SEED COTTON CLEANING EFFECTS ON SEED COAT FRAGMENTS

J. Clif Boykin
USDA/ARS Cotton Ginning Research Unit
Stoneville, MS

Abstract

Processing problems in textile mills have been linked to seed coat fragments (SCF), so cotton ginning facilities should take steps to prevent them from forming. The objective of this experiment was to determine if the use of seed-cotton cleaners, prior to the extractor-feeder/gin stand, caused increased SCF levels in ginned lint. Cotton was processed with different seed-cotton cleaning sequences and lint samples were analyzed for SCF. Manual removal and weighing of SCF from lint samples revealed that cotton processed with either a cylinder cleaner or stick machine, before the extractor-feeder/gin stand, was not found to contain larger quantities of SCF (mg SCF/g lint) than cotton processed with only the extractor-feeder/gin stand. The same was true for the number of SCF manually removed from lint (SCF/g lint) and the number of seed coat neps (SCN/g lint) measured with the Advanced Fiber Information System. Also, cotton processed with a standard machine sequence (cylinder cleaner, stick machine, cylinder cleaner, extractor-feeder/gin stand, and two lint cleaners) was not found to have an increased weight of SCF in comparison to lint processed with only an extractor-feeder/gin stand and two lint cleaners. Again, this was also true for the number of SCF (SCF/g lint) and the number of SCN (SCN/g lint). In conclusion, seed-cotton cleaners were not found to increase SCF levels in comparison to the extractor-feeder/gin stand.

Introduction

After harvest, cotton is ginned to remove lint from the seed. Ginning facilities also remove trash from cotton containing seed (seed-cotton), as well as from ginned lint. This requires pneumatic and mechanical processes, which lead to seed coat fragments (SCF) dislodged from the cotton seed. Some SCF remain attached to lint, which make them difficult to remove with lint cleaners. The major point of origin for SCF is the gin stand where saws are used to remove lint from seed, but there has been some evidence of damage to seed before reaching the gin stand. Moore and Shaw (1967) sampled seven commercial gins in Mississippi and Louisiana. For 210 bales ginned, they found that seed damage increased from 4.2% at the wagon, to 5.0% at the gin stand feeder, to 9.7% in the ginned seed. Mechanical and pneumatic handling before the gin stand may cause SCF, or it may cause damage to the cotton seed making them more prone to SCF formation in the gin stand. The objective of this experiment was to determine if SCF levels increase with the number of seed-cotton cleaners.

Materials and Methods

Cotton was ginned in a small-scale cotton saw gin (microgin) equipped with standard gin machinery (two dryers, two cylinder cleaners, stick machine, extractor-feeder/gin stand, and two saw-type lint cleaners) in Stoneville, MS (Anthony and McCaskill, 1974). The setup of the microgin allowed machine sequence to vary. The test evaluated five machine sequences:

- Extractor-Feeder/Gin Stand (EFGS)
- Cylinder Cleaner (CC) + EFGS
- Stick Machine (SM) + EFGS
- EFGS + 2 Lint Cleaners (2LC)
- CC + SM + CC + EFGS + 2LC

Drying was varied to achieve low and high moisture levels. Low moisture was achieved by drying at 150 ºF, and high moisture was achieved by by-passing the drying stage. Eight cottons were tested, which included SG215 (two sources), DP434, DP444 (two sources), ST4892 (two sources), and ST5599. All treatment combinations (five machine sequences, two moisture levels, and eight cottons) were included in the experiment for a total of 80 treatments.

Each of the 80 treatments was replicated in three test runs, each 30 to 40 lb of seed-cotton. For each test run, three lint samples were taken at the battery condenser and analyzed for fiber properties by the Advanced Fiber

Information System (AFIS, Uster Technologies, Knoxville, Tenn.) and for seed coat fragments by ASTM Method D 2496 (ASTM, 1985). Statistical analysis was performed using the Mixed model procedure (Proc MIXED, SAS v8.2, Cary, N.C., SAS Institute, Inc., 2001). The LSMeans statement was used to determine least square means for treatments, as well as the significance of treatment differences. These results were illustrated in figures where significant differences ($p<0.05$) were noted with a series of letters for each treatment. Significant differences were not observed among treatments with the same letter.

Results

Lint samples collected at the battery condenser were analyzed manually to determine SCF content. In this preliminary report, results were averaged over the different varieties and moisture treatments tested. The weight of SCF was reported per gram of lint (SCF mg/g lint) and the number of SCF was reported per gram of lint (SCF/g lint). Results were used to compare cotton processed with an extractor-feeder/gin stand (EFGS) to cotton processed with an added cylinder cleaner (CC+EFGS), or an added stick machine (SM+EFGS). In this case, the EFGS was the baseline machine treatment. Also, results were used to compare cotton processed with an extractor-feeder/gin stand with two lint cleaners (EFGS+2LC) to cotton processed with three added seed-cotton cleaners (CC+SM+CC+EFGS+2LC). In this case, including lint cleaning, the EFGS+2LC was the baseline treatment.

In comparison to the EFGS treatment, the weight of SCF (mg/g lint) did not increase for the CC+EFGS or SM+EFGS treatments (Figure 1). In fact, the SM+EFGS treatment was statistically lower. In comparison to the EFGS+2LC treatment, the weight of SCF did not increase for the CC+SM+CC+EFGS+2LC treatment. This suggested seed-cotton cleaners did not increase SCF over levels observed with the extractor-feeder/gin stand alone.

It was unexpected that the weight of SCF was lower for the SM+EFGS treatment than for the EFGS treatment (Figure 1). This indicated that the stick machine either removed SCF, or a source of SCF. There was no indication of this trend in the treatments including lint cleaning.

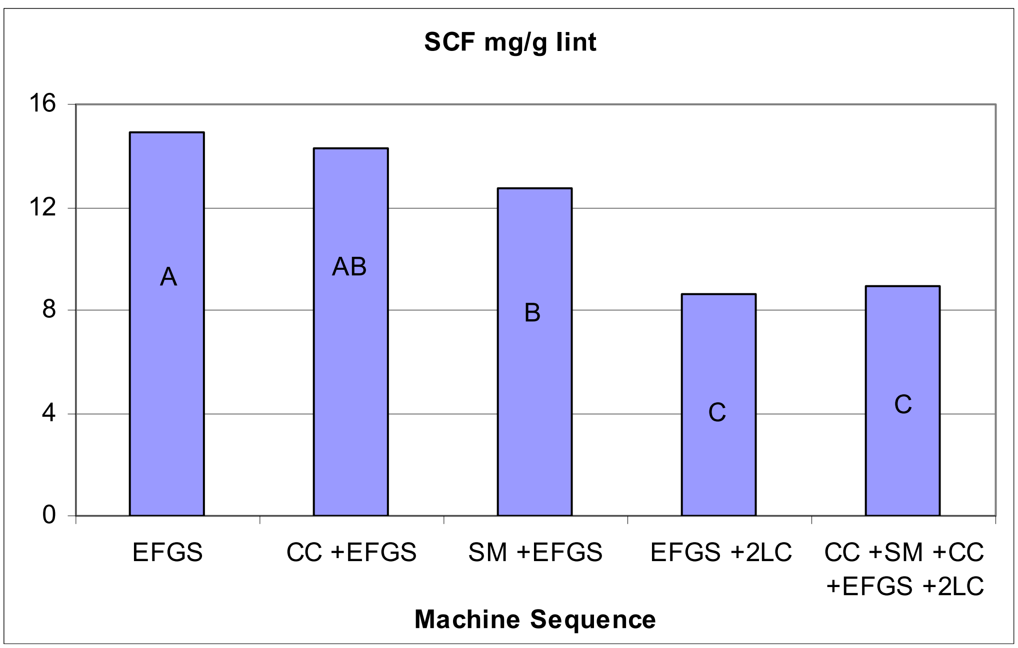

Figure 1. Weight of seed coat fragment (mg of SCF/g lint) determined for lint samples from different sequences of gin machinery.

Results for the number of SCF (SCF/g lint) also suggested seed-cotton cleaners did not increase SCF over levels observed with the extractor-feeder/gin stand alone. The number of SCF for the EFGS treatment was not statistically different from the CC+EFGS or SM+EFGS treatment (Figure 2). Also, the EFGS+2LC treatment was not statistically different from the CC+SM+CC+EFGS+2LC treatment (Figure 2).

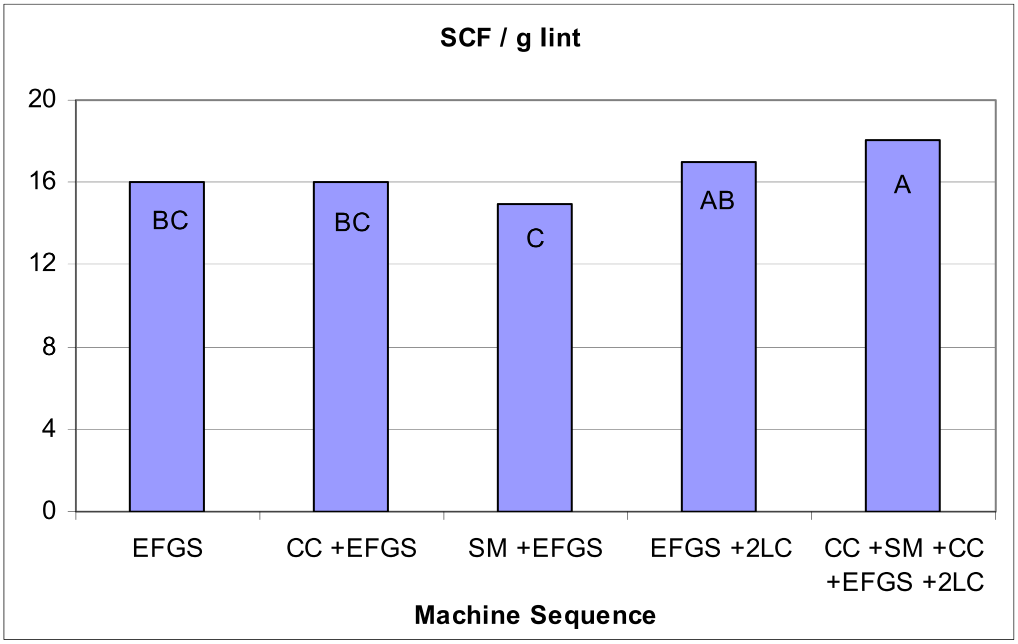

Figure 2. Number of seed coat fragments (number of SCF/g lint) determined for lint samples from different sequences of gin machinery.

Another indicator of SCF levels in lint is the AFIS measurement for seed coat neps (SCN/g lint). Again, results for the number of SCN (SCN/g lint) suggested seed-cotton cleaners did not increase SCF over levels observed with the extractor-feeder/gin stand alone (Figure 3).

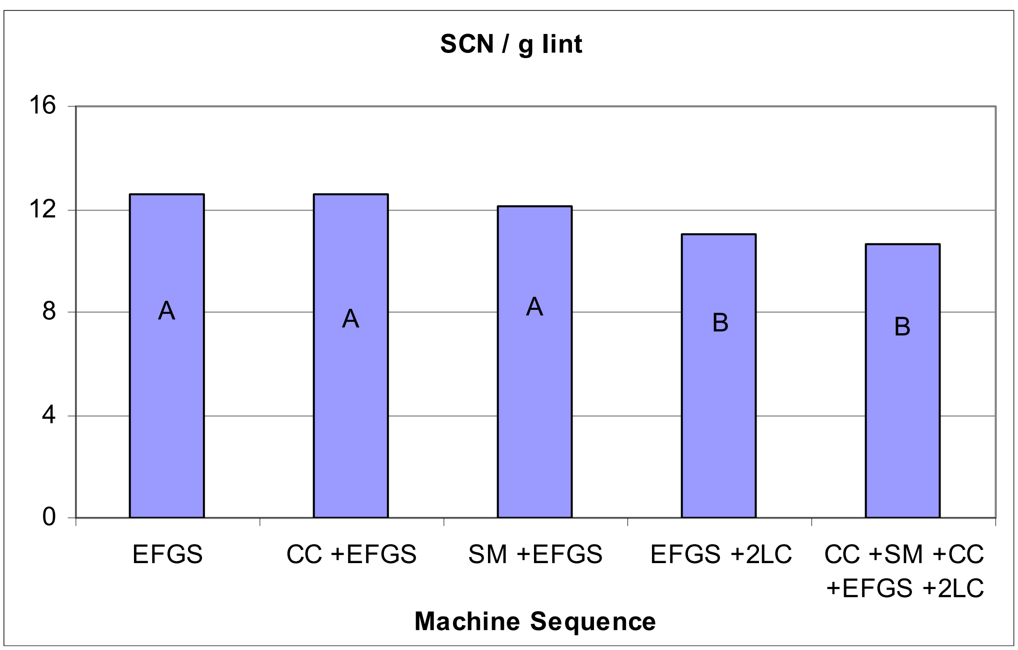

Figure 3. Number of seed coat neps (number of SCN/g lint) determined for lint samples from different sequences of gin machinery.

Conclusion

Results of this study suggest that seed-cotton cleaning, in addition to that provided by the extractor-feeder, does not lead to increased levels of SCF in lint. This evidence was drawn from samples analyzed manually for the weight and number of SCF, and samples analyzed with the AFIS for seed coat neps. But, this evidence does not support the conclusion that SCF do not form or begin to form during harvesting and seed-cotton cleaning. Ginning research aimed at preventing SCF formation should primarily be focused on improvements to the gin stand, but pneumatic handling systems and cotton harvesters may also be studied. In addition, seed that tend to be more mature with stronger seed coats should form fewer SCF, so cotton varieties and production practices may be modified to improve these seed properties.

Disclaimer

Acknowledgement

The author would like to thank Cotton Incorporated, Cary, NC, for their assistance with this project.

References

ASTM. 1985. D 2496: Standard test methods for seed coat fragments and funiculi in cotton fiber samples. West Conshohocken, Pa.: American Society for Testing and Materials.

Anthony, W.S., and O.L. McCaskill. 1974. Development and evaluation of a small-scale cotton ginning system. ARS-S-36. New Orleans, La.: USDA Agricultural Research Service.

Moore, V.P., and C.S. Shaw. 1967. Mechanical damage to cottonseed: Ginning effects. *Cotton Gin and Oil Mill Press* 68(5): 10-11, 14.