VARIETAL RESPONSE TO GINNING WITH ONE LINT CLEANER

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Abstract

Comparisons of the ginning performance of cotton varieties are normally done with two stages of saw-type lint cleaners; however, many varieties respond very favorably to only one stage of saw-type lint cleaning. This study compared fiber properties of cotton processed with one and two stages of saw-type lint cleaning. Evaluation of 49 varieties grown near Stoneville, MS, on two soil types indicated significant differences between the varieties for most properties measured by the High Volume Instrument (HVI) classing system. Significant differences also occurred between fields (growth locations). One stage of saw-type lint cleaning was the most profitable for the farmer--these results differed from previous results which indicated that most, but not all, varieties were most profitable when processed with one stage of saw-type lint cleaning. These results indicate the potential for improving cotton fiber quality parameters based upon the option to use fewer than the current stages of saw-type lint cleaning.

Introduction

Improvement of cotton fiber quality involves a number of complex interactions that reach beyond the normal technical aspects of genetics, cultural practices, harvesting, ginning, mill processing, etc. (Anthony, 1990). It also involves social, political and governmental factors. Variety selection is one of the first and one of the most important decisions that a cotton producer makes and is influenced by past experiences, reputation of varieties, knowledge of the performance of varieties, and available technical information (Anthony, 1994). Much of the technical information is available from private breeders and governmental agencies. The **purpose** of this study was to quantify grade, fiber quality, and monetary returns for regional cotton varieties grown near Stoneville, MS, and ginned on commercial style equipment as a function of number of saw-type lint cleaners. Results should allow plant breeders to consider improvements in cotton varieties that are in response to ginning conditions that will more nearly reflect commercial practices in the future.

Discussion

Varieties submitted for testing were divided into two groups based on maturity classifications determined by the companies submitting each variety (Anthony and Calhoun, 1996). The Early Maturing Cotton Variety Test was comprised of 32 varieties in the Delta. The Mid-season Cotton Variety Test was comprised of 17 varieties in the Delta. Stoneville LA 887 and Deltapine 50 were used as check varieties in tests of both maturity groups. The Early Maturing and Mid-Season Variety Tests were conducted at two locations in the Delta: Stoneville (sandy loam soil) and Elizabeth (Sharkey clay soil). In all tests, seed of each variety was supplied by the company that submitted the variety for testing. Recommended management practices were followed in each test. The on-farm cooperators decided planting dates, fertilizer rates, amount of supplemental irrigation, defoliation date, insect and weed control strategies, and harvest date. These tests do not encompass all growing and environmental conditions in the state, but they provide a guide to producers in selecting varieties.

All tests were planted solid in 38- or 40-inch rows. Each variety was replicated six times at each location. Yield determinations were based on the weight of seed cotton mechanically harvested from two-row plots that ranged from 40 to 50 feet in length. These samples were used to determine commercial gin turnout, and fiber samples were evaluated at the Agricultural Marketing Service office in Dumas, AR, for classer's grade and HVI fiber properties.

Varieties of cotton were planted on Bosket very fine sandy loam soil at Stoneville, MS, and Sharkey clay soil at Elizabeth, MS, for both the Early Maturing Cotton Variety Test and the Mid-season Cotton Variety Test in six replications. The cottons were harvested mechanically and stored at the Ginning Lab until ginning in the Microgin during October 1995. The seed cotton was conditioned for 48 hours at 75 °F and 55% relative humidity before ginning through the following machine sequence: Dryer, cylinder cleaner, stick machine, dryer, cylinder cleaner, extractor-feeder/gin stand, and two lint cleaners. Samples were taken before processing for moisture and foreign matter determinations. Since insufficient seed cotton was available in individual replications for ginning in the microgin, reps 1 and 2, reps 3 and 4, and reps 5 and 6 were combined as reps 1, 2, and 3 within each field. Samples were taken at the feeder apron after all seed cotton cleaning for moisture and foreign matter analyses. Ginned lint samples were taken after the battery condenser for fiber analyses for the two-lint-cleaner treatment. The one-lint-cleaner sample was manually extracted from the lint flue between the lint cleaner. Collected samples in the gin were analyzed by the

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 1:467-469 (1997)
National Cotton Council, Memphis TN

HVI and manual classing systems. Analyses were done with the SAS General Linear Models procedure.

Analyses

Initial foreign matter was unusually low for this crop year and averaged 5.4% across all fields. Consequently, leaf grade results were skewed in favor of one stage of lint cleaning. Number of lint cleaners was significant for the following variables: Classers' leaf, Classers' color, HVI color, HVI trash, reflectance, plus b, length, premium, and uniformity, but was not significant for micronaire and strength (Table 1).

Manual Grade

Classers' color index averaged 98.9 and 100.5, respectively, for one and two lint cleaners while leaf grade averaged 2.7 and 2.3; in essence, the color means would round to Middling color but the leaf grade would round to leaf 3 and leaf 2 (Table 2). Further analysis of the change in leaf grade due to the second stage of lint cleaning indicated that 11 of the 44 varieties improved to the next grade while 33 did not improve. Regardless, premiums do not exist for leaf grade 3 as compared to leaf grade 2 except for some poor color (light spotted) cotton. As a result, the second stage of lint cleaning was not needed for any of the varieties. Significant interactions occurred due to Field*Lint Cleaner and Varieties*Lint Cleaners. The significant interactions clearly indicate that all types of cotton (varieties, growth environments, production practices, etc.) cannot be ginned in the same manner and suggested that comparisons must be made within fields as well as within varieties.

HVI classification

Color grade index as judged by the HVI system averaged 99.4 and 100.9 for one and two lint cleaners, respectively. Trash area was 0.23% and 0.15% for one and two lint cleaners, respectively. Uniformity was significantly influenced by number of lint cleaners but the means were only 82.8 and 82.4, respectively, for one and two lint cleaners. The second stage of lint cleaning reduced the fiber length from 1.099 in. to 1.085 in.

The second stage of lint cleaning generally improved leaf grade and color, but reduced length and uniformity. Although not analyzed herein, the second stage of lint cleaning increases neps and short fiber content and decreases bale weight (lint turnout), and degrades mill performance (Anthony, 1996). The 7 to 10 pounds of material valued at about $0.75 per pound removed by the second lint cleaner typically represents $5.25 to $7.50 per bale loss and suggests that only one lint cleaner should be used. However, experience has shown that two lint cleaners are required to achieve optimum monetary returns on some cottons partly due to the initial foreign matter in the cotton and to the degree of leaf hairiness.

Bale Value

Market premiums based on the Commodity Credit Corporation Loan for the samples were significantly influenced (not shown) by Field, Variety, Lint Cleaners, and the Variety*Field interaction. Overall, premiums averaged $0.012 and $0.015 per pound above the base market price for one and two lint cleaners, respectively. Thus, the second stage of lint cleaning increased the value of the cotton by $0.003 per pound or 0.3 cents. This small increase in premium ($1.50 per bale) does not offset the cost of the second stage of lint cleaning for reductions in bale weight of $5.25 to $7.50 per bale.

Summary

Numerous varieties of cotton were grown in four fields near Stoneville, MS, and ginned with a small-scale gin equipped with conventional machinery. Samples were collected after one and two stages of saw-type lint cleaning for comparison of their physical properties with HVI classing instruments. The second stage of lint cleaning significantly influenced all measured variables except micronaire and strength. Overall means showed no market advantage to using more than one stage of lint cleaning; however, interactions between Varieties, Fields (growth locations) and Lint Cleaners clearly indicate that different levels of cleaning machinery is required to maximize monetary returns to the farmer.

Disclaimer

Mention of a trade name, propriety product or specific equipment does not constitute a guarantee or warranty by the U.S. Department of Agriculture and does not imply approval of a product to the exclusion of others that may be suitable.

References

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Table 1. Analyses of variance for comparison of number of lint cleaners as a function of varieties and growth location.

Source of variation	Degrees of freedom	Mean squares for Color index	HVI color index	Leaf	Length	Percent area	Mike	Strength	Uniformity	Rd	+b
FIELD	3	489.42**	313.41**	11.59**	7.65**	0.10**	2.93**	19.67**	3.36**	291.09**	1.12**
VARIETY	43	12.43**	10.35**	3.02**	3.01**	0.05**	0.59**	17.28**	1.01**	8.73**	0.90**
LINTCL	1	218.65**	183.13**	12.11**	17.83**	0.63**	0.12ns	0.00ns	13.90**	54.27**	2.27**
VARIETY*FIELD	42	1.65ns	4.34*	0.29**	0.02ns	0.01**	0.00ns	0.00ns	0.29ns	0.00ns	0.04ns
LINTCL*FIELD	3	5.40ns	5.12ns	1.09**	0.21ns	0.02**	0.05ns	0.70ns	0.78*	1.32*	0.18**
VARIETY*LINTCL	43	2.90ns	3.23ns	0.20ns	0.18ns	0.01**	0.01ns	0.54ns	0.28ns	0.45ns	0.04ns
VARIETY*LINTCL*FIELD	42	2.63ns	3.81ns	0.14ns	0.14ns	0.00ns	0.02ns	0.49ns	0.14ns	0.46ns	0.02ns
Error	178	3.10	2.99	0.14	0.21	0.00	0.02	0.53	0.20	0.46	0.04

* = significant at the 5% level of probability
** = significant at the 1% level of probability
ns = not significant at the 5% level of probability

Table 2. Summary and comparison of means for comparison of number of lint cleaners as a function of varieties and growth location.

Number lint cleaners	Variety	Color grade index	MVI color grade index	Length, inches	Trash, percent Leaf	Trash, percent area	Trash, percent Mike	Strength, grams/ tex	Rd	Plus b	Uni-formity	Premium
All	All	99.7	100.2	1.092	2.49	0.188	4.5	29.9	76.2	8.7	82.2	0.013
1	All	98.9	99.4	1.099	2.67	0.230	4.5	29.9	75.8	8.7	82.8	0.012
2	All	100.5	100.9	1.085	2.30	0.146	4.5	29.9	76.6	8.8	82.4	0.015
1	A1517-88	100.0	100.0	1.130	3.00	0.400	3.8	33.9	76.0	8.6	81.5	0.023
2	A1517-88	101.3	102.0	1.130	3.00	0.183	3.9	33.8	76.7	9.1	82.2	0.023
1	CB1135	96.5	96.2	1.112	3.75	0.350	4.4	30.7	74.0	8.6	82.2	-0.001
2	CB1135	99.8	100.8	1.084	2.92	0.258	4.5	30.6	76.2	8.8	82.0	0.020
1	CB1233	99.5	99.5	1.107	2.25	0.175	4.8	31.0	76.2	8.6	83.0	0.013
2	CB1233	101.1	101.3	1.082	2.25	0.142	4.7	30.5	77.0	8.7	82.4	0.019
1	CB232	100.2	100.0	1.107	2.25	0.200	4.6	28.8	75.5	8.6	82.7	0.016
2	CB232	99.2	99.4	1.090	2.08	0.117	4.6	28.5	75.3	8.8	82.2	0.016
1	CB333	98.5	98.5	1.097	3.75	0.425	4.2	29.0	75.2	8.4	82.2	0.008
2	CB333	98.7	99.5	1.075	2.92	0.200	4.2	28.8	75.8	8.8	81.7	0.011
1	DES119	96.5	97.0	1.105	4.00	0.400	4.5	30.7	73.8	8.9	83.7	-0.000
2	DES119	97.7	98.0	1.090	3.58	0.250	4.6	29.7	74.5	9.2	83.2	0.005
1	DP0227	97.7	98.5	1.082	2.25	0.150	4.5	30.3	74.7	8.8	83.5	0.014
2	DP0227	101.3	101.3	1.066	1.92	0.108	4.5	31.0	76.2	9.0	82.7	0.013
1	DP20	100.5	100.5	1.070	2.00	0.125	4.6	27.2	76.5	8.3	82.5	0.011
2	DP20	101.7	101.7	1.059	2.08	0.092	4.5	27.5	77.4	8.5	82.1	0.008
1	DP50	99.6	100.0	1.097	2.12	0.125	4.7	28.1	76.7	8.3	82.9	0.017
2	DP50	101.6	101.7	1.082	1.92	0.092	4.8	28.3	77.3	8.6	82.7	0.012
1	DP51	98.5	100.0	1.102	1.75	0.150	4.9	28.0	76.5	8.4	83.2	0.009
2	DP51	101.1	100.8	1.078	1.75	0.083	4.9	27.8	77.1	8.5	82.2	0.015
1	DP5409	98.5	98.5	1.085	2.00	0.150	4.5	29.8	76.2	8.3	82.5	0.016
2	DP5409	100.7	100.8	1.068	1.75	0.092	4.5	29.5	77.2	8.5	82.2	0.016
1	DP5415	101.0	101.0	1.105	2.00	0.125	4.8	30.4	77.5	8.5	82.5	0.015
2	DP5415	102.0	102.1	1.088	1.58	0.075	5.0	30.2	78.7	8.4	82.6	0.008
1	DP5690	100.2	101.0	1.085	2.75	0.225	4.7	30.7	77.0	8.6	82.7	0.009
2	DP5690	101.7	101.3	1.068	2.33	0.117	4.8	31.0	77.3	8.5	82.5	0.011
1	DP90	102.0	102.0	1.075	2.00	0.250	4.6	31.7	78.5	8.5	83.0	0.020
2	DP90	103.3	103.3	1.055	2.00	0.117	4.7	31.2	78.3	8.7	82.3	0.018
1	H1215	100.2	101.0	1.130	2.75	0.200	4.0	30.1	76.5	8.7	83.0	0.018
2	H1215	100.2	100.5	1.122	2.25	0.142	3.9	30.8	76.3	8.7	82.5	0.023
1	H1220	99.2	100.0	1.125	2.50	0.275	4.1	30.4	76.7	8.6	83.2	0.019
2	H1220	100.8	101.3	1.103	2.08	0.125	4.3	29.8	76.7	8.8	83.2	0.018
1	H1244	99.2	100.0	1.120	3.00	0.200	3.8	29.8	76.0	8.5	83.0	0.016
2	H1244	99.7	100.7	1.101	2.42	0.133	3.9	30.0	76.6	8.7	82.6	0.018
1	H1277	98.5	98.5	1.075	1.75	0.150	4.4	28.2	76.5	8.3	82.7	0.012
2	H1277	101.4	101.7	1.062	2.00	0.108	4.5	27.9	77.1	8.6	82.2	0.009
1	H1330	98.5	98.5	1.090	3.25	0.250	4.4	29.4	75.2	8.7	83.0	0.013
2	H1330	98.3	99.8	1.085	2.75	0.183	4.4	30.0	75.7	8.8	82.5	0.019
1	H1560	97.0	100.0	1.125	4.00	0.425	4.6	31.0	74.0	9.1	83.7	-0.003
2	H1560	99.9	100.7	1.111	3.00	0.225	4.5	31.2	75.3	9.5	83.0	0.014
1	HS23	97.0	97.0	1.090	4.25	0.500	4.1	28.8	74.7	8.5	82.0	-0.002
2	HS23	98.2	99.7	1.076	3.50	0.292	4.2	29.6	75.7	8.8	82.2	0.011
1	HS26	100.0	100.0	1.075	4.00	0.350	3.9	31.8	77.5	8.1	82.5	0.014
2	HS26	101.3	100.7	1.062	3.50	0.217	4.1	31.6	78.0	8.3	82.8	0.014
1	HS44	101.0	101.0	1.110	2.00	0.175	4.9	31.6	76.5	8.6	82.5	0.009
2	HS44	102.0	102.0	1.086	1.58	0.092	5.0	30.4	77.9	8.6	82.3	0.015
1	HS46	99.2	101.0	1.107	2.25	0.250	4.4	31.7	76.2	9.2	83.2	0.019
2	HS46	101.0	101.3	1.089	2.08	0.108	4.4	31.7	77.1	9.0	82.2	0.021
1	HY39	100.0	100.0	1.117	3.50	0.275	4.4	31.5	76.5	8.3	82.5	0.020
2	HY39	100.3	100.3	1.106	2.58	0.208	4.4	32.0	77.7	8.5	82.3	0.023
1	QA13	97.7	98.5	1.117	3.50	0.375	4.0	31.1	75.2	8.2	82.5	0.014
2	QA13	99.8	100.7	1.103	2.67	0.208	4.1	30.6	76.8	8.7	82.1	0.025
1	QA44	98.7	99.5	1.072	1.75	0.125	4.8	29.3	75.7	8.7	83.0	0.004
2	QA44	99.6	100.2	1.066	1.83	0.067	4.9	30.5	75.8	8.9	82.9	0.011
1	QA50	99.5	102.0	1.142	2.25	0.150	4.6	29.9	76.0	8.9	82.7	0.015
2	QA50	101.4	101.7	1.115	1.75	0.083	4.6	30.7	77.2	8.9	82.8	0.023
1	QA8	100.0	100.0	1.110	3.50	0.300	4.5	29.5	76.7	8.3	82.7	0.018
2	QA8	99.8	99.8	1.097	3.50	0.300	4.4	29.6	77.2	8.3	82.3	0.015
1	SG125	96.5	98.5	1.100	2.00	0.150	4.6	28.7	74.5	9.1	83.0	0.008
2	SG125	100.2	100.7	1.084	1.92	0.117	4.6	28.3	75.3	9.2	82.5	0.011
1	SG404	96.5	95.7	1.070	2.00	0.125	4.8	30.1	74.2	9.1	82.7	0.000
2	SG404	99.0	99.7	1.062	1.92	0.117	4.8	30.5	74.9	9.4	82.7	0.003
1	SG501	98.5	100.0	1.105	3.00	0.200	4.7	32.8	74.7	9.1	83.5	0.015
2	SG501	99.7	100.7	1.101	2.50	0.175	4.7	32.3	75.5	9.2	83.2	0.016
1	SS 9202	99.5	100.0	1.102	2.75	0.150	4.5	31.5	76.2	8.6	82.5	0.015
2	SS 9202	101.7	101.7	1.083	2.08	0.133	4.5	31.4	77.3	8.7	82.3	0.022
1	SS 9303	99.2	100.0	1.112	2.75	0.250	4.3	31.2	76.0	8.5	83.0	0.018
2	SS 9303	100.1	100.7	1.092	2.83	0.167	4.3	31.0	76.9	8.6	81.8	0.019
1	SS 9412	101.0	101.0	1.052	1.75	0.150	4.3	27.4	77.0	8.4	82.2	0.008
2	SS 9412	102.0	102.0	1.057	1.75	0.108	4.5	27.5	77.6	8.6	82.5	0.012
1	ST132	98.0	98.0	1.072	2.50	0.175	4.0	29.5	76.2	8.4	83.2	0.012
2	ST132	100.7	101.5	1.050	2.00	0.142	4.1	29.4	77.0	8.6	82.6	0.008
1	ST474	94.5	95.7	1.070	3.25	0.325	4.5	27.9	73.0	9.2	83.0	-0.006
2	ST474	98.9	99.3	1.070	2.75	0.183	4.6	29.1	74.7	9.4	82.2	0.013
1	ST495	99.5	101.0	1.095	2.25	0.150	4.4	28.7	75.7	8.9	82.2	0.012
2	ST495	101.7	101.7	1.095	1.83	0.100	4.7	29.2	76.8	9.1	81.6	0.019
1	STLA887	98.1	98.6	1.122	3.25	0.312	4.5	32.5	74.4	9.4	83.0	0.010
2	STLA887	99.7	100.5	1.112	2.71	0.183	4.5	32.2	75.0	9.7	83.0	0.012
1	T 207	97.0	99.0	1.090	2.75	0.250	4.4	28.9	75.5	8.8	83.0	0.012
2	T 207	100.1	101.3	1.078	2.33	0.150	4.4	28.5	76.1	8.8	82.2	0.014
1	T292	100.0	101.0	1.107	2.00	0.150	4.8	29.0	76.5	8.4	82.5	0.013
2	T292	101.5	102.0	1.091	1.83	0.117	4.8	29.0	77.3	8.7	82.6	0.019
1	T302	98.5	97.0	1.090	2.50	0.175	4.6	27.9	75.0	8.9	82.7	0.009
2	T302	100.7	101.0	1.076	2.00	0.142	4.7	28.2	75.7	9.0	82.0	0.009
1	T366	100.0	100.0	1.092	3.25	0.325	4.8	27.8	76.7	8.3	82.7	0.015
2	T366	99.2	99.5	1.077	2.25	0.142	4.8	27.3	77.3	8.3	81.8	0.013
1	TC-40	102.0	102.0	1.085	2.00	0.150	4.6	29.4	77.2	8.5	82.7	0.019
2	TC-40	102.0	102.0	1.076	1.92	0.083	4.7	28.8	78.0	8.5	82.1	0.018