	1173H	10.9	11.5L	6.4	0.59H	1.6HL	8.0L	4.7HL
DP451BR	688	214	1178H	10.3	11.6L	5.7L	0.54HL	2.4H	12.2H	4.7HL
SG105	682	184L	1160H	8.9L	12.4L	5.3L	0.44L	2.3H	9.5H	3.9L
PM1199RR	691	169L	1207H	10.9	12.6L	6.8	0.55HL	2.0HL	11.3H	5.8H
FM958BG	692	227	1063L	12.4	12.9	6.5	0.57HL	1.4L	2.8L	3.0L
FM958	683	182L	1124HL	9.1L	13.6	6.6	0.55HL	1.1L	3.6L	3.0L
DES816	697	199	1189H	13.7	13.8	5.8L	0.46HL	1.5HL	5.7L	3.7L
ST4892BR	687	168L	1163H	11.7	13.8	7.5	0.56HL	2.4H	10.4H	4.3L
ST4793R	689	169L	1187H	11.6	13.9	7.6	0.54HL	2.1H	10.6H	5.2H
NX2429	699H	202	1098L	16.2	14.8	7.5	0.57HL	2.1H	11.1H	5.0H
BXN49B	691	245H	1138HL	13.0	15.8	9.1H	0.59H	1.6HL	6.0L	4.0L
PSC355	698	185	1153H	15.7	18.1	8.0	0.50HL	2.1H	14.7H	6.3H
PM1218BR	693	208	1169H	12.4	19.6	9.6H	0.52HL	2.3H	11.0H	4.5L
DES810	710H	232H	1209H	19.6H	27.4H	11.2H	0.45L	1.8HL	8.5L	4.9H
LSD	11	17	89	2.2	3.8	2.4	0.14	1.0	5.8	1.8
Test					Least square means					
Stoneville2002	684	231	1127	11.2	18.5	5.8	0.32	1.5	6.5	4.3
Stoneville2003	699	188	1177	13.1	10.8	7.4	0.67	2.5	13.0	5.1
Tribbett2003	686	168	1163	10.7	11.9	6.8	0.59	1.8	8.2	4.7
Overall	690	196	1156	11.7	13.7	6.6	0.53	1.9	9.2	4.7
Effect					*F* values					
Test	24.9**	291**	4.33*	17.2**	66.8**	6.67**	90**	14.1**	18.7**	3.25*
Cultivar	4.14**	24.3**	1.84*	15.2**	11.64**	5.98**	0.97	1.75*	2.4**	2.14**
Test*cultivar	0.88	3.59**	1.15	1.27	1.3	1.4	1.01	1.16	1.28	1.52

[z] Values statistically equal to maximum followed by "H" and minimum followed by "L".

[x] *F* values corresponding to *p* values > 0.05 followed by "*" and > 0.01 followed by "**".

Table 7. Pearson correlations (*r*) between neps (AFIS), SCN (AFIS), SCF, and motes in the 2002 Stoneville test

	Nep size, µm[z]	Neps/g[z]	SCN size, µm[z]	SCN/g[z]	SCF/g[z]	SCF mg/g[z]	mg/ SCF[z]	Motes/g[z]	Motes mg/g[z]	mg/motes[z]
Nep size, µm	1.00**	0.38*	0.34*	0.75**	0.56**	0.44**	–0.22	–0.22	−0.16	0.09
Neps/g		1.00**	0.02	0.26	0.31	0.35*	0.14	–0.12	−0.17	−0.05
SCN size, µm			1.00**	0.27	0.13	0.06	–0.15	0.46**	0.45**	0.24
SCN/g				1.00**	0.84**	0.66**	–0.36*	−0.25	−0.20	0.18
SCF/g					1.00**	0.84**	–0.32	−0.21	−0.24	0.02
SCF mg/g						1.00**	0.22	−0.11	−0.11	0.06
mg/SCF							1.00**	0.14	0.20	0.14
Mote/g								1.00**	0.93**	0.27
Mote mg/g									1.00**	0.54**
mg/mote										1.00**

[z] Values corresponding to *p* values > 0.05 followed by "*" and > 0.01 followed by "**".

Table 8. Pearson correlations (*r*) between neps (AFIS), SCN (AFIS), SCF, and motes in the 2003 Stoneville test

	Nep size, µm[z]	Neps/g[z]	SCN size, µm[z]	SCN/g[z]	SCF/g[z]	SCF mg/g[z]	mg/ SCF[z]	Motes/g[z]	Motes mg/g[z]	mg/motes[z]
Nep size, µm	1.00**	0.45**	0.14	0.77**	0.48**	0.46**	0.17	−0.09	−0.10	0.00
Neps/g		1.00**	−0.08	0.54**	0.42**	0.40*	0.22	0.01	−0.11	−0.13
SCN size, µm			1.00**	−0.15	0.13	0.12	0.01	0.23	0.28	0.19
SCN/g				1.00**	0.59**	0.48**	0.01	0.00	0.01	0.14
SCF/g					1.00**	0.89**	0.15	−0.09	−0.03	0.08
SCF mg/g						1.00**	0.56**	0.04	−0.01	−0.01
mg/SCF							1.00**	0.36*	0.15	−0.11
Mote/g								1.00**	0.80**	0.28
Mote mg/g									1.00**	0.76**
mg/mote										1.00**

[z] Values corresponding to *p* values > 0.05 followed by "*" and > 0.01 followed by "**".

Table 9. Pearson correlations (*r*) between neps (AFIS), SCN (AFIS), SCF, and motes in the 2003 Tribbett test

	Nep size, µm[z]	Neps/g[z]	SCN size, µm[z]	SCN/g[z]	SCF/g[z]	SCF mg/g[z]	mg/ SCF[z]	Motes/g[z]	Motes mg/g[z]	mg/mote[z]
Nep size, µm	1.00**	0.14	0.17	0.78**	0.66**	0.70**	0.00	0.35	0.47*	0.08
Neps/g		1.00**	0.05	0.16	0.24	0.15	−0.26	0.24	0.17	−0.05
SCN size, µm			1.00**	0.04	0.15	0.10	−0.19	0.01	−0.02	−0.41*
SCN/g				1.00**	0.71**	0.73**	−0.04	0.58**	0.62**	0.08
SCF/g					1.00**	0.94**	−0.29	0.57**	0.49*	-0.18
SCF mg/g						1.00**	0.02	0.62**	0.56**	−0.17
mg/SCF							1.00**	0.15	0.18	0.04
Motes/g								1.00**	0.74**	−0.23
Motes mg/g									1.00**	0.29
mg/mote										1.00**

[z] Values corresponding to *p* values > 0.05 followed by "*" and > 0.01 followed by "**".

Table 10. Results from the statistical analysis of seed coat levels with test, measurement technique (manual SCF and AFIS SCN), and cultivar

Effect	Degrees of Freedom	*F* value	*P* value
Test	2	17.23	0.0028
Measurement	1	17.93	0.0055
Test*measurement	2	34.97	0.0005
Cultivar	18	21.24	< 0.0001
Cultivar*measurement	18	2.80	0.0002
Cultivar*test	34	1.37	0.0939
Cultivar*measurement*test	34	1.24	0.1813

Table 11. Least square means and statistical analysis of HVI properties and seed index for cultivars common to the three test groups

Cultivar	HVI							Seed index (g/100)
	Micronaire	Strength cN/tex	Length, cm	Uniformity, %	Reflectance, Rd	Yellowness, +B	% area (trash)	
	Least square means							
FM966	4.45	32.71	2.85	82.9	78.19	7.68	4.19	10.12
SG215BR	4.78	26.24	2.68	82.4	76.59	8.47	2.22	8.65
SG747	4.96	26.94	2.79	83.1	75.78	8.58	2.44	8.58
SG521R	4.69	26.85	2.70	83.0	76.15	8.26	3.81	8.73
BCG28R	4.70	28.13	2.80	82.0	77.30	8.04	2.85	7.77
DP436RR	4.70	27.51	2.81	82.7	77.33	7.80	3.04	8.82
DP451BR	4.59	27.78	2.80	82.5	77.64	7.72	2.95	8.79
SG105	4.86	28.81	2.80	83.2	76.70	8.03	2.59	8.94
PM1199RR	4.78	29.10	2.77	83.4	75.59	8.20	3.37	9.14
FM958BG	4.12	31.85	2.81	82.6	77.38	7.67	4.69	9.29
FM958	4.60	31.11	2.87	82.2	78.07	7.83	3.70	9.65
DES816	4.56	29.53	2.78	82.4	75.41	7.84	4.30	9.28
ST4892BR	4.76	28.31	2.76	82.9	76.07	8.43	3.56	8.75
ST4793R	4.84	28.28	2.73	82.8	75.85	8.47	3.41	8.95
NX2429	4.65	29.92	2.81	83.4	73.74	7.93	6.19	9.24
BXN49B	4.41	28.35	2.84	82.1	76.52	8.23	4.26	8.81
PSC355	4.79	29.21	2.78	83.1	73.85	8.03	5.30	8.90
PM1218BR	4.72	27.91	2.70	82.5	76.85	8.14	2.63	9.62
DES810	4.40	29.95	2.76	82.9	74.07	7.75	5.19	8.90
LSD	0.18	1.13	0.040	0.59	0.87	0.28	0.94	0.45
Test	Least square means							
Stoneville 2002	4.64	28.96	2.78	82.6	74.71	8.22	2.75	8.93
Stoneville 2003	4.62	29.64	2.84	83.2	78.32	7.99	4.95	9.42
Tribbett 2003	4.69	28.00	2.72	82.4	75.78	7.96	3.45	8.64
Overall	4.65	29.44	2.78	82.7	76.27	8.06	3.72	9.00
Effect	*F* values[z]							
Test	5.83**	77.38**	356.4**	73.24**	691.0**	39.2**	217.1**	99.6**
Cultivar	25.74**	52.16**	38.20**	10.94**	54.99**	24.89**	31.22**	29.80**
Test*cultivar	2.82**	1.41	1.56 *	2.10**	3.40**	2.36**	3.04**	0.95

[z] *F* values corresponding to *p* values > 0.05 followed by “*” and > 0.01 followed by “**”.

Table 12. Least square means and statistical analysis of AFIS properties for cultivars common to the three test groups

Cultivar	AFIS							
	Trash size, µm	Dust/g lint	Trash/g lint	Upper quartile length, cm[z]	Short fiber content, %[z]	Fineness, mTex	Immature fiber content, %	Maturity ratio
	Least square means							
FM966	367	322	86	3.01	7.41	168	3.57	0.909
SG215BR	353	198	44	2.80	7.92	182	3.68	0.861
SG747	352	222	51	2.94	7.37	184	3.08	0.881
SG521R	350	317	77	2.83	6.69	181	3.46	0.870
BCG28R	344	275	62	2.96	8.24	181	3.20	0.896
DP436RR	338	267	57	2.95	7.61	183	3.19	0.880
DP451BR	354	261	61	2.96	7.40	183	2.99	0.897
SG105	336	234	49	2.94	6.52	182	3.09	0.897
PM1199RR	349	307	72	2.93	6.26	181	2.88	0.912
FM958BG	356	440	110	2.95	7.93	163	4.10	0.881
FM958	368	293	77	3.04	7.50	173	3.12	0.913
DES816	351	438	105	2.92	6.68	173	3.46	0.888
ST4892BR	353	361	91	2.91	6.80	184	3.09	0.894
ST4793R	355	361	89	2.88	6.69	184	3.04	0.894
NX2429	356	587	148	2.97	6.66	178	3.46	0.880
BXN49B	358	386	99	2.97	8.89	173	3.89	0.862
PSC355	360	521	134	2.92	7.02	180	3.26	0.884
PM1218BR	350	223	53	2.83	7.86	182	3.41	0.884
DES810	344	551	126	2.87	6.54	172	3.43	0.885
LSD	23	75	18	0.044	0.62	3.19	0.35	0.011
Test	**Least square means**							
Stoneville 2002	349	257	58	2.91	8.23	179	3.58	0.883
Stoneville 2003	361	434	111	3.01	6.46	177	3.45	0.888
Tribbett 2003	348	345	81	2.86	7.10	179	2.99	0.892
Overall	352	345	84	2.92	7.26	178	3.34	0.888
Effect	***F* values[y]**							
Test	15.52**	206.9**	343.2**	462.6**	318.2**	15.51**	114.4**	23.84**
Cultivar	3.03**	54.92**	69.7**	44.56**	30.37**	87.81**	19.1**	38.93**
Test*cultivar	1.15	5.50**	7.49**	2.49**	3.59**	2.34**	2.67**	2.32**

[z] Length distributions were by weight.

[y] *F* values corresponding to *p* values > 0.05 followed by “*” and > 0.01 followed by “**”.

Table 13a. Pearson correlations (*r*) between SCN (AFIS), neps (AFIS), SCF, motes, and other cotton properties averaged over common cultivars

	HVI							Seed index (g/100)[z]
	Micronaire[z]	Strength cN/tex[z]	Length, cm[z]	% uniformity[z]	Reflectance, Rd[z]	Yellowness, +B[z]	% area (trash)[z]	
Nep size, µm	−0.40	0.49*	0.25	0.27	−0.56*	−0.47*	0.74**	0.28
Neps/g	−0.74**	0.22	0.32	−0.47*	0.08	−0.57*	0.33	−0.05
SCN size, µm	0.54*	−0.60**	−0.43	−0.06	−0.27	0.38	−0.45	−0.52*
SCN/g	−0.37	0.31	0.02	0.30	−0.74**	−0.32	0.81**	0.17
SCF/g	−0.26	0.18	−0.12	0.05	−0.54*	−0.22	0.49*	0.10
SCF mg/g	−0.27	0.12	−0.10	−0.02	−0.45	−0.12	0.45	0.09
mg/SCF	−0.25	0.00	0.20	−0.34	0.29	−0.05	0.08	−0.09
Mote/g	0.47*	−0.63**	−0.67**	0.12	−0.23	0.41	-0.28	−0.52*
Mote mg/g	0.63**	−0.59**	−0.60**	0.33	−0.41	0.41	-0.16	−0.44
mg/mote	0.41	−0.25	−0.38	0.49*	−0.41	0.27	0.07	−0.13

[z] Values corresponding to *p* values > 0.05 followed by "*" and > 0.01 followed by "**".

Table 13b. Pearson correlations (*r*) between SCN (AFIS), neps (AFIS), SCF, motes, and other cotton properties averaged over common cultivars

	AFIS							
	Trash size, µm[z]	Dust/g lint[z]	Trash/g lint[z]	Upper quartile length, cm[z]	Short fiber content, %[z]	Fineness, mTex[z]	Immature fiber content, %[z]	Maturity ratio
Nep size, µm	0.04	0.79**	0.75**	0.16	−0.29	-0.40	0.10	0.13
Neps/g	−0.11	0.32	0.28	0.16	0.55*	-0.53*	0.58**	−0.33
SCN size, µm	−0.54*	−0.24	−0.34	−0.40	−0.23	0.61**	−0.60**	0.05
SCN/g	0.02	0.89**	0.85**	−0.10	−0.30	-0.32	0.23	−0.17
SCF/g	−0.11	0.59**	0.54*	−0.25	−0.17	-0.19	0.09	−0.08
SCF mg/g	−0.05	0.54*	0.51*	−0.21	−0.03	-0.12	0.11	−0.12
mg/SCF	0.21	0.02	0.07	0.23	0.46*	-0.02	0.16	−0.10
Mote/g	−0.41	−0.16	−0.20	−0.60**	−0.15	0.69**	−0.28	−0.21
Mote mg/g	−0.24	−0.07	−0.10	−0.52*	−0.26	0.75**	−0.42	−0.14
mg/mote	0.02	0.08	0.08	−0.35	−0.28	0.38	−0.23	−0.06

[z] Values corresponding to *p* values > 0.05 followed by "*" and > 0.01 followed by "**".

SUMMARY AND DISCUSSION

Cultivar differences in SCF, mote, nep, and SCN content were evaluated in three test groups, each containing 38 cultivars. There were 19 cultivars in common to all test groups. The cotton was machine picked and processed with standard gin machinery, and samples were collected after the lint cleaner for analysis. Cultivars differences were found for SCF, mote, nep, and SCN contents. When values were averaged across tests for the 19 common cultivars, the SCF number ranged from 8.9 to 27.4 SCF/g lint and the SCN number ranged from 7.2 to 19.6 SCN/g lint. The interaction between cultivar and test was not significant for the number of SCF or SCN. For the 19 cultivars common to all groups, nine were statistically equal to the minimum SCF number, four were statistically equal to the minimum SCN number, and three (SG215BR, BCG28R, and SG105) were statistically equal to the minimum for both. Differences in cultivars with large numbers of SCN or SCF were more discernable. The cultivar DES810 had the highest number of both SCF and SCN, and it was statistically higher than all other cultivars.

There was a significant positive correlation between the SCN and SCF number in each test group ranging from 0.59 to 0.84. This correlation suggested the measurements were similar. When both methods (SCN and SCF) were used to model the number of seed coats, a significant interaction was found between cultivar and the method, so cultivar differences depended on which method was used. There were several explanations why these measurements differed. As discussed in the introduction, the AFIS does not count some seed coats as SCN when they are ejected into trash or dust streams (Baldwin et al. 1995). Neps may have been incorrectly categorized by the AFIS as SCN or vice versa; large SCF and motes may have been counted as AFIS trash; small SCF may have been counted as dust; the AFIS may have broken motes and SCF into multiple smaller SCN; and trash entangled within fibers may have been incorrectly categorized as SCN. It was also possible that the AFIS counted SCN not found manually as SCF. Both the number of SCN and SCF increased with the average nep size measured by the AFIS. The corresponding increase in nep size and SCN count support the explanation that SCN were incorrectly categorized as neps. Both the number of SCN and SCF increased with the number of trash particles measured by the AFIS. The corresponding increase in SCN and SCF with trash content suggested that lint cleaners were less effective at removing trash and seed coats (either SCF or SCN) for certain cultivars. Two cultivars did not fit the trend between SCF and trash, but they did fit the trend between SCN and trash. This supported the explanation that trash entangled within fibers may have been incorrectly categorized as SCN.

CONCLUSION

Significant cultivar differences were observed for SCF content, and these differences were found to be consistent for cultivars evaluated in multiple test groups. This was also true for SCN and mote content. The number of SCN measured with the AFIS was similar to the number of SCF measured manually, but some cultivars compared differently for these measurements. The SCN measurement is an acceptable screening tool to detect cotton cultivars with high SCF levels, but manual measurements may also be needed when analyzing ginned lint. Because fragments of cottonseed are not easily removed from lint, prevention is the key to keeping them from reaching cotton mills. This study points out the critical role cotton breeding plays in SCF prevention, but research should also be focused on harvesting and ginning.

DISCLAIMER

Mention of a trade names or commercial products in the publication is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the USDA.

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